

Welcome!

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WordPub

BECE

Mathematics

Past Questions & Answers

1990 - 2019

**Junior High School
Years 1, 2 & 3**

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- Junior High School **students** – you are the ultimate reason for this work.

DEDICATION

To the Lord **Jesus Christ**, our Saviour and soon-coming King

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1990 MATHEMATICS SECTION A

1990 MATHEMATICS SECTION B

JUNE 2019

MATHEMATICS 1

Objective Test

1 Hour

*Answer **all** the questions*

Do all rough work on this question paper

1. Given that $A = \{2, 4, 6, 8, 10\}$ and $B = \{4, 8, 12\}$, find $A \cup B$.

A. $\{4, 8\}$
B. $\{2, 8, 12\}$
C. $\{4, 6, 8, 12\}$
D. $\{2, 4, 6, 8, 10, 12\}$

2. Express 0.000344 in standard form.

A. 3.44×10^{-6}
B. 3.44×10^{-5}
C. 3.44×10^{-4}
D. 3.44×10^{-3}

3. Which of the following numbers is the largest?

A. -70
B. -50
C. -3
D. -2

4. Correct 0.024561 to three significant figures.

A. 0.03
B. 0.025
C. 0.0245
D. 0.0246

5. Simplify: $(7^5 \times 7^3) \div 7^6$

A. 7^9
B. 7^4
C. 7^3
D. 7^2

6. How many lines of symmetry has a square?

A. 0
B. 1
C. 2
D. 4

7. Solve the equation $10 - \frac{(x+3)}{2} = 8$.
- A. -9
B. -3
C. 1
D. 15
8. Factorize: $kx + 2xt - 4k - 8t$.
- A. $(k - 2t)(x + 4)$
B. $(k + 2t)(x + 4)$
C. $(k + t)(x - 4)$
D. $(k + 2t)(x - 4)$
9. There are 12 boys and 18 girls in a class. Find the fraction of boys in the class.
- A. $\frac{2}{5}$
B. $\frac{3}{5}$
C. $\frac{2}{3}$
D. $\frac{3}{4}$
10. Express 30% as a fraction in its lowest term.
- A. $\frac{7}{10}$
B. $\frac{3}{20}$
C. $\frac{7}{20}$
D. $\frac{3}{10}$
11. Make k the subject of the relation, $ky - k = y^2$.
- A. $k = \frac{y^2}{y-1}$
B. $k = \frac{y^2}{y+1}$
C. $k = -\frac{y^2}{y+1}$

D. $k = \frac{y^2+1}{y-1}$

12. The mean of the numbers 5, $2x$, 4 and 3 is 5. Find the value of x .

A. 3
B. 4
C. 5
D. 8

13. Find the rule of the mapping:

| | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|
| x | 1 | 2 | 3 | 4 | 5 |
| \downarrow | \downarrow | \downarrow | \downarrow | \downarrow | \downarrow |
| y | 3 | 1 | -1 | -3 | -5 |

A. $y = 2x + 2$
B. $y = -2x + 2$
C. $y = 4x$
D. $y = -2x + 5$

14. The two sides of a parallelogram are 4.8m and 7.2m long. Find its perimeter.

A. 48.0 m
B. 34.6 m
C. 24.0 m
D. 17.3 m

15. A tank in the form of a cuboid has length 6m and breadth 4m. If the volume of the tank is 36m^3 , find the height.

A. 0.67m
B. 1.5m
C. 1.8m
D. 5.0m

16. If the bearing of A from B is 240° , find the bearing of B from A .

A. 040°
B. 060°
C. 120°
D. 300°

17. Find the truth set of the inequality $2y + 5 < 4y - 5$.

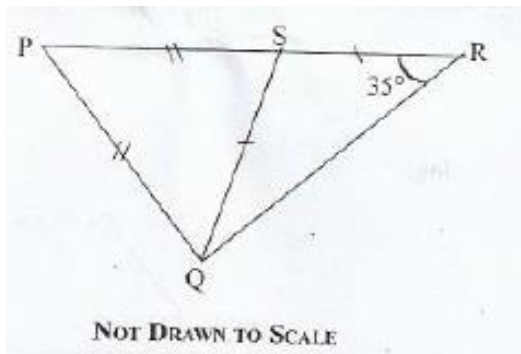
A. $\{y: y > 5\}$
B. $\{y: y < 5\}$
C. $\{y: y > 1\}$
D. $\{y: y > 0\}$

18. Find the gradient of the straight line which passes through the points $(-3, 4)$ and $(3, -2)$.

A. 2
B. 1
C. -2
D. -1

19. If $6:8 = r:48$, find the value of r .

- A. 36
- B. 34
- C. 14
- D. 12



20. Find $\angle QPS$ in the diagram.

- A. 70°
- B. 40°
- C. 35°
- D. 20°

21. A man travelled a distance of 8km in an hour. How long will it take him to cover a distance of 12km, travelling at the same speed?

- A. $1\frac{1}{3}hrs$
- B. $1\frac{1}{2}hrs$
- C. $1\frac{3}{4}hrs$
- D. $2hrs$

22. A number is selected at random from: 25, 26, 27, 28, ..., 35. Find the probability that the number selected is a prime number.

- A. $\frac{6}{11}$
- B. $\frac{3}{11}$
- C. $\frac{2}{11}$
- D. $\frac{1}{11}$

23. Express $\frac{12}{25}$ in decimal fraction.

- A. 0.0408
- B. 0.048
- C. 0.408
- D. 0.48

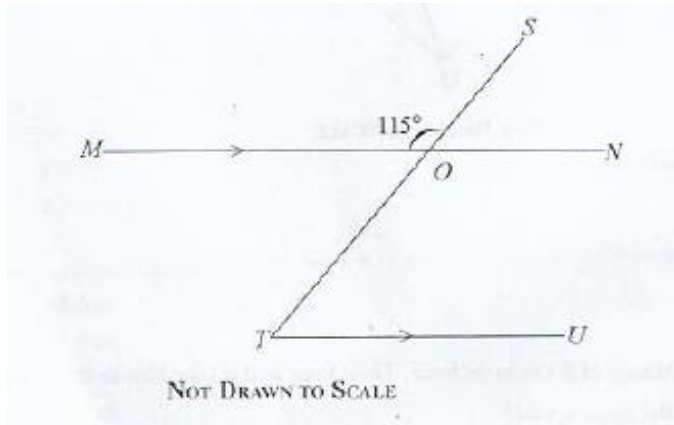
24. Find the diameter of a circle whose circumference is 88cm. [take $\pi = \frac{22}{7}$].

- A. 14 cm

- B. 22 cm
- C. 28 cm
- D. 20 cm

25. When twelve is subtracted from three times a certain number and the result is divided by four, the answer is eighteen. Find the number.

- A. 84
- B. 40
- C. 28
- D. 20



26. In the diagram, line MN is parallel to line TU , line TS cuts line MN at O and $\angle MOS = 115^\circ$. Find $\angle OTU$.

- A. 65°
- B. 55°
- C. 45°
- D. 25°

27. Given that $r = \begin{pmatrix} -3 \\ -5 \end{pmatrix}$ and $t = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$, find $r + t$.

- A. $\begin{pmatrix} -6 \\ 10 \end{pmatrix}$
- B. $\begin{pmatrix} -6 \\ -10 \end{pmatrix}$
- C. $\begin{pmatrix} 0 \\ -10 \end{pmatrix}$
- D. $\begin{pmatrix} 6 \\ 10 \end{pmatrix}$

28. A trader sold 90 oranges at 3 for **GH¢ 0.75**. How much did she get from selling all the oranges?

- A. GH¢ 22.50
- B. GH¢ 67.50
- C. GH¢ 75.00
- D. GH¢ 225.50

29. Express 72 as a product of prime factors
- A. $2^3 \times 3^2$
 - B. $2^2 \times 3^3$
 - C. $2^2 \times 3^2$
 - D. 2×3
30. Simplify: $3a \times 24ab$.
- A. $27ab^2$
 - B. $27a^2b$
 - C. $72ab^2$
 - D. $72a^2b$
31. Simplify: $\left(\frac{-2}{3}\right) + \left(\frac{-1}{5}\right)$
- A. $\left(\frac{-3}{2}\right)$
 - B. $\left(\frac{-1}{2}\right)$
 - C. $\left(\frac{-3}{8}\right)$
 - D. $\left(\frac{-1}{-2}\right)$
32. Multiply 247 by 32
- A. 6916
 - B. 7804
 - C. 7904
 - D. 1235
33. Evaluate: $(0.07 \times 0.02) \div 14$.
- A. 0.01
 - B. 0.001
 - C. 0.0001
 - D. 0.00001
34. In a class of 23 students, the girls were 7 more than the boys. How many boys were in the class?
- A. 8
 - B. 15
 - C. 16
 - D. 30
35. Express 30 minutes as a percentage of 3 hours 20 minutes.
- A. 12.5 %
 - B. 15 %
 - C. $16\frac{2}{3}\%$

D. 20 %

36. Find the Least Common Multiple (LCM) of 2, 3 and 5.

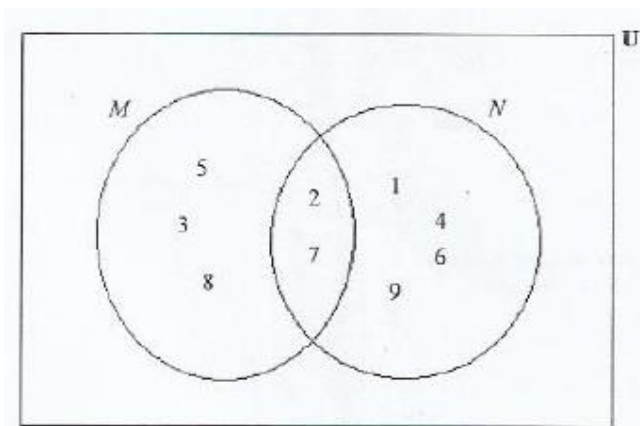
- A. 6
- B. 12
- C. 24
- D. 30

37. The simple interest on GH¢ 450.00 for 4 years is GH¢ 45.00, find the rate of interest.

- A. 2.5 %
- B. 10 %
- C. 25 %
- D. 6.5 %

38. Find the median of the following numbers: 46, 68, 34, 37, 76 and 81.

- A. 35.5
- B. 57
- C. 67
- D. 68



In the Venn diagram M and N are the subsets of the universal set U .

Use this information to answer questions 39 and 40.

39. Find $M \cap N$.

- A. $\{7\}$
- B. $\{2, 7\}$
- C. $\{3, 5, 8\}$
- D. $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

40. How many members are in the set N ?

- A. 2
- B. 3
- C. 4
- D. 6

JUNE 2019

MATHEMATICS 1

Objective Test

SOLUTIONS

1. D. $\{2, 4, 6, 8, 10, 12\}$
2. C. 3.44×10^{-4}
3. D. -2
4. D. 0.0246
5. D. 7^2
6. D. 4
7. C. 1
8. D. $(k + 2t)(x - 4)$
9. A. $\frac{2}{5}$
10. D. $\frac{3}{10}$
11. A. $k = \frac{y^2}{y-1}$
12. B. 4
13. D. $y = -2x + 5$
14. C. 24.0 m
15. B. 1.5 m
16. B. 060°
17. A. $\{y: y > 5\}$
18. D. -1
19. A. 36
20. B. 40°
21. B. $1\frac{1}{2} \text{ hrs}$
22. C. $\frac{2}{11}$
23. D. 0.48
24. C. 28 cm
25. C. 28
26. A. 65°

27. C. $\begin{pmatrix} 0 \\ -10 \end{pmatrix}$
28. A. GH¢ 22.50
29. A. $2^3 \times 3^2$
30. D. $72a^2b$
31. C. $\begin{pmatrix} -3 \\ 8 \end{pmatrix}$
32. C. 7904
33. C. 0.0001
34. A. 8
35. B. 15 %
36. D. 15 %
37. A. 2.5 %
38. B. 57
39. B. {2,7}
40. D. 6

JUNE 2019

MATHEMATICS 2

ESSAY

1 hour

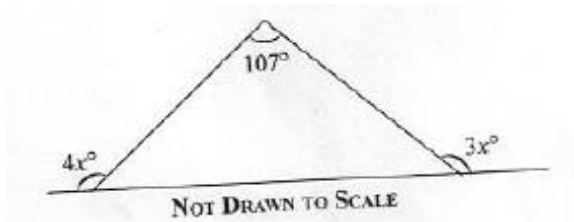
*Answer **four** questions **only**.*

*All questions carry **equal** marks.*

*All working **must** be clearly shown.*

*Marks will **not** be awarded for correct answers without corresponding working*

1. (a) Given that $X = \{\text{whole numbers from 4 to 13}\}$ and $Y = \{\text{multiples of 3 between 2 and 20}\}$, find $X \cap Y$.
- (b) Find the Least Common Multiple (L.C.M) of the following numbers: 3, 5, and 9.
- (c) If $\frac{p+2q}{p} = \frac{7}{5}$, find the value of $\frac{q}{p}$, where $p \neq 0$.
2. (a) Solve: $\frac{4x+5}{5} + \frac{x-3}{4} = -1$.
- (b) The ratio of boys to girls in a school is 12:25. If there are 120 boys.
 - (i) how many girls are in the school?
 - (ii) what is the total number of boys and girls in the school?
- (c) Simplify: $(8x^2y^3)\left(\frac{3}{8}xy^4\right)$.
3. (a) In an examination, 60 candidates passed Integrated Science or Mathematics. If 15 passed both subjects and 9 more passed Mathematics than Integrated Science, find the:
 - (i) number of candidates who passed each subject
 - (ii) probability that a candidate passed exactly one subject.
- (b) Factorize: $xy + 6x + 3y + 18$.
4. (a) Express 250% as a fraction in its lowest term.
- (b)



Use the diagram to find the value of x .

(c) Simplify: $2 \div \left(\frac{15}{64} \div \frac{6}{7} \right)$

(d) If $q = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$ and $r = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$ find $(q + r)$

5. (a)

| | | | | | |
|---|---|---|---|---|----|
| x | 1 | 2 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 0 | 3 | 6 | 9 | 12 |

The mapping shows the relationship between x and y .

- using a scale of 2cm to 1unit on the x-axis and 2 cm to 2 units on the y-axis, draw two perpendicular axes Ox and Oy on a graph sheet for $1 \leq x \leq 5$ and $0 \leq y \leq 14$;
- plot the point for each ordered pair, (x, y) .
- Join the points with a straight line;
- Using the graph, find the gradient of the line in 5 (a)(iii);
- Use the graph to find the equation of the line in 5 (a)(iii).

(b) Simplify: $32 \times 8 \times 4 \times 2$, leaving your answer in the form 2^n .

6. The marks obtained by students in a class test were

| | | | | |
|---|---|---|---|---|
| 4 | 8 | 7 | 6 | 7 |
| 2 | 1 | 7 | 4 | 7 |
| 3 | 7 | 6 | 4 | 3 |
| 7 | 5 | 2 | 7 | 2 |
| 5 | 4 | 8 | 3 | 2 |

(a) construct a frequency distribution table for the data.

(b) Find the:

- mode of the distribution;

- (ii) median mark of the test;
- (iii) mean mark.

END OF ESSAY TEST

JUNE 2018

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) Given that $X = \{\text{whole numbers from 4 to 13}\}$ and $Y = \{\text{multiples of 3 between 2 and 20}\}$, find $X \cap Y$.

$$x = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$$

$$y = \{3, 6, 9, 12, 15, 18\}$$

$$x \cap y = \{6, 9, 12\}$$

- (b) Find the Least Common Multiple (L.C.M) of the following numbers: 3, 5, and 9.

Method 1

$$3 = 3^1$$

$$5 = 5^1$$

$$9 = 3^2$$

$$\text{L.C.M} = 3^2 \times 5$$

$$= 9 \times 5$$

$$= 45$$

Method 2

| | | | |
|-----|-----------------------------------|---|---|
| | 3 | 5 | 9 |
| 3 | 1 | 5 | 3 |
| 3 | 1 | 5 | 1 |
| 5 | 1 | 1 | 1 |
| ↑ | | | |
| LCM | $= 3 \times 3 \times 5$ $= 45$ | | |

Successive division of 3, 5, 9 by the prime factors of 3, 5 and 9.

[prime factors = 3 and 5]

NB: When a factor does not divide directly, the number is simply repeated.

Method 3

Multiples of 3 = $\{3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, \underline{45}, \dots\}$

Multiples of 5 = $\{5, 10, 15, 20, 25, 30, 35, 40, \underline{45}, \dots\}$

Multiples of 9 = $\{9, 18, 27, 36, \underline{45}, \dots\}$

LCM = Least Common Multiple = 45.

(c) If $\frac{p+2q}{p} = \frac{7}{5}$, find the value of $\frac{q}{p}$, where $p \neq 0$.

Method 1

$$\frac{p+2q}{p} = \frac{7}{5}$$

$$5(p+2q) = 7p$$

$$5p + 10q = 7p$$

$$10q = 7p - 5p$$

$$10q = 2p$$

$$\frac{q}{p} = \frac{2}{10}$$

$$= \frac{1}{5}$$

Cross-Multiplying (OR Multiplying both sides by 5p)

Expanding

Rearranging / Grouping like-terms on same side

Simplifying

Dividing both sides by 10p (to obtain $\frac{q}{p}$)

Method 2

$$p + 2q = 7 \quad \text{---(1)}$$

$$p = 5 \quad \text{---(2)}$$

Put (2) into (1)

$$5 + 2q = 7$$

$$2q = 2$$

$$q = 1$$

$$\frac{q}{p} = \frac{1}{5}$$

2. (a) Solve: $\frac{4x+5}{5} + \frac{x-3}{4} = -1$.

Method 1

$$\frac{4x+5}{5} + \frac{x-3}{4} = -1$$

$$\frac{4(4x+5) + 5(x-3)}{20} = -1$$

$$\frac{16x + 20 + 5x - 15}{20} = -1$$

$$21x + 5 = -20$$

$$21x = -20 - 5$$

$$21x = -25$$

$$x = -\frac{25}{21} \text{ or } -1\frac{4}{21}$$

Simplifying fraction on the Left hand side

[5 'into' 20 = 4, $4 \times (4x+5)$]

[4 'into' 20 = 5, $5 \times (x-3)$]

Expanding and simplifying numerator terms

Cross-multiplying OR Multiplying both sides by 20

Solving for x

Simplifying

Method 2

$$\frac{4x+5}{5} + \frac{x-3}{4} = -1$$

$$20\left(\frac{4x+5}{5}\right) + 20\left(\frac{x-3}{4}\right) = -20$$

$$4(4x+5) + 5(x-3) = -20$$

$$16x + 20 + 5x - 15 = -20$$

$$21x + 5 = -20$$

$$21x = -20 - 5$$

$$21x = -25$$

$$x = -\frac{25}{21} \text{ or } -1\frac{4}{21}$$

Multiplying both sides by 20 (LCM of denominators 4 & 5)

Simplifying

Expanding and simplifying

Solving for x

Simplifying

(b) The ratio of boys to girls in a school is 12:25. If there are 120 boys.

(i) how many girls are in the school?

(i) If $12 \equiv 120$ or $12 \rightarrow 120$

Then $25 \equiv 120 \times \frac{25}{12}$ or $= \frac{25}{12} \times 120$

$$= 10 \times 25$$

$$= 250 \text{ girls}$$

- (ii) What is the total number of boys and girls in the school?

$$120 + 250 = 370 \text{ boys and girls}$$

Method 2

(i) Total Ratio = $12 + 25 = 37$
 Total Number = $\frac{37}{12} \times 120$

$$= 37 \times 10$$

$$= 370$$

(ii) No of girls = $270 - 120$
 $= 250$

$$\text{Total No of Boys and girls} = 370$$

- (c) Simplify: $(8x^2y^3)\left(\frac{3}{8}xy^4\right)$.

$$(8x^2y^3)\left(\frac{3}{8}xy^4\right)$$

$$= 8 \times x \times x \times y \times y \times y \times \frac{3}{8} \times x \times y \times y \times y \times y$$

$$= 8 \times x^2 \times y^3 \times \frac{3}{8} \times x \times y^4 \text{ (Accept)}$$

$$= 8 \times \frac{3}{8} \times x^2 \times x \times y^3 \times y^4$$

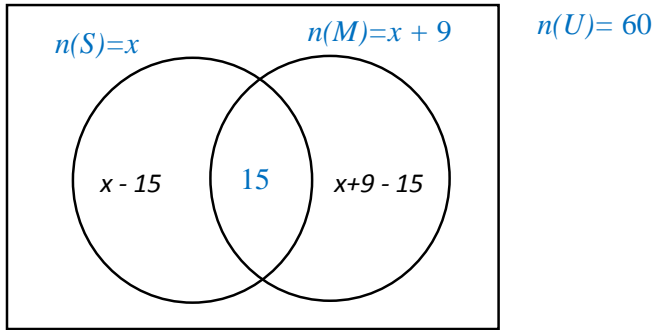
$$= 3x^3y^7$$

3. (a) In an examination, 60 candidates passed Integrated Science or Mathematics. If 15 passed both subjects and 9 more passed Mathematics than Integrated Science, find the:

- (i) number of candidates who passed each subject

(a) (i)

Method 1



Let number of students that passed in Science $[n(S)] = x$
Then number of students that passed in Science $[n(S)] = x+9$

$$x - 15 + 15 + x + 9 - 15 = 60$$

$$2x - 6 = 60$$

$$2x = 60 + 6$$

$$x = 33$$

Number of students who passed in Science $[n(S)] = 33$

Therefore, number of students who passed in Maths $[n(M)] = 33+9$
 $= 42$

OR

From the venn diagram,

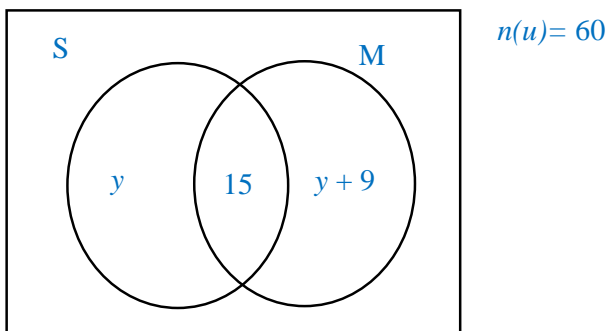
$$n(M) = 15 + x + 9 - 15$$

$$= 15 + 33 + 9 - 15$$

$$= 33 + 9$$

$$= 42$$

Method 2



Let number of students that passed in Science only = y

$$y + 15 + x + 9 = 60$$

$$2y + 24 = 60$$

$$2y = 60 - 24$$

$$y = 18$$

$$n(S) = 18 + 15 = 33$$

$$n(M) = 18 + 9 + 15 = 42$$

(a) (i) $n(S) \text{ only} = 33 - 15 = 18$

$$n(M) \text{ only} = 18 + 9 = 27$$

$$n(\text{Exactly one subject}) = 18 + 27 = 45$$

(ii) **Probability that a candidate passed exactly one subject.**

$$\begin{aligned} P(\text{Exactly one subject}) &= \frac{45}{60} \\ &= \frac{3}{4} \end{aligned}$$

(b) **Factorize: $xy + 6x + 3y + 18$.**

$$\begin{aligned} &xy + 6x + 3y + 18 \\ &= x(y + 6) + 3(y + 6) \\ &= (x + 3)(y + 6) \end{aligned}$$

4. (a) **Express 250% as a fraction in its lowest term.**

$$250\% = \frac{250}{100}$$

$$= \frac{25}{10}$$

$$= \frac{5}{2} \text{ or } 2\frac{1}{2}$$

(b) **Use the diagram to find the value of x .**

$$180 - 4x + 107 = 3x$$

$$287 = 7x$$

$$x = \frac{287}{7}$$

$$x = 41^\circ$$

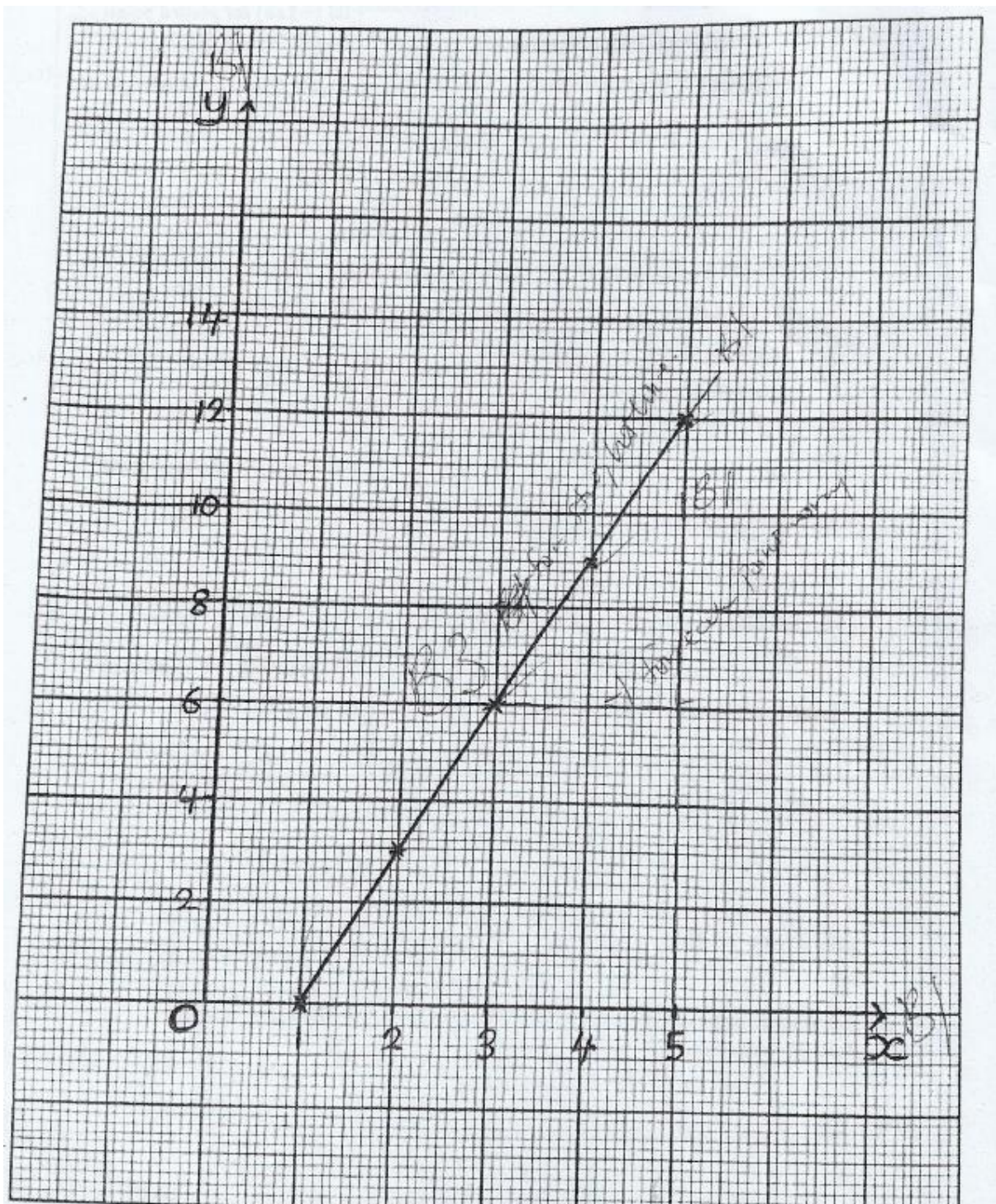
(c) **Simplify:** $2 \div \left(\frac{15}{64} \div \frac{6}{7} \right)$

$$\begin{aligned} & 2 \div \left(\frac{15}{64} \div \frac{6}{7} \right) \\ &= 2 \div \left(\frac{15}{64} \times \frac{7}{6} \right) \\ &= 2 \div \left(\frac{15 \times 7}{64 \times 6} \right) \\ &= 2 \times \frac{64 \times 6}{15 \times 7} \\ &\Rightarrow \frac{2 \times 64 \times 2}{5 \times 7} \\ &= \frac{256}{35} \text{ or } 7 \frac{11}{35} \end{aligned}$$

(d) **If** $q = \begin{pmatrix} 7 \\ -1 \end{pmatrix}$ **and** $r = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$ **find** $(q + r)$

$$\begin{aligned} q &= \begin{pmatrix} 7 \\ -1 \end{pmatrix}, r = \begin{pmatrix} 4 \\ -5 \end{pmatrix} \\ q + r &= \begin{pmatrix} 7 \\ -1 \end{pmatrix} + \begin{pmatrix} 4 \\ -5 \end{pmatrix} \\ &= \begin{pmatrix} 7 + 4 \\ -1 - 5 \end{pmatrix} \\ &= \begin{pmatrix} 11 \\ -6 \end{pmatrix} \end{aligned}$$

5. (a)



(iv) Using the graph, find the gradient of the line in 5 (a)(iii)

$$\text{Gradient} = \frac{12-0}{5-1} \quad (\text{or any other equivalent})$$

$$= \frac{12}{4}$$

$$= 3$$

(v) Use the graph to find the equation of the line in 5 (a)(iii)

$$\text{Gradient} = \frac{y-6}{x-3} = 3 \quad (\text{or equivalent})$$

$$y - 6 = 3(x - 3)$$

$$y - 6 = 3x - 9$$

$$y = 3x - 9 + 6$$

$$y = 3x - 3$$

Cross –multiplying OR
 Multiplying both sides by (x-3)
 Expanding
 Making y the subject

- (b) **Simplify: $32 \times 8 \times 4 \times 2$, leaving your answer in the form 2^n .**

$$32 = 2^5$$

$$8 = 2^3$$

$$4 = 2^2$$

$$2 = 2^1$$

$$\text{Hence,} \quad 32 \times 8 \times 4 \times 2$$

$$= 2^5 \times 2^3 \times 2^2 \times 2^1$$

$$= 2^{5+3+2+1}$$

$$= 2^{11}$$

6. (a)

| Marks | Tally | Frequency (<i>f</i>) | <i>fx</i> |
|-------|--------|------------------------|-------------------|
| 1 | / | 1 | 1 |
| 2 | //// | 4 | 8 |
| 3 | /// | 3 | 9 |
| 4 | //// | 4 | 16 |
| 5 | // | 2 | 10 |
| 6 | // | 2 | 12 |
| 7 | ### // | 7 | 49 |
| 8 | // | 2 | 16 |
| | | $\Sigma f = 25$ | $\Sigma fx = 121$ |

(i) **mode** = 7 marks

(ii) **median** = 5 marks

(iii) **mean** = $\frac{\sum fx}{\sum f}$

$$= \frac{121}{25} \quad \text{OR} \quad 4\frac{21}{25}$$

JUNE 2018

MATHEMATICS 1

Objective Test

1 Hour

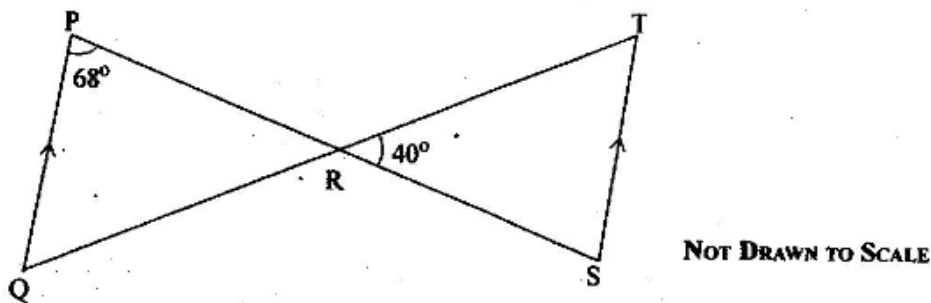
*Answer **all** the questions*

Do all rough work on this question paper

1. Which of the following is arranged in ascending order?
A. $-25, -64, 4, 17$
B. $-64, -25, 4, 17$
C. $-64, -25, 17, 4$
D. $17, 4, -25, -64$
2. If $P = \{x: x \text{ is an even number greater than two and less than or equal to twelve}\}$, list the members of P
A. $\{2, 4, 6, 8, 10, 12\}$
B. $\{3, 4, 6, 8, 10, 12\}$
C. $\{2, 4, 6, 8, 10\}$
D. $\{4, 6, 8, 10, 12\}$
3. Which of the following is an infinite set?
A. $\{1, 2, \dots, 5, 6, 7\}$
B. $\{4, 6, 8, 10, 12\}$
C. $\{2, 3, 5, 7, 11, \dots\}$
D. $\{3, 6, \dots, 18, 21, \dots, 33, 36\}$
4. Find the HCF of 18, 36 and 60.
A. $2^2 \times 3^2 \times 5$
B. $2^2 \times 3^2$
C. $2 \times 3 \times 5$
D. 2×3
5. Write two hundred and two million, two thousand, two hundred and two in figures.
A. 202,002,202
B. 202,020,202
C. 202,022,202
D. 202,200,202
6. Find the number that can be added to 207 to make the sum divisible by 17.
A. 3
B. 13
C. 14
D. 30

7. If $P = \{\text{factors of } 36\}$ and $Q = \{\text{multiples of } 4 \text{ less than } 40\}$, find the number of subsets in $P \cap Q$.
- A. 10
B. 8
C. 6
D. 4
8. Find the LCM of 10, 15 and 25
- A. 90
B. 120
C. 150
D. 300
9. Evaluate $\left(\frac{2}{3} - \frac{1}{4}\right) \div \frac{5}{6}$
- A. $\frac{1}{2}$
B. $\frac{12}{25}$
C. $\frac{5}{12}$
D. $\frac{1}{5}$
10. Arrange $\frac{2}{3}$, $\frac{4}{9}$ and $\frac{3}{7}$ in ascending order.
- A. $\frac{2}{3}$, $\frac{3}{7}$, $\frac{4}{9}$
B. $\frac{4}{9}$, $\frac{3}{7}$, $\frac{2}{3}$
C. $\frac{3}{7}$, $\frac{2}{3}$, $\frac{4}{9}$
D. $\frac{3}{7}$, $\frac{4}{9}$, $\frac{2}{3}$
11. Find the simple interest on GHc 600.00 saved for 2 years 8 months at 5% per annum.
- A. GHc 64.00
B. GHc 80.00
C. GHc 84.00
D. GHc 92.00
12. The number of girls in a mixed school is 420. If the ratio of boys to girls in the school is 3:2, how many students are in the school?
- A. 1050
B. 1470
C. 1630
D. 1680

13. Mary had a chance to select a number from 1 to 20 randomly. What is the probability that the number is divisible by 3?
- A. $\frac{3}{20}$
- B. $\frac{1}{5}$
- C. $\frac{3}{10}$
- D. $\frac{7}{20}$
14. Ama bought a pair of sandals for GHc 20.00 and sold it at GHc 24.00. Find her percentage profit.
- A. 4%
- B. 17%
- C. 20%
- D. 44%
15. Eight men can do a piece of work in 12 days. How long will 6 men take to do the same work if they work at the same rate?
- A. 14 days
- B. 16 days
- C. 18 days
- D. 20 days



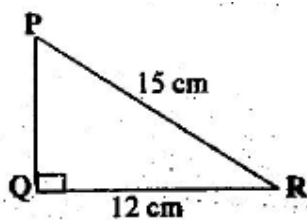
In the diagram \overline{QP} is parallel to \overline{ST} , angle $QPR = 68^\circ$ and angle $SRT = 40^\circ$.

Use the information to answer questions 16 and 17

16. Find the value of angle PQR
- A. 40°
- B. 68°
- C. 72°
- D. 108°
17. Find the value of angle TSR .
- A. 40°
- B. 68°
- C. 72°
- D. 112°

18. A train is travelling at a speed of 60 km/h. What distance would it cover from 10:45 am to 12:15 pm?
- A. 75 km
B. 87 km
C. 90 km
D. 150 km
19. The perimeter of a rectangle is 26 cm. If its length is 10 cm, find its area.
- A. 30 cm^2
B. 60 cm^2
C. 130 cm^2
D. 160 cm^2
20. Find the slope of the line $3x - 6y = 33$.
- A. -3
B. $-\frac{1}{2}$
C. $\frac{1}{2}$
D. 3
21. If $y = c + bx^2$, find y when $c = \frac{14}{5}$, $b = \frac{4}{5}$ and $x = 2$
- A. 3
B. 4
C. 6
D. 7
22. The volume of a cylinder is $20\pi \text{ cm}^3$. If the height of the cylinder is 5 cm, find the base radius.
- A. 1 cm
B. 2 cm
C. 3 cm
D. 4 cm

23.



NOT DRAWN TO SCALE

In the diagram, PQR is a right-angled triangle with $|PR| = 15\text{cm}$ and $|QR| = 12 \text{ cm}$. Find the length PQ

- A. 3.0 cm
B. 8.0 cm
C. 9.0 cm
D. 19.2 cm

24. How many edges has a triangular prism?
- A. 3
 - B. 5
 - C. 6
 - D. 9
25. Make m the subject of the relation $q = \frac{1}{3}(m + n)h$
- A. $m = \frac{3q}{h} - n$
 - B. $m = 3q - hn$
 - C. $m = 3q + hn$
 - D. $m = \frac{3q}{h} + n$
26. Simplify: $16^2 \times 8^2$
- A. 2^{10}
 - B. 2^{14}
 - C. 2^{15}
 - D. 2^{16}
27. Simplify: $4a - 9b - 2(2a - 3b)$
- A. $8a + 3b$
 - B. $8a - 3b$
 - C. $-15b$
 - D. $-3b$
28. If $\mathbf{u} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$, evaluate $6\mathbf{v} + 2\mathbf{u}$
- A. $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$
 - B. $\begin{pmatrix} -6 \\ 8 \end{pmatrix}$
 - C. $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$
 - D. $\begin{pmatrix} 6 \\ 8 \end{pmatrix}$
29. Find the image of the point (2, 5) under the transformation: $\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x \\ 2 - y \end{pmatrix}$
- A. (2, -3)
 - B. (2, 2)
 - C. (2, 3)
 - D. (2, 7)
30. Find the image of Q(-4, 5) when rotated anticlockwise through 90° about the origin.
- A. $Q(-5, 4)$
 - B. $Q(-5, -4)$

- C. $Q(4, -5)$
 D. $Q(4, 5)$

The following data show the marks of students in a test:
 10, 4, 1, 4, 3, 3, 2, 1, 1, 7, 8

Use the information to answer **questions 31 and 32**.

- 31.** If the pass mark is 4, find the number of students who scored more than the pass mark.
 A. 1
 B. 2
 C. 3
 D. 4
- 32.** Find the mean mark.
 A. 3
 B. 4
 C. 7
 D. 8
- 33.** How many lines of symmetry has a rhombus?
 A. 2
 B. 3
 C. 4
 D. 5
- 34.** In an enlargement length $AB = 3$ cm and the length of its image $A_1B_1 = 15$ cm. Calculate the scale factor.
 A. $\frac{1}{5}$
 B. $\frac{2}{3}$
 C. 5
 D. 12
- 35.** Find the rule of the mapping:
- | | | | | | |
|-----|----|---|----|----|----|
| x | 0 | 3 | 6 | 9 | 12 |
| y | -2 | 4 | 10 | 16 | 22 |
- A. $y \rightarrow \frac{x}{2} - 2$
 B. $y \rightarrow x - 2$
 C. $y \rightarrow x^2 - 2$
 D. $y \rightarrow 2x - 2$
- 36.** Solve the inequality: $\frac{1}{2}(3x - 1) + 1 \leq 7 + 2x$
 A. $x \geq -14$

- B. $x \leq -14$
- C. $x \geq -13$
- D. $x \leq -13$

37. If $4 - x = 3(4x + 5)$, find the value of x .

- A. $\frac{11}{13}$
- B. $1\frac{6}{13}$
- C. $-1\frac{6}{13}$
- D. $-\frac{11}{13}$

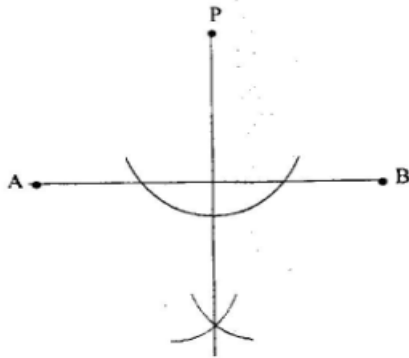
38. In class, there are 12 girls and 48 boys. Find the percentage of boys in the class.

- A. 20%
- B. 40%
- C. 60%
- D. 80%

39. The bearing of P from Q is 060° . Find the bearing of Q from P .

- A. 120°
- B. 150°
- C. 210°
- D. 240°

40. Which of the following statements **best** describes the construction below?



- A. construction of line AB from P
- B. construction of perpendicular from P to meet line AB
- C. construction of an arc of a circle with centre P .
- D. construction of the bisector of line AB .

END OF PAPER ONE

JUNE 2018

MATHEMATICS 1

Objective Test

SOLUTIONS

1. B. -64, -25, 4, 17
2. D. {4, 6, 8, 10, 12}
3. C. {2, 3, 5, 7, 11, ...}
4. D. 2×3
5. A. 202,002,202
6. C. 14
7. B. 8
8. C. 150
9. A. $\frac{1}{2}$
10. D. $\frac{3}{7}, \frac{4}{9}, \frac{2}{3}$
11. B. GHc 80.00
12. A. 1050
13. C. $\frac{3}{10}$
14. C. 20%
15. B. 16 days
16. C. 72°
17. B. 68°
18. C. 90 km
19. A. 30cm^2
20. C. $\frac{1}{2}$
21. C. 6
22. B. 2cm
23. C. 9.0 cm

24. D. 9
25. A. $m = \frac{3q}{h} - n$
26. B. 2^{14}
27. D. $-3b$
28. B. $\begin{pmatrix} -6 \\ 8 \end{pmatrix}$
29. A. $(2, -3)$
30. B. $Q(-5, -4)$
31. C. 3
32. B. 4
33. A. 2
34. C. 5
35. D. $y \rightarrow 2x - 2$
36. C. $x \geq -13$
37. D. $-\frac{11}{13}$
38. D. 80%
39. D. 240°
40. B. construction of perpendicular from P to meet line AB.

JUNE 2018

MATHEMATICS 2

PAPER 2

ESSAY

1 hour

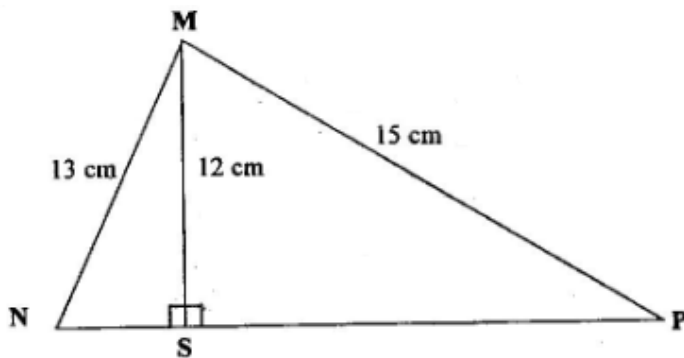
Answer **four** questions **only**.

All questions carry **equal** marks.

All working **must** be clearly shown.

Marks will **not** be awarded for correct answers without corresponding working

1. (a) Solve the inequality $5x - 3 \geq \frac{15x - 11}{2}$ and represent the answer on the number line.
- (b) Given that $\mathbf{t} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ and $\mathbf{k} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$, find $2\mathbf{t} + \mathbf{k}$
- (c) The sides of a triangle are in the ratio 6 : 8 : 10. If the perimeter of the triangle is 288 cm, find the:
- (i) longest side;
 - (ii) shortest side
 - (iii) difference between the longest and the shortest sides.
2. (a) An English textbook costs GHc 25.00. The author of the book agreed to take 20% of the cost of each book sold. If 1,702 copies were sold, calculate the author's share.
- (b) Simplify: $\left(\frac{2}{15} + \frac{2}{5}\right) + \left(\frac{9}{10} \times \frac{4}{3}\right) + \left(\frac{1}{5} \div \frac{1}{4}\right)$
- (c)



NOT DRAWN TO SCALE

In the diagram, $|MN| = 13$ cm, $|MP| = 15$ cm, $|MS| = 12$ cm and \overline{MS} is perpendicular to \overline{NP} . Calculate length NP .

3. (a) Simplify $\frac{0.084 \times 0.81}{0.027 \times 0.04}$, leaving the answer in standard form.
- (b) (i) Make r the subject of the relation: $y = \frac{x-r}{x+r}$
(ii) From (b)(i), find the value of r when $y = 3$ and $x = 10$
- (c) Juliet bought 1,756 kg of frozen chicken, 675 g of vegetables, and 95 g of corn oil from a shopping mall. What is the total weight of the items she bought in kilograms?
4. (a) The sum of the interior angles of a regular polygon is 900° . Find the number of sides of the polygon.
- (b) Using a ruler and a pair of compasses only, construct:
(i) triangle XYZ such that the length $XY = 10\text{cm}$, angle $XYZ = 30^\circ$ and length $YZ = 9\text{ cm}$;
(ii) perpendicular from Z to meet line XY at P ;
(iii) measures the:
(α) length PZ ;
(β) angle XZY .
(iv) calculate, correct to the **nearest** whole number, the area of triangle XYZ .
5. (a) A property worth GHc 10,480.00 is shared between a widow and her 10 children in the ratio 1 : 4 respectively. The children shared their portions equally. Find **each** child's share.
- (b) The data shows the distribution of marks in a class test.

| | | | | | |
|----|----|----|----|----|----|
| 27 | 55 | 19 | 65 | 69 | 46 |
| 38 | 42 | 14 | 57 | 11 | 13 |
| 14 | 67 | 22 | 10 | 25 | 17 |
| 45 | 39 | 61 | 52 | 43 | 24 |
| 28 | 63 | 56 | 49 | 64 | 32 |

Use the data to answer the following questions:

- (i) make a Stem and Leaf plot of the data;
(ii) how many students scored more than 10 marks and less than 20 marks?
(iii) what is the probability of a student scoring less than 20 marks?
6. (a) An aeroplane left the Kotoka International Airport on Wednesday at 7:26 pm and reached its destination after nine hours thirty minutes. Find the day and the time the aeroplane reached its destination.
- (b) (i) Using a scale of 2 cm to 2 units on both axes, draw two perpendicular axes Ox and Oy on a graph sheet for $-10 \leq x \leq 10$ and $-12 \leq y \leq 12$.

- (ii) Draw on this graph, indicating the co-ordinates of all vertices, the quadrilateral $ABCD$ with vertices $A(0, 10)$, $B(-6, -2)$, $C(-3, -11)$ and $D(4, 3)$
- (iii) Draw the line $x = -2$ to meet AB at P and CD at Q .
- (iv) Measure angles BPQ and PQD
- (v) State the relationship between:
 - (α) angles BPQ and PQD ;
 - (β) lines AB and CD .

END OF ESSAY TEST

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) Solve the inequality $5x - 3 \geq \frac{15x-11}{2}$ and represent the answer on the number line.

$$2(5x - 3) \geq 15x - 11$$

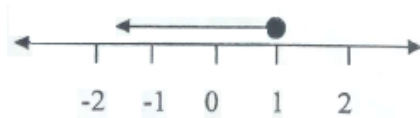
$$10x - 6 \geq 15x - 11$$

$$11 - 6 \geq 15x - 10x$$

$$5 \geq 5x$$

$$1 \geq x$$

$$\underline{x \leq 1}$$



1. Multiplying both sides by 2
2. Expanding left hand side
3. Grouping terms with x on right hand side (so that the x remains positive)
- 4 Simplifying
- 5 Expressing final answer

- (b) Given that $\mathbf{t} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ and $\mathbf{k} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$, find $2\mathbf{t} + \mathbf{k}$

$$2\mathbf{t} + \mathbf{k}$$

$$= 2 \begin{pmatrix} -1 \\ 3 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \times -1 \\ 2 \times 3 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} -2 \\ 6 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} -2 + 2 \\ 6 + (-4) \end{pmatrix}$$

$$= \begin{pmatrix} 0 \\ 2 \end{pmatrix}$$

Substituting vectors in given expression

Multiplying both components [of $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$] by 2

Adding -2 to 2 ; and 6 to (-4)

Expressing final answer

- (c) The sides of a triangle are in the ratio $6 : 8 : 10$. If the perimeter of the triangle is 288 cm, find the:

- (i) longest side;

$$= \frac{10}{6+8+10} \times 288 \text{ cm}$$

$$= \frac{10}{24} \times 288 \text{ cm}$$

$$= 10 \times 12 \text{ cm}$$

$$= \underline{120 \text{ cm}}$$

The ratio of the longest side = 10

Share of longest

$$= \frac{\text{Ratio of longest}}{\text{Total ratio}} \times \text{Total length}$$

(ii) **shortest side**

First Method

$$\begin{aligned} & \frac{6}{6+8+10} \times 288 \text{ cm} \\ = & \frac{6}{24} \times 288 \text{ cm} \\ = & 6 \times 12 \text{ cm} \\ = & \underline{72 \text{ cm}} \end{aligned}$$

Second Method (using simple proportion)

$$\begin{aligned} \text{If} & \quad \text{ratio } 10 \rightarrow 120 \text{ cm,} \\ \text{Then} & \quad \text{ratio } 6 \rightarrow ? \text{ (less)} \\ & \quad \text{If less, more (10) divides} \\ \Rightarrow & \quad \frac{6}{10} \times 120 \text{ cm} \\ = & \quad 6 \times 12 \text{ cm} \\ = & \quad \underline{72 \text{ cm}} \end{aligned}$$

(iii) **difference between the longest and the shortest sides.**

$$\begin{aligned} \text{Difference} & = \text{Longest} - \text{Shortest} \\ & = 120 - 72 \\ & = \underline{48 \text{ cm}} \end{aligned}$$

2. (a) **An English textbook costs GHc 25.00. The author of the book agreed to take 20% of the cost of each book sold. If 1,702 copies were sold, calculate the author's share.**

First Approach (finding his share for each book first)

$$\begin{aligned} \text{Author's share for each book} & = 20\% \text{ of GHc } 25.00 \\ & = \frac{20}{100} \times 25 \\ & = \frac{1}{5} \times 25 = 5 \\ & = \text{GHc } 5.00 \end{aligned}$$

Therefore Author's share for 1,702 copies sold

$$\begin{aligned} & = 1702 \times 5 = 8510 \\ & = \underline{\text{GHc } 8510.00} \end{aligned}$$

Second Approach (finding the total sale first)

Total sales made from 1702 copies

$$\begin{aligned} & = \text{Total no. of copies} \times \text{Selling price for each} \\ & = 1702 \times 25 \\ & = \text{GHc } 42550 \end{aligned}$$

Therefore Author's share for 1702

$$\begin{aligned} & = \frac{20}{100} \times 42550 \\ & = 2 \times 4255 = 8510 \\ & = \underline{\text{GHc } 8510.00} \end{aligned}$$

(b) Simplify: $\left(\frac{2}{15} + \frac{2}{5}\right) + \left(\frac{9}{10} \times \frac{4}{3}\right) + \left(\frac{1}{5} \div \frac{1}{4}\right)$

$$\left(\frac{1(2)+3(2)}{15}\right) + \left(\frac{9 \times 4}{10 \times 3}\right) + \left(\frac{1}{5} \times \frac{4}{1}\right)$$

$$\left(\frac{2+6}{15}\right) + \left(\frac{9 \times 4}{10 \times 3}\right) + \left(\frac{1}{5} \times \frac{4}{1}\right)$$

$$\frac{8}{15} + \frac{36}{30} + \frac{4}{5}$$

$$\frac{2(8)+1(36)+6(4)}{30}$$

$$\frac{16+36+24}{30}$$

$$= \frac{76}{30}$$

$$= \frac{38}{15} \quad \text{OR} \quad 2\frac{8}{15}$$

Note:

From $\left(\frac{2}{15} + \frac{2}{5}\right)$, the LCM of 15 and 5 = 15

15 'into' 15 (LCM) = 1, [15 × 1 = 15]

1 times 2 = 2

5 'into' 15 (LCM) = 3 [5 × 3 = 15]

3 times 2 = 6

Therefore $\left(\frac{2}{15} + \frac{2}{5}\right) = \left(\frac{2+6}{15}\right)$

Similarly, from $\frac{8}{15} + \frac{36}{30} + \frac{4}{5}$

LCM of 15, 30 and 5 = 30

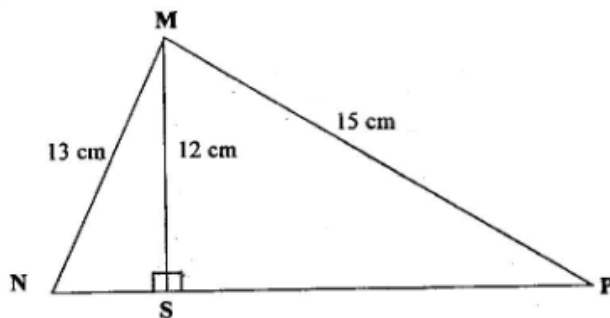
15 'into' 30 = 2 [15 × 2 = 30]

2 × 8 = 16

etc.

LCM = The least common multiple of the given numbers.

(c)



NOT DRAWN TO SCALE

In the diagram, $|MN| = 13$ cm, $|MP| = 15$ cm, $|MS| = 12$ cm and \overline{MS} is perpendicular to \overline{NP} . Calculate length NP .

$$|NP| = |NS| + |SP|$$

From the Pythagoras theorem, $|NS|^2 + 12^2 = 13^2$

$$|NS|^2 = 13^2 - 12^2$$

$$|NS|^2 = 169 - 144$$

$$|NS|^2 = 25$$

$$|NS| = \sqrt{25}$$

$$= 5 \text{ cm}$$

Similarly, from the Pythagoras theorem,

$$|SP|^2 = 15^2 - 12^2$$

$$= 225 - 144$$

$$= 81$$

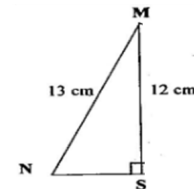
$$|SP| = \sqrt{81}$$

$$= 9 \text{ cm}$$

NOTE:

The Pythagoras theorem states that The square of the hypotenuse of a right-angled triangle equals the sum of the squares of the other two sides.

Thus, for triangle MNS,



$$13^2 = 12^2 + |NS|^2$$

$$\Rightarrow 13^2 - 12^2 = |NS|^2$$

$$\Rightarrow |NS|^2 = 13^2 - 12^2$$

$$\begin{aligned}\text{Hence, length NP} &= 5\text{cm} + 9\text{cm} \\ &= \underline{14\text{cm}}\end{aligned}$$

3. (a) Simplify $\frac{0.084 \times 0.81}{0.027 \times 0.04}$, leaving the answer in standard form.

1st Method

$$\begin{aligned}&= \frac{0.084 \times 0.81}{0.027 \times 0.04} \times \frac{100000}{100000} \\&= \frac{84 \times 81}{27 \times 4} \\&= 21 \times 3 \\&= 63 \\&= \underline{6.3 \times 10} \quad \text{OR} \quad \underline{6.3 \times 10^1}\end{aligned}$$

2nd Method

$$\begin{aligned}&= \frac{0.084 \times 0.81}{0.027 \times 0.04} \\&= (0.084 \times 0.81) \div (0.027 \times 0.04) \\&= \left(\frac{84}{1000} \times \frac{81}{100}\right) \div \left(\frac{27}{1000} \times \frac{4}{100}\right) \\&= \left(\frac{84}{1000} \times \frac{81}{100}\right) \times \left(\frac{1000}{27} \times \frac{100}{4}\right) \\&= \left(\frac{84}{1000} \times \frac{81}{100}\right) \times \left(\frac{1000}{27} \times \frac{100}{4}\right) \\&= \frac{84}{1} \times \frac{81}{1} \times \frac{1}{27} \times \frac{1}{4} \\&= \frac{84 \times 81}{27 \times 4} \\&= 21 \times 3 \\&= 63 \\&= \underline{6.3 \times 10} \quad \text{OR} \quad \underline{6.3 \times 10^1}\end{aligned}$$

3rd Method

$$\begin{aligned}&= \frac{0.084 \times 0.81}{0.027 \times 0.04} \\&= \frac{84 \times 10^{-3} \times 81 \times 10^{-2}}{27 \times 10^{-3} \times 4 \times 10^{-2}} \\&= \frac{84 \times \cancel{10^{-3}} \times 81 \times \cancel{10^{-2}}}{27 \times \cancel{10^{-3}} \times 4 \times \cancel{10^{-2}}} \\&= \frac{84 \times 81}{27 \times 4} \\&= 21 \times 3 \\&= 63 \\&= \underline{6.3 \times 10} \quad \text{OR} \quad \underline{6.3 \times 10^1}\end{aligned}$$

STEPS (1st Method)

1. Multiply both numerator and denominator by 100000
(or shift the decimal point 5 places to the right in both numerator and denominator – to convert to whole numbers)
2. Divide ('cancel') 84 by 4 to get 21 and divide 81 by 27 to get 3
Multiply 21 by 3 to get 63 [Note: $63 = 63.0$]
3. Convert to standard form by shifting decimal point 1 place to the left and multiplying by 10 to the power 1 (because decimal point was shifted once)

STEPS (2nd Method)

1. Express using the \div sign
2. Change all decimals to fractions
 $\left(\frac{27}{1000} \times \frac{4}{100}\right)$
3. Change the \div sign to \times and turn the divisors upside down to $\left(\frac{1000}{27} \times \frac{100}{4}\right)$
4. Divide ('cancel') 84 by 4 to get 21 and divide 81 by 27 to get 3.&
Divide ('cancel') 100 (numerator) by 100 (denominator) to get 1
Divide ('cancel') 1000 (numerator) by 1000 (denominator) to get 1
5. Multiply 21 by 3 to get 63 [Note: $63 = 63.0$]
6. Convert to standard form by shifting decimal point 1 place to the left and multiplying by 10 to the power 1 (because decimal point was shifted once)

STEPS (3rd Method)

1. Change decimals to whole numbers by shifting decimal point to the right and multiplying by 10 raised to negated same no. of times the point was shifted.
2. Divide 10^{-3} (numerator) by 10^{-3} (denominator) to get 1
4. Divide 10^{-2} (numerator) by 10^{-2} (denominator) to get 1
4. Divide ('cancel') 84 by 4 to get 21 and divide 81 by 27 to get 3.&
5. Multiply 21 by 3 to get 63 [Note: $63 = 63.0$]
6. Convert to standard form by shifting decimal point 1 place to the left and multiplying by 10 to the power 1 (because decimal point was shifted once)

(b) (i) Make r the subject of the relation:

$$y = \frac{x-r}{x+r}$$

$$y \times (x+r) = \frac{x-r}{(x+r)} \times (x+r)$$

$$y \times (x+r) = \frac{x-r}{\cancel{(x+r)}} \times \cancel{(x+r)}$$

$$y(x+r) = x-r$$

$$xy + ry = x - r$$

$$r + ry = x - xy$$

$$r(1+y) = x - xy$$

$$\frac{r \cancel{(1+y)}}{\cancel{(1+y)}} = \frac{x-xy}{(1+y)}$$

$$r = \frac{x-xy}{(1+y)}$$

STEPS:

1. Multiply both sides by denominator $(x+r)$ - to clear the fraction.
2. Simplify
3. Expand the left hand side
Note: $y \times x = yx = xy$
 $y \times r = yr = ry$
4. Regroup terms containing r on one side of the equation.
[NB: Regroup in such a way that the r becomes positive]
5. Factorize to give $r(1+y)$ - to make the r 's just one
6. Divide both sides by $(1+y)$

(ii) From (b)(i), find the value of r when $y = 3$ and $x = 10$

$$r = \frac{x-xy}{(1+y)}$$

$$r = \frac{10-(10 \times 3)}{(1+3)}$$

$$r = \frac{10-30}{4}$$

$$r = \frac{-20}{4}$$

$$\underline{\underline{r = -5}}$$

STEPS:

1. Put 10 in the place of x and 3 in place of y
Note $xy = x \times y$
2. Simplify

(c) Juliet bought 1,756 kg of frozen chicken, 675 g of vegetables, and 95 g of corn oil from a shopping mall. What is the total weight of the items she bought in kilograms?

$$\text{Total weigh of items} = 1,756 \text{ kg} + 675 \text{ g} + 95 \text{ g}$$

First Approach (converting to g first)

$$1756 \text{ kg} = 1756 \times 1000 \text{ g} = 1756000 \text{ g}$$

Now adding in grams (g)

$$\begin{array}{r} 1756000 \text{ g} \\ 675 \text{ g} \\ + \quad 95 \text{ g} \\ \hline 1756770 \text{ g} \end{array}$$

Converting to kg, we have $\frac{1756770}{1000} = \underline{1756.770 \text{ kg}}$

Second Approach (converting to kg first)

$$675 \text{ g} = \frac{675}{1000} = 0.675 \text{ kg}$$

$$95 \text{ g} = \frac{95}{1000} = 0.095 \text{ kg}$$

Now adding in kilograms (kg)

$$\begin{array}{r} 1756.000 \text{ kg} \\ 0.675 \text{ kg} \\ + \quad 0.095 \text{ kg} \\ \hline \underline{1756.770 \text{ kg}} \end{array}$$

4. (a) The sum of the interior angles of a regular polygon is 900° . Find the number of sides of the polygon.

Sum of interior angles = $(n - 2) \times 180^\circ$, where n = no. of sides

$$\Rightarrow 900^\circ = 180^\circ n - 360^\circ$$

$$900^\circ + 360^\circ = 180^\circ n$$

$$1260^\circ = 180^\circ n$$

$$\frac{\overset{7}{\cancel{1260^\circ}}}{\underset{1}{\cancel{180^\circ}}} = \frac{\overset{180^\circ}{\cancel{180^\circ}}}{\cancel{180^\circ}} n$$

$$\frac{7}{1} = n$$

$$n = 7$$

Hence, the polygon has 7 sides

STEPS:

1. Expand right hand side.

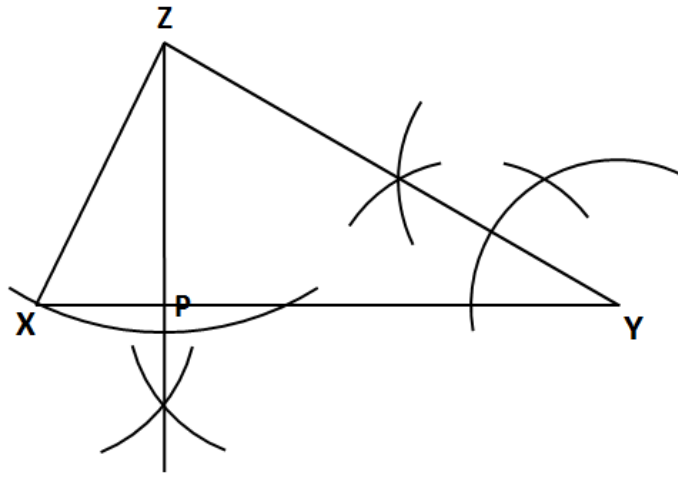
[$180 \times n = 180n$; $180 \times -2 = -360$]

2. Adding 360° to both sides
(sending -360 to the left hand side)

3. Dividing both sides by 180°

- (b) Using a ruler and a pair of compasses only, construct:

- triangle XYZ such that the length $XY = 10\text{cm}$, angle $XYZ = 30^\circ$ and length $YZ = 9 \text{ cm}$;
- perpendicular from Z to meet line XY at P ;



(iii) measure the:

(α) length PZ = 4.5 cm or 4.4 cm or 4.6 cm

(β) angle XZY = 86° or 85° or 87°

(iv) calculate, correct to the nearest whole number, the area of triangle XYZ .

$$\text{Area of a triangle} = \frac{1}{2} \times \text{Base} \times \text{Height}$$

$$\text{Area of triangle } XYZ = \frac{1}{2} \times |XY| \times |PZ|$$

$$= \frac{1}{2} \times 10\text{cm} \times 4.5$$

$$= \frac{1}{2} \times 45$$

$$= 22.5$$

$$\approx 23 \text{ cm}^2 \text{ (to nearest whole number)}$$

Note: If 4.4 cm is used, Area = 22 cm

If 4.6 cm is used, Area = 23 cm

5. (a) A property worth GHc 10,480.00 is shared between a widow and her 10 children in the ratio 1 : 4 respectively. The children shared their portions equally. Find each child's share.

1st Approach

$$\text{The Children's share} = \frac{4}{1+4} \times 10,480$$

$$= \frac{4}{5} \times 10,480$$

$$= 8384$$

$$\text{Each child's share} = \frac{8384}{10} = 838.4$$

$$= \text{GHc } 838.40$$

2nd Approach

$$\text{The widow's share} = \frac{1}{1+4} \times 10,480$$

$$= \frac{1}{5} \times 10,480$$

$$= 2,096$$

$$\begin{aligned} \text{The Children's share} &= 10,480 - 2,096 \\ &= 8384 \end{aligned}$$

$$\begin{aligned} \text{Each child's share} &= \frac{8384}{10} = 838.4 \\ &= \text{GHc } 838.40 \end{aligned}$$

3rd Approach

$$\begin{aligned} \text{The Children's share} &= 4 \times \text{Widow's share} \\ &= 4 \times 2,096 \\ &= 8384 \end{aligned}$$

$$\begin{aligned} \text{Each child's share} &= \frac{8384}{10} = 838.4 \\ &= \text{GHc } 838.40 \end{aligned}$$

(b) The data shows the distribution of marks in a class test.

| | | | | | |
|----|----|----|----|----|----|
| 27 | 55 | 19 | 65 | 69 | 46 |
| 38 | 42 | 14 | 57 | 11 | 13 |
| 14 | 67 | 22 | 10 | 25 | 17 |
| 45 | 39 | 61 | 52 | 43 | 24 |
| 28 | 63 | 56 | 49 | 64 | 32 |

Use the data to answer the following questions:

(i) make a Stem and Leaf plot of the data;

| Stem | Leaf |
|------|---------------------|
| 1 | 0, 1, 3, 4, 4, 7, 9 |
| 2 | 2, 4, 5, 7, 8, |
| 3 | 2, 8, 9 |
| 4 | 2, 3, 5, 6, 9 |
| 5 | 2, 5, 6, 7, |
| 6 | 1, 3, 4, 5, 7, 9 |

(ii) how many students scored more than 10 marks and less than 20 marks?

$$= 6 \text{ students}$$

(iii) what is the probability of a student scoring less than 20 marks?

$$\begin{aligned} \text{Probability} &= \frac{\text{Number of students who scored less than 20 marks}}{\text{Total number of students}} \\ &= \frac{7}{30} \end{aligned}$$

6. (a) An aeroplane left the Kotoka International Airport on Wednesday at 7:26 pm and reached its destination after nine hours thirty minutes. Find the day and the time the aeroplane reached its destination.

1st approach

Departure time = 7:26 pm;
Duration of flight = 9 h 30 min

$$\begin{array}{r}
 \text{H} \quad \text{M} \\
 7 \quad 26 \\
 + \quad 9 \quad 30 \\
 \hline
 16 \quad 56
 \end{array}$$

$$\begin{array}{r}
 \text{H} \quad \text{M} \\
 16 \quad 56 \\
 - \quad 12 \quad 00 \\
 \hline
 4 \quad 56
 \end{array}$$

2nd approach

7:26 pm = 7:26 + 12:00 = 19:26 GMT

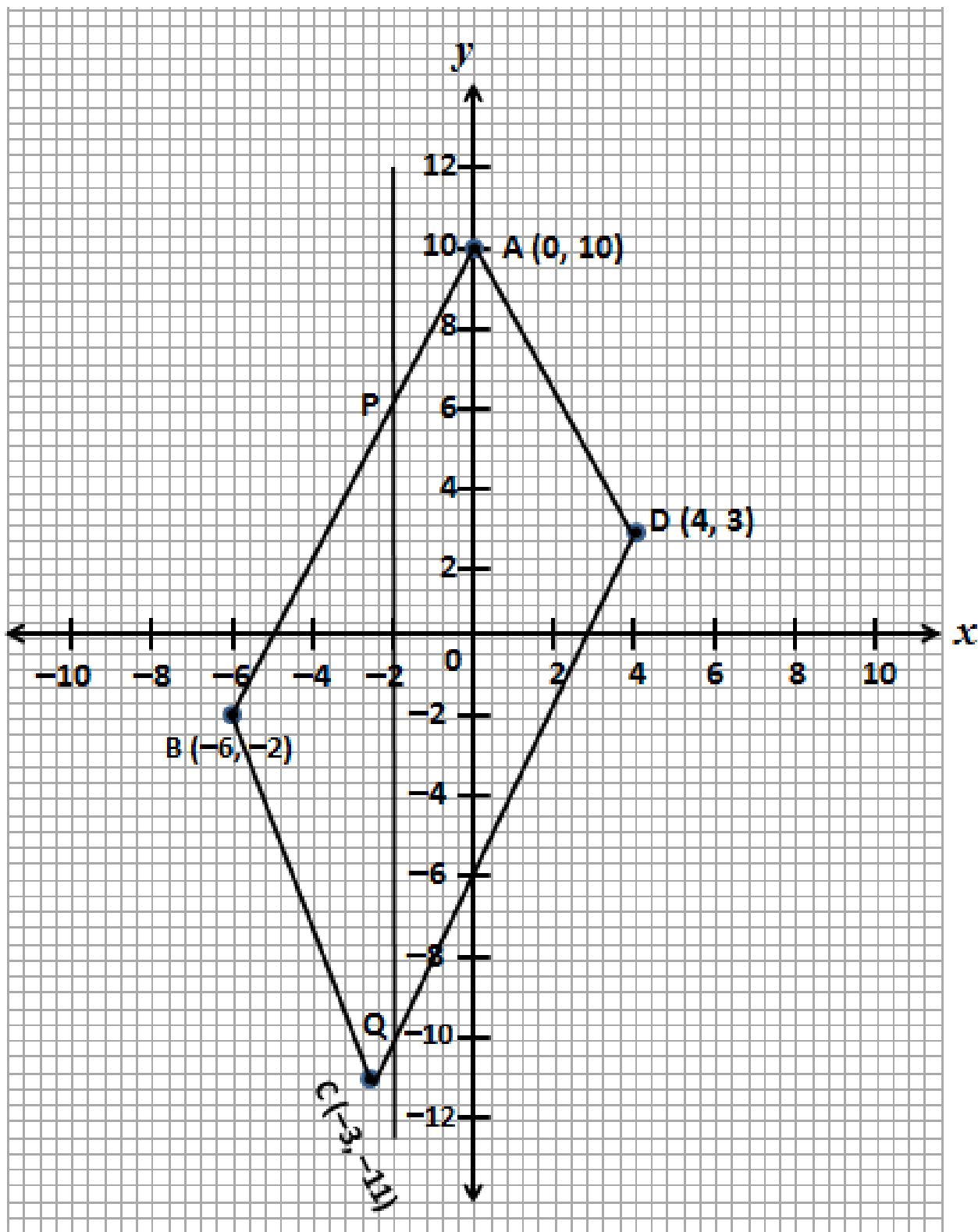
$$\begin{array}{r}
 \text{H} \quad \text{M} \\
 19 \quad 26 \\
 + \quad 9 \quad 30 \\
 \hline
 28 \quad 56
 \end{array}$$

$$\begin{array}{r}
 \text{H} \quad \text{M} \\
 28 \quad 56 \\
 - \quad 24 \quad 00 \\
 \hline
 4 \quad 56
 \end{array}$$

The aeroplane arrives on Thursday at 4:56 am.

(b)

- (i) Using a scale of 2 cm to 2 units on both axes, draw two perpendicular axes Ox and Oy on a graph sheet for $-10 \leq x \leq 10$ and $-12 \leq y \leq 12$.
- (ii) Draw on this graph, indicating the co-ordinates of all vertices, the quadrilateral ABCD with vertices $A(0, 10)$, $B(-6, -2)$, $C(-3, -11)$ and $D(4, 3)$
- (iii) Draw the line $x = -2$ to meet AB at P and CD at Q.



(iv) Measure angles BPQ and PQD

$$\text{Angle } BPQ = 26^\circ \text{ or } 25^\circ \text{ or } 27^\circ$$

$$\text{Angle } PQD = 26^\circ \text{ or } 25^\circ \text{ or } 27^\circ$$

(i) State the relationship between:

(a) angles BPQ and PQD ;

They are alternate angles

(β) **lines AB and CD .**

They are parallel

JUNE 2017

MATHEMATICS 1

Objective Test

1 Hour

1. If $Q = \{1, 3, 5, 7, 9, 10, 11, 13, 15\}$ and $T = \{1, 2, 3, 5, 6, 7, 10, 11, 12\}$, find $Q \cup T$
A. $\{1, 2, 3, 5, 7, 10, 11\}$
B. $\{1, 3, 5, 7, 9, 11, 13, 15\}$
C. $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$
D. $\{1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 15\}$
2. If $21 : 2x = 7 : 12$, find the value of x .
A. 10
B. 12
C. 15
D. 18
3. Given that $\frac{1}{2p} = \frac{1}{8}$, find the value of p .
A. 4
B. 3
C. 2
D. 1
4. Simplify $3q \times 12pq$
A. $15pq^2$
B. $15p^2q$
C. $36pq^2$
D. $36p^2q$
5. If $A = \{2, 6, 8\}$ and $B = \{4, 6, 8, 10\}$, which of the following statements is true?
A. $A \subset B$
B. $A \cap B = \{2, 6, 8\}$
C. $A \cup B = \{2, 4, 6, 8, 10\}$
D. $A \supset B$
6. Find the product of $4xy^4$ and x^2yz
A. $4x^3y^4z$
B. $4x^3y^5z$
C. $4x^2y^4z$
D. $4x^2y^4$
7. The sum of the interior angles of a regular polygon with 10 sides is
A. 144°

- B. 900°
- C. 1440°
- D. 1800°

8. Solve $2 + \frac{x}{3} = 1 - 2x$

- A. $-1\frac{2}{7}$
- B. $-\frac{3}{7}$
- C. $\frac{3}{7}$
- D. $1\frac{2}{7}$

9. The ages of the members of a social club are 20 years, 55 years, 60 years and 25 years. Find the mean age of the members of the club.

- A. 20 years
- B. 30 years
- C. 40 years
- D. 50 years

10. Evelyn saved GHc 35.48 every month for 8 months. How much did she save?

- A. GHc 183.60
- B. GHc 280.63
- C. GHc 283.20
- D. GHc 283.84

11. Evaluate: $\frac{0.00492}{0.041}$

- A. 0.012
- B. 0.12
- C. 1.2
- D. 12.0

12. A woman deposited an amount of GHc 50,000.00 at a bank for 2 years at a rate of 20% per annum. Find the simple interest.

- A. GHc 1,000.00
- B. GHc 2,000.00
- C. GHc 10,000.00
- D. GHc 20,000.00

13. What is the total cost of x shirts at GHc 5.00 **each** and y shirts at GHc 1.50 **each**?

- A. $5x + 1.5y$
- B. $5y + 1.5x$
- C. $5(x + 1.5y)$
- D. $1.5(5x + y)$

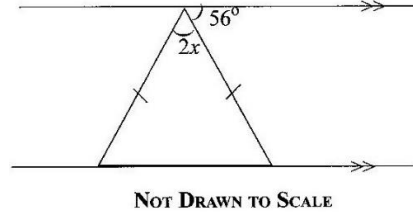
14. At a meeting attended by 23 people, the females were 7 more than the males. How many males were there?

- A. 8
- B. 15

- C. 16
- D. 30

15. Find the value of x in the diagram.

- A. 28°
- B. 30°
- C. 34°
- D. 60°



16. How many lines of symmetry does a rhombus have?

- A. 2
- B. 3
- C. 4
- D. 5

17. In 1995, 215 boys and 185 girls were admitted into a Senior Secondary School. Find, correct to the nearest whole number, the percentage of girls admitted.

- A. 46%
- B. 47%
- C. 53%
- D. 54%

18. Simplify: $\frac{2(u-v)(2u+3v)}{(4u+6v)}$

- A. $\frac{(u-v)(2u+v)}{(u+v)}$
- B. $\frac{(u-v)(u+v)}{(u+2v)}$
- C. $\frac{1}{2}(u-v)$
- D. $(u-v)$

19. Solve $25x + 450 \leq 3000$

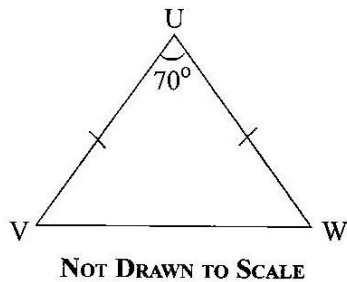
- A. $x \geq 102$
- B. $x \leq 102$
- C. $x \geq 138$
- D. $x \leq 138$

20. Given that $a = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$ and $b = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$, find $a + b$.

- A. $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$
- B. $\begin{pmatrix} -8 \\ 12 \end{pmatrix}$
- C. $\begin{pmatrix} 8 \\ -12 \end{pmatrix}$
- D. $\begin{pmatrix} -8 \\ 0 \end{pmatrix}$

21. Mr. Agyekum has 11 of the GHc 20.00 notes, 15 of the GHc 10.00 notes and 6 of the GHc 5.00 notes. How much does Mr. Agyekum have altogether?
- A. 280.00
B. 320.00
C. 360.00
D. 400.00
22. A man travelled a distance of 1.5 km in 30 minutes. What distance can he cover in 50 minutes, travelling at the same speed?
- A. 2.2 km
B. 2.5 km
C. 2.8 km
D. 3.2 km

23.



In the diagram, UVW is an isosceles triangle, $|UV| = |UW|$ and angle $VUW = 70^\circ$. Find angle UVW

- A. 70°
B. 60°
C. 55°
D. 35°
24. Arrange the following in descending order: $\frac{7}{20}$, $\frac{7}{25}$, $\frac{37}{100}$, $\frac{1}{4}$
- A. $\frac{37}{100}$, $\frac{7}{20}$, $\frac{7}{25}$, $\frac{1}{4}$
B. $\frac{1}{4}$, $\frac{7}{25}$, $\frac{7}{20}$, $\frac{37}{100}$
C. $\frac{37}{100}$, $\frac{7}{20}$, $\frac{1}{4}$, $\frac{7}{25}$
D. $\frac{7}{25}$, $\frac{1}{4}$, $\frac{7}{20}$, $\frac{37}{100}$
25. The point D(4, 3) is reflected in the y-axis. Find the coordinates of its image.
- A. $(-4, -3)$
B. $(-3, 4)$
C. $(-4, 3)$
D. $(3, -4)$
26. Simplify: $7\frac{1}{2} \times \left(\frac{1}{4} \div \frac{1}{2}\right) - \frac{1}{4}$
- A. $\frac{7}{2}$

- B. $\frac{11}{16}$
- C. $\frac{7}{32}$
- D. $\frac{1}{2}$

27. Divide 64.5 by 0.015, leaving the answer in standard form.

- A. 4.3×10^4
- B. 4.3×10^3
- C. 4.3×10^2
- D. 4.3×10

28. The point Q(−2, 3) is rotated anticlockwise about the origin through an angle of 90°. Find the coordinates of its image.

- A. (−3, −2)
- B. (−3, 2)
- C. (3, −2)
- D. (3, 2)

29. Elias bought five books. Their mean price was GHc 3.25. The total cost for four of the books was GHc 11.75. What was the cost of the fifth book?

- A. GHc 3.50
- B. GHc 4.00
- C. GHc 4.20
- D. GHc 4.50

Tins of milk **each** of volume 77 cm³ and weight 170 g were packed into an empty carton of volume 1540 cm³ and weight 500 g.

Use this information to answer Questions 30 and 31

30. How many tins of milk can be packed to fill the carton?

- A. 2
- B. 3
- C. 20
- D. 22

31. What is the weight of the carton when packed with the tins of milk?

- A. 2.06 kg
- B. 2.94 kg
- C. 3.90 kg
- D. 8.50 kg

32. A piece of cloth is 8.4 m long. If 30 cm is needed to sew a napkin, how many napkins can be sewn from this piece of cloth?

- A. 20
- B. 25
- C. 28
- D. 30

33. Express $\frac{10}{32}$ as a decimal fraction.

- A. 0.3200
- B. 0.3125
- C. 0.3676
- D. 0.3222

34. A match box contains 40 sticks. If 15 of them are spoil, find the probability that a stick chosen at random is **not** spoilt?

- A. $\frac{3}{5}$
- B. $\frac{3}{8}$
- C. $\frac{5}{8}$
- D. $\frac{2}{5}$

The number of pupils who attended hospital from eight classes on a particular day are: 1, 5, 3, 1, 7, 5, 1, 1.

Use the information to answer Questions 35 to 37.

35. Find the median number.

- A. 1
- B. 2
- C. 3
- D. 4

36. What is the modal number?

- A. 1
- B. 4
- C. 5
- D. 7

37. Calculate the mean.

- A. 2
- B. 3
- C. 4
- D. 5

38. The distance from the centre of a circle to any point on it is called

- A. Circumference
- B. Diameter
- C. Radius
- D. Sector

39. Express 1352 as a product of prime factors.

- A. $2^3 \times 13^3$
- B. $2^3 \times 13^2$

- C. $2^2 \times 13^3$
- D. $2^2 \times 13^2$

40. Which of the following statements about sets is **true**?
- A. Every set is a subset of the null set.
 - B. The universal set is the subset of the null set
 - C. The intersection of two sets is always a null set
 - D. The universal set is the union of all its subsets.

JUNE 2017

MATHEMATICS 1

Objective Test

SOLUTIONS

1. D. $\{1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 15\}$

2. D. 18

3. A. 4

4. C. $36pq^2$

5. C. $A \cup B = \{2, 4, 6, 8, 10\}$

6. B. $4x^3y^5z$

7. C. 1440°

8. B. $-\frac{3}{7}$

9. C. 40 years

10. D. GHc 283.84

11. B. 0.12

12. D. GHc 20,000.00

13. A. $5x + 1.5y$

14. A. 8

15. C. 34°

16. A. 2

17. A. 46%

18. D. $(u - v)$

19. B. $x \leq 102$

20. A. $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$

21. D. GHc 400.00

22. B. 2.5 km

23. C. 55°

24. A. $\frac{37}{100}, \frac{7}{20}, \frac{7}{25}, \frac{1}{4}$

25. C. $(-4, 3)$

26. A. $\frac{7}{2}$

27. B. 4.3×10^3

- 28. A. $(-3, -2)$
- 29. D. GHc 4.50
- 30. C. 20
- 31. C. 3.90 kg
- 32. C. 28
- 33. B. 0.3125
- 34. C. $\frac{5}{8}$
- 35. B. 2
- 36. A. 1
- 37. B. 3
- 38. C. Radius
- 39. B. $2^3 \times 13^2$
- 40. D. The universal set is the union of all its subsets

JUNE 2017

MATHEMATICS 2

PAPER 2

ESSAY

1 HOUR

Answer four questions only.

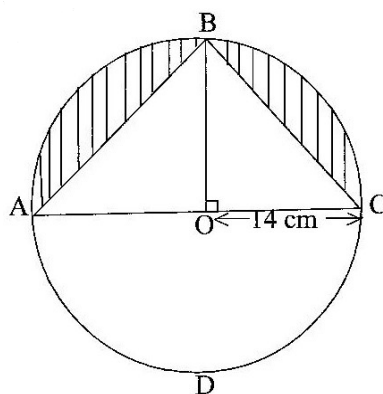
All questions carry equal marks.

*All working **must** be clearly shown.*

Marks will **not** be awarded for correct answers without corresponding working

1. (a) In a class of 30 girls, 17 play football, 12 play hockey and 4 play both games.
 - (i) Draw a Venn diagram to illustrate the given information
 - (ii) How many girls play:
 - (α) one or two of the games;
 - (β) none of the two games?

- (b)



NOT DRAWN TO SCALE

In the diagram, ABCD is a circle of radius 14 cm and centre O. Line BO is perpendicular to line AC. Calculate, the total area of the shaded portions.

[Take $\pi = \frac{22}{7}$]

2. (a) Two consecutive odd numbers are such that seven times the smaller, subtracted from nine times the bigger, gives 144. Find the two numbers.
- (b) A paint manufacturing company has a machine which fills 24 tins with paint in 5 minutes.
- (i) How many tins will the machine fill in
- (α) 1 minute, correct to the nearest whole number?
- (β) 1 hour?
- (ii) How many hours will it take to fill 1440 tins?
- (c) Given that $s = \frac{n}{2} [2a + (n - 1)d]$, $a = 3$, $d = 4$ and $n = 10$, find the value of s .

3. (a) Using a ruler and pair of compasses only, construct:
- a triangle ABC, with $|BC| = 9\text{cm}$, $|AC| = 8$ and $|AB| = 6$ cm;
 - the perpendicular bisector of line BC;
 - the bisector of angle ACB

(b) Label the point of intersection of the two bisectors as Y.

(c) Draw a line to join B and Y.

(d) Measure

- $|BY|$;
- $|YC|$;
- the base angles of triangle BYC.

(e) What type of triangle is BYC?

4. (a) The table below shows the ages of students admitted in a hospital.

| | | | | | | |
|--------------------|----|----|----|----|----|----|
| Age (years) | 10 | 11 | 12 | 13 | 14 | 15 |
| Number of Students | 5 | 1 | 7 | 10 | 3 | 4 |

Use the information to answer the following questions:

- What is the modal age?
- Calculate, correct to two decimal places, the mean age of the students.

(b) Rice is sold at GHc 56.00 per bag of 50 kg. A trader bought some bags of rice and paid GHc 1,344.00.

- How many bags of rice did the trader buy?
- If the trader retailed the bags of rice at GHc 1.40 per kg, how much profit was made on 1 kg of rice?

5. (a) Using a scale of 2 cm to 1 unit on both axes, draw on a graph sheet two perpendicular axes Ox and Oy for $-5 \leq x \leq 5$ and $-5 \leq y \leq 5$

- Plot, indicating the coordinates of all points A(2, 3) and B(-3, 4). Draw a straight line passing through the points A and B.
- Plot on the same graph sheet, indicating the coordinates of the points C(4, 2) and D(-2, -3). Draw a straight line passing through the points to meet line AB

(b) Using the graphs in 5(a),

- find the values of y when $x = -2$;
- measure the angle between the lines AB and CD.

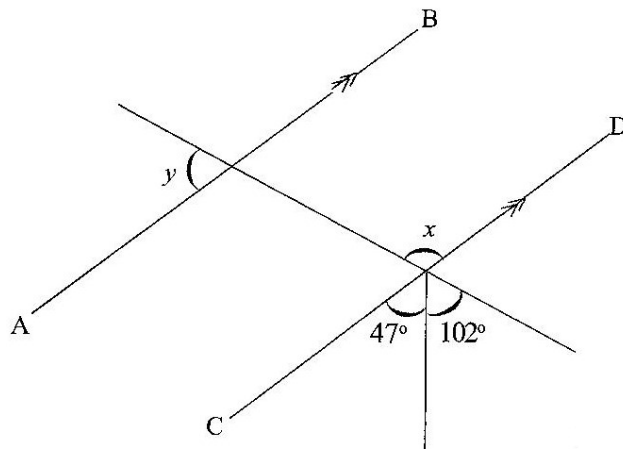
6. (a) If $m = \frac{2x+1}{2-3y}$, $n = \frac{2x+1}{2-3y}$ and $m+n = \frac{2x+1}{2-3y}$, find the:

- values of x and y
- components of m

(b) (i) Solve the inequality: $\frac{3}{4}(x + 1) + 1 \leq \frac{1}{2}(x - 2) + 5$

(ii) Illustrate the answer in b(i) on a number line.

(c)



NOT DRAWN TO SCALE

In the diagram, AB is parallel to CD. Find the value of:

(i) x

(ii) y

JUNE 2017

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) In a class of 30 girls, 17 play football, 12 play hockey and 4 play both games.

- (i) Draw a Venn diagram to illustrate the given information

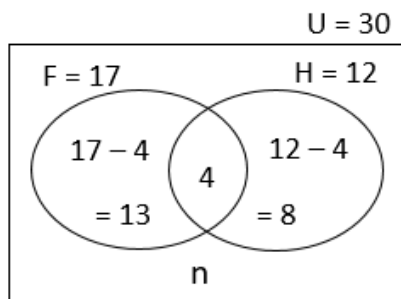
Let

U = Total number in class

F = Number of girls who play football

H = Number of girls who play hockey

n = Number of girls who play none of the two games



- (ii) How many girls play:

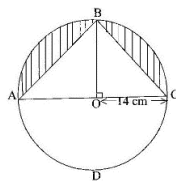
- (α) one or two of the games;

$$\begin{aligned} &= 13 + 4 + 8 \\ &= 25 \end{aligned}$$

- (β) none of the two games?

$$\begin{aligned} &= 30 - 25 \\ &= 5 \end{aligned}$$

- (b)



Total area of shaded portion

$$= \text{Area of semi-circle} - \text{Area of the triangle } ABC$$

$$\begin{aligned} \text{Area of semi-circle} &= \frac{1}{2} \pi r^2 \\ &= \frac{1}{2} \times \frac{22}{7} \times 14 \times 14 \end{aligned}$$

Alternatively, you may first find the area of the entire circle and divide by 2 to get area of semicircle

$$= 11 \times 2 \times 14$$

$$= 308 \text{ cm}^2$$

$$\begin{aligned} \text{Area of triangle ABC} &= \frac{1}{2} b h \\ &= \frac{1}{2} \times |AC| \times |OB| \\ &= \frac{1}{2} \times 28 \times 14 \\ &= 14 \times 14 \\ &= 196 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Therefore, Area of shaded portion} &= 308 - 196 \\ &= 112 \text{ cm}^2 \end{aligned}$$

2. (a) Two consecutive odd numbers are such that seven times the smaller, subtracted from nine times the bigger, gives 144. Find the two numbers.

$$\begin{aligned} \text{Let the first (smaller) odd number} &= n \\ \text{Then the next (bigger) odd number} &= n + 2 \\ \text{Seven times the smaller} &= 7n \\ \text{Nine times the bigger} &= 9(n + 2) \end{aligned}$$

$$\begin{aligned} \text{Hence} \quad \Rightarrow \quad 9(n + 2) - 7n &= 144 \\ \Rightarrow 9n + 18 - 7n &= 144 \\ \Rightarrow 9n - 7n &= 144 - 18 \\ \Rightarrow 2n &= 126 \\ \Rightarrow n &= \frac{126}{2} \\ \Rightarrow n &= 63 \end{aligned}$$

Therefore the smaller odd number is 63

$$\text{And the bigger odd number} = 63 + 2 = 65$$

- (b) A paint manufacturing company has a machine which fills 24 tins with paint in 5 minutes.
 (i) How many tins will the machine fill in
 (α) 1 minute, correct to the nearest whole number?

$$\begin{aligned} \text{If } 5 \text{ minutes} &\rightarrow 24 \text{ tins,} \\ \text{then } 1 \text{ minute} &\rightarrow \frac{24}{5} = 4\frac{4}{5} \text{ tins} \approx 5 \text{ tins} \end{aligned}$$

Hence, 1 minute \rightarrow 5 tins (to the nearest whole number)

- (β) 1 hour?

$$\begin{aligned} \text{If } 1 \text{ minute} &\rightarrow \frac{24}{5} \\ \text{then } 1 \text{ hour (60 minutes)} &\rightarrow \frac{24}{5} \times 60 \end{aligned}$$

$$= 24 \times 12$$

$$= 288 \text{ tins}$$

(ii) How many hours will it take to fill 1440 tins?

$$\begin{array}{llll} \text{If} & 288 \text{ tins} & \rightarrow & 1 \text{ hour} \\ \text{then} & 1440 \text{ tins} & \rightarrow & \frac{1440}{288} \times 1 \text{ hour} \\ & & = & 5 \text{ hours} \end{array}$$

(c) Given that $s = \frac{n}{2} [2a + (n-1)d]$, $a = 3$, $d = 4$ and $n = 10$, find the value of s .

$$\Rightarrow s = \frac{10}{2} [2 \times 3 + (10-1)4],$$

$$\Rightarrow s = 5 [6 + (9)4],$$

$$\Rightarrow s = 5 [6 + 36],$$

$$\Rightarrow s = 5(42)$$

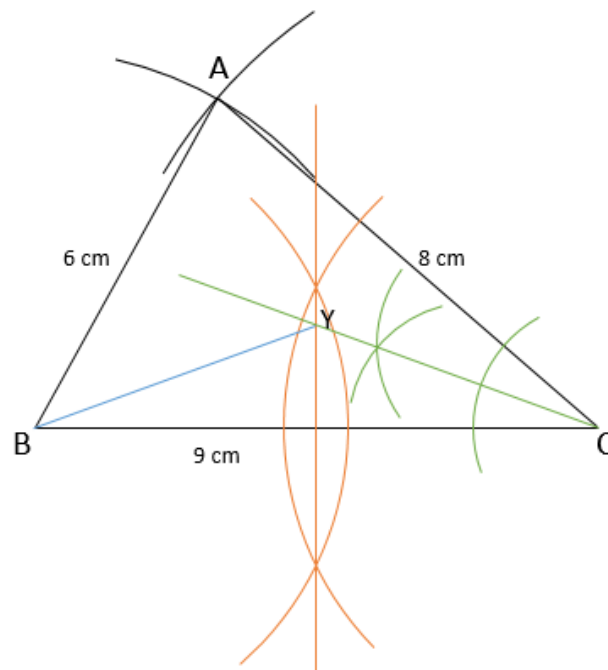
$$\Rightarrow s = 210$$

3. (a) Using a ruler and pair of compasses only, construct:

(i) a triangle ABC, with $|BC| = 9\text{cm}$, $|AC| = 8$ and $|AB| = 6 \text{ cm}$;

(ii) the perpendicular bisector of line BC;

(iii) the bisector of angle ACB



(b) Label the point of intersection of the two bisectors as Y.

See diagram (point Y within triangle ABC)

(c) Draw a line to join B and Y.

See diagram (blue line from B to Y)

(d) **Measure**

(i) **|BY|;**

$$= 4.8 \text{ cm} \quad [\pm 0.1 \text{ cm}]$$

(ii) **|YC|;**

$$= 4.8 \text{ cm} \quad [\pm 0.1 \text{ cm}]$$

(iii) **the base angles of triangle BYC.**

$$= 20.5^\circ \quad [\text{or } 20^\circ \text{ or } 21^\circ]$$

(e) **What type of triangle is BYC?**

$$= \text{Isosceles triangle}$$

4. (a) The table below shows the ages of students admitted in a hospital.

| Age (years) | 10 | 11 | 12 | 13 | 14 | 15 |
|--------------------|----|----|----|----|----|----|
| Number of Students | 5 | 1 | 7 | 10 | 3 | 4 |

Use the information to answer the following questions:

(i) **What is the modal age?**

$$= 13 \text{ years} \quad (\text{the age with the highest no. of students})$$

(ii) **Calculate, correct to two decimal places, the mean age of the students.**

$$\begin{aligned}
 \text{Mean age} &= \frac{(10 \times 5) + (11 \times 1) + (12 \times 7) + (13 \times 10) + (14 \times 3) + (15 \times 4)}{(5 + 1 + 7 + 10 + 3 + 4)} \\
 &= \frac{50 + 11 + 84 + 130 + 42 + 60}{30} \\
 &= \frac{377}{30} \\
 &= 12\frac{17}{30} \\
 &= 12.57 \text{ years.}
 \end{aligned}$$

(a) (ii) **ALTERNATIVE APPROACH (using the table)**

| Age in years (x) | 10 | 11 | 12 | 13 | 14 | 15 | |
|------------------------|----|----|----|-----|----|----|-------------------|
| No. of Students (f) | 5 | 1 | 7 | 10 | 3 | 4 | $\Sigma f = 30$ |
| fx | 50 | 11 | 84 | 130 | 42 | 60 | $\Sigma fx = 377$ |

$$\begin{aligned}
 \text{Mean age} &= \frac{\Sigma fx}{\Sigma f} \\
 &= \frac{377}{30} \\
 &= 12\frac{17}{30} \\
 &= 12.57 \text{ years}
 \end{aligned}$$

- (b) Rice is sold at GHc 56.00 per bag of 50 kg. A trader bought some bags of rice and paid GHc 1,344.00.

- (i) How many bags of rice did the trader buy?

$$\begin{aligned}
 \text{No. of bags bought} &= \frac{1344}{56} \\
 &= 24 \text{ bags}
 \end{aligned}$$

- (ii) If the trader retailed the bags of rice at GHc 1.40 per kg, how much profit was made on 1 kg of rice?

$$\text{Profit} = \text{Selling Price} - \text{Cost Price}$$

$$\text{Cost Price of 1 kg} = \frac{56}{50} = \text{GHc } 1.12$$

$$\text{Selling Price of 1 kg} = \text{GHc } 1.40$$

$$\begin{aligned}
 \text{Therefore Profit made on 1 kg} &= 1.40 - 1.12 \\
 &= \text{GHc } 0.28
 \end{aligned}$$

- (b) (ii) **ALTERNATIVE APPROACH (using the totals)**

$$\begin{aligned}
 \text{Total amount of rice} &= 24 \times 50 \text{ kg} \\
 &= 1200 \text{ kg}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Retailed (selling) price} &= \text{GHc } 1.40 \times 1200 \\
 &= \text{GHc } 1680
 \end{aligned}$$

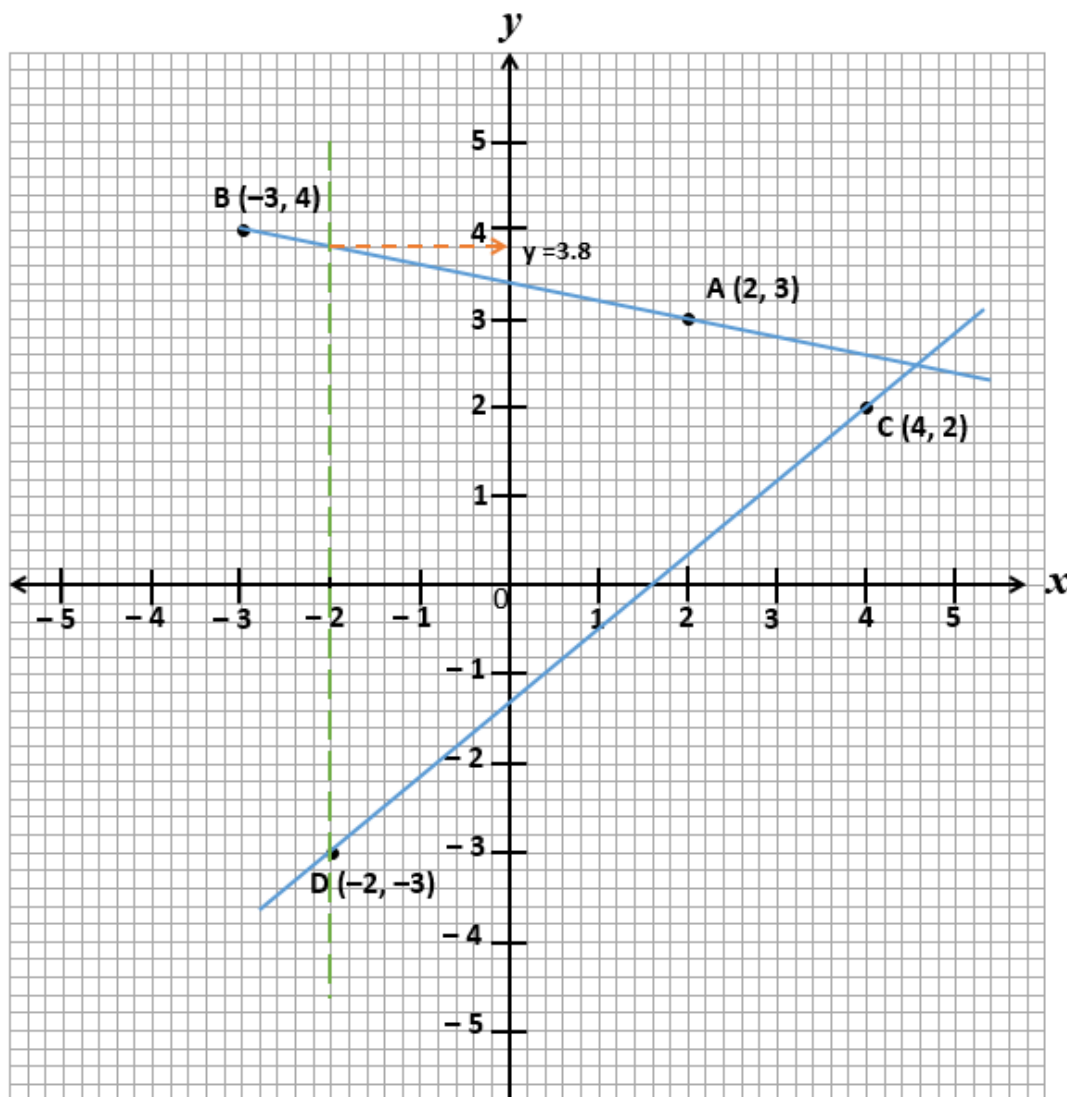
$$\text{Total cost price (given)} = \text{GHc } 1344$$

$$\begin{aligned}
 \text{Profit on total amount} &= \text{Total SP} - \text{Total CP} \\
 &= 1680 - 1344 \\
 &= \text{GHc } 336
 \end{aligned}$$

$$\text{Profit on each kg (1 kg)} = \frac{336}{1200}$$

$$= \text{GHc } 0.28$$

5. (a) Using a scale of 2 cm to 1 unit on both axes, draw on a graph sheet two perpendicular axes Ox and Oy for $-5 \leq x \leq 5$ and $-5 \leq y \leq 5$
- (i) Plot, indicating the coordinates of all points A(2, 3) and B(-3, 4). Draw a straight line passing through the points A and B.
- (ii) Plot on the same graph sheet, indicating the coordinates of the points C(4, 2) and D(-2, -3). Draw a straight line passing through the points to meet line AB



- (b) Using the graphs in 5(a),
- (i) find the values of y when $x = -2$;
 Values of y = -3 and 3.8 $[\pm 0.1]$
- (ii) measure the angle between the lines AB and CD.
Acute angle between lines = 51° $[\pm 0.1]$
 OR
Obtuse angle between lines = 129° $[\pm 0.1]$

6. (a) If $\mathbf{m} = \begin{pmatrix} 2x+1 \\ 2-3y \end{pmatrix}$, $\mathbf{n} = \begin{pmatrix} 6 \\ -8 \end{pmatrix}$ and $\mathbf{m} + \mathbf{n} = \begin{pmatrix} 9 \\ -12 \end{pmatrix}$, find the:

(i) values of x and y

Since $\mathbf{m} + \mathbf{n} = \begin{pmatrix} 9 \\ -12 \end{pmatrix}$

Then from the horizontal (x) component,

$$\Rightarrow 2x + 1 + 6 = 9$$

$$\Rightarrow 2x = 9 - 1 - 6$$

$$\Rightarrow 2x = 2$$

$$\Rightarrow x = 1$$

and from the vertical (y) component,

$$\Rightarrow 2 - 3y - 8 = -12$$

$$\Rightarrow 2 - 8 + 12 = 3y$$

$$\Rightarrow 6 = 3y$$

$$\Rightarrow \frac{6}{3} = \frac{3y}{3}$$

$$\Rightarrow 2 = y$$

$$\Rightarrow y = 2$$

(ii) components of \mathbf{m}

$$\begin{aligned} \mathbf{m} &= \begin{pmatrix} 2x+1 \\ 2-3y \end{pmatrix} \\ &= \begin{pmatrix} 2 \times 1 + 1 \\ 2 - 3 \times 2 \end{pmatrix} \\ &= \begin{pmatrix} 2+1 \\ 2-6 \end{pmatrix} \\ &= \begin{pmatrix} 3 \\ -4 \end{pmatrix} \end{aligned}$$

Substituting $x = 1$ and $y = 2$

Simplifying

(b) (i) Solve the inequality: $\frac{3}{4}(x+1) + 1 \leq \frac{1}{2}(x-2) + 5$

$$\Rightarrow 4 \times \frac{3}{4}(x+1) + 1 \times 4 \leq 4 \times \frac{1}{2}(x-2) + 5 \times 4$$

$$\Rightarrow 3(x+1) + 4 \leq 2(x-2) + 20$$

$$\Rightarrow 3x + 3 + 4 \leq 2x - 4 + 20$$

$$\Rightarrow 3x + 7 \leq 2x + 16$$

$$\Rightarrow 3x - 2x \leq 16 - 7$$

$$\Rightarrow x \leq 9$$

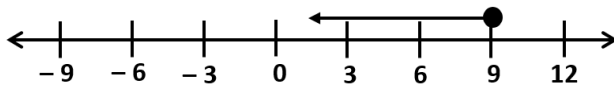
Multiplying through by 4 (to clear fractions) and simplifying

Expanding

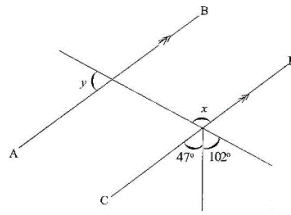
Simplifying and regrouping

Simplifying

(ii) Illustrate the answer in b(i) on a number line.



(c)



In the diagram, AB is parallel to CD. Find the value of:

(i) x

Angle x and $(47^\circ + 102^\circ)$ form vertically opposite angles

Hence, $x = 47^\circ + 102^\circ$

$\Rightarrow x = 149^\circ$

(ii) y

x is congruent to the angles adjacent to y (alternate or corresponding)

Hence $y + 149^\circ = 180^\circ$

$\Rightarrow y = 180^\circ - 149^\circ$

$\Rightarrow y = 31^\circ$

JUNE 2016

MATHEMATICS 1

Objective Test

1 Hour

1. Which of the following is a finite set?
 - A. $\{2, 4, 6, 8, \dots\}$
 - B. $\{1, 2, 3, 4, \dots\}$
 - C. $\{\dots, 2, 3, 5, 7\}$
 - D. $\{3, 6, 9, 12\}$
2. Given that $M = \{a, b, c\}$, find the number of subsets of M
 - A. 3
 - B. 4
 - C. 6
 - D. 8
3. If $P = \{2, 3, 4, 6, 8\}$ and $Q = \{1, 2, 3, 4\}$, find $P \cap Q$
 - A. $\{2, 3, 4\}$
 - B. $\{7, 9, 10\}$
 - C. $\{2, 3, 4, 6, 8\}$
 - D. $\{1, 2, 3, 4, 6, 8\}$
4. A boy bought 3 pairs of socks at GHc 17.50 per a pair and paid with two GHc 50.00 notes. How much change was he given?
 - A. GHc 27.50
 - B. GHc 37.50
 - C. GHc 47.50
 - D. GHc 48.50
5. Find the least Common Multiple (LCM) of the numbers 5, 10 and 12
 - A. $2 \times 3 \times 5$
 - B. $2 \times 3^2 \times 5$
 - C. $2^2 \times 3 \times 5$
 - D. $2^2 \times 3^2 \times 5^2$
6. Correct 48,947.2547 to the nearest hundred.
 - A. 490
 - B. 48,900
 - C. 48,950
 - D. 49,000
7. Simplify: $16 + 5.6 + 0.681$
 - A. 2.2281
 - B. 22.281

- C. 222.81
D. 2228.1

8. Evaluate: $\frac{4}{5} - \frac{1}{3} + \frac{2}{9}$

- A. $\frac{5}{11}$
B. $\frac{11}{45}$
C. $\frac{31}{45}$
D. $\frac{41}{45}$

9. Arrange the following integers from the least to the highest - 4, 9, - 10, - 7 and 2.

- A. -10, -7, -4, 2, 9
B. -10, 9, -7, -4, 2
C. -4, -7, -10, 2, 9
D. 2, -4, -7, 9, -10

10. Simplify: $(46 \times 102) + (102 \times 54)$

- A. 1,020
B. 10,200
C. 102,000
D. 1,020,000

11. Correct 5178.3426 to two decimal places

- A. 5178.00
B. 5178.30
C. 5178.34
D. 5178.35

12. Find the simple interest on GHc 120,000.00 for 5 months at 12% per annum.

- A. GHc 6,000.00
B. GHc 7,200.00
C. GHc 50,000.00
D. GHc 72,000.00

13. Fifteen boys took 12 hours to weed a plot of land. If nine boys work at the same rate, how long will it take them to weed the plot of land?

- A. 6 hours
B. $7\frac{1}{5}$ hours
C. $11\frac{1}{4}$ hours
D. 20 hours

14. A car cost GHc 12,500.00. A discount of 9% is given for cash payment. Find the cost of the car when payment is made by cash.

- A. GHc 10,250.00
B. GHc 11,250.00

- C. GHc 11,375.00
D. GHc 13,625.00

15. Simplify: $5^2 \times 2^2 \times 5^2 \times 2$
A. $2^2 \times 5^2$
B. $2^2 \times 5^4$
C. $2^3 \times 5^2$
D. $2^3 \times 5^4$

The table shows the marks of some students in a test.

| Marks | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------|---|---|---|---|---|---|---|---|---|---|----|
| Number of students | 3 | 4 | 5 | 4 | 5 | 4 | 7 | 3 | 4 | 2 | 2 |

Use the information to answer questions 16 and 17

16. What is the modal mark?
A. 2
B. 5
C. 6
D. 10
17. How many students failed the test, if the pass mark was 4?
A. 4
B. 6
C. 16
D. 21
18. What is the probability of obtaining 4, when a fair die is tossed once?
A. $\frac{1}{6}$
B. $\frac{1}{2}$
C. $\frac{2}{3}$
D. $\frac{5}{6}$
19. Make P the subject of the relation, $R = \frac{(P+Q)}{2}$
A. $P = Q - 2R$
B. $P = 2R - Q$
C. $P = 2R + Q$
D. $P = 2Q + R$
20. Given that $t = p^2 + 1$, find p when $t = 10$.
A. 3.0
B. 4.5
C. 11.0
D. 81.0

21. Simplify: $4(x + 2) - 3(x + 1)$.
- A. $x + 5$
 - B. $x + 11$
 - C. $7x + 5$
 - D. $7x + 11$
22. When a number is doubled and the result is decreased by 9, the answer is 19. Find the number.
- A. 5
 - B. 7
 - C. 14
 - D. 16
23. Solve the inequality $2x + 10 \geq \frac{7}{2}x - 5$
- A. $x \geq 10$
 - B. $x \leq 10$
 - C. $x \leq 40$
 - D. $x \geq 40$
24. Find the image of 5, under the mapping $x \rightarrow 4x - 7$
- A. 3
 - B. 13
 - C. 20
 - D. 27
25. An angle which is greater than 180° but less than 360° is
- A. a right angle
 - B. an acute angle
 - C. an obtuse angle
 - D. a reflex angle
26. How many lines of symmetry has a rectangle?
- A. 1
 - B. 2
 - C. 3
 - D. 4
27. The perimeter of an isosceles triangle is 45 cm. Find the length of the third side, if each of the equal sides is 14 cm long.
- A. 11 cm
 - B. 14 cm
 - C. 17 cm
 - D. 31 cm
28. Find the area of a circle whose diameter is 7cm. [Take $\pi = \frac{22}{7}$]
- A. 11 cm^2
 - B. $38\frac{1}{2} \text{ cm}^2$

C. $44\frac{1}{2} \text{ cm}^2$

D. 54 cm^2

29. The mean of three numbers is 12. If two of the numbers are 14 and 16, find the third number.

A. 6

B. 12

C. 30

D. 36

30. The sum of the interior angles of a regular polygon is 540° . Find the number of sides of the polygon.

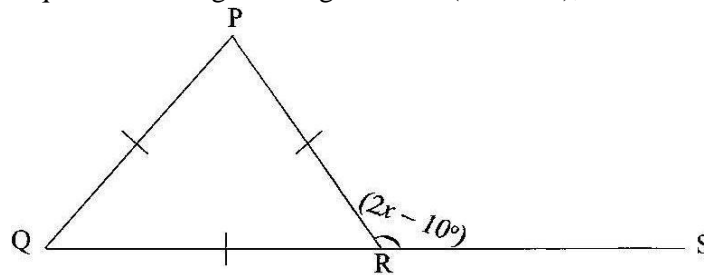
A. 7

B. 6

C. 5

D. 4

31. The figure QPR is an equilateral triangle. If angle PRS = $(2x - 10^\circ)$, find the value of x.



NOT DRAWN TO SCALE

A. 55°

B. 65°

C. 85°

D. 95°

32. The diagonal of a rectangle is 10 cm long. If the length of the rectangle is 8 cm, find its breadth.

A. 2 cm

B. 3 cm

C. 5 cm

D. 6 cm

33. In an enlargement, $XY \rightarrow X_1Y_1$. If $|XY| = 24 \text{ cm}$ and $|X_1Y_1| = 8 \text{ cm}$, calculate the scale factor of the enlargement.

A. $\frac{1}{32}$

B. $\frac{1}{24}$

C. $\frac{1}{8}$

D. $\frac{1}{3}$

Study the triangle of odd numbers and use it to answer Questions 34 and 35.

$$\begin{array}{ccccccc}
 & & 13 & & b & & c & & 19 \\
 & & 7 & & & & 9 & & a \\
 & & & & 3 & & & & 5 \\
 & & & & & & 1 & &
 \end{array}$$

34. Evaluate: $13 + b + c + 19$.

- A. 62
- B. 64
- C. 74
- D. 76

35. Evaluate: $a + b + c$

- A. 24
- B. 29
- C. 36
- D. 43

36. Simplify: $\begin{pmatrix} -3 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ -7 \end{pmatrix}$

- A. $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$
- B. $\begin{pmatrix} -5 \\ 12 \end{pmatrix}$
- C. $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$
- D. $\begin{pmatrix} -5 \\ -12 \end{pmatrix}$

37. The bearing of X from Y is 196° . What is the bearing of Y from X?

- A. 016°
- B. 074°
- C. 106°
- D. 244°

38. If $a = -4$ and $b = 3$, evaluate $\frac{3a+2b}{ab}$

- A. $\frac{3}{2}$
- B. 1
- C. $\frac{1}{2}$
- D. $-\frac{3}{2}$

39. The point P $(-3, 7)$ is reflected in the x-axis. Find its image.

- A. $(-3, -7)$
- B. $(-3, 7)$
- C. $(-7, 3)$
- D. $(3, -7)$

40. The instrument used to measure the angle between two lines that meet at a point is known as a
- A. pair of compasses
 - B. set-square
 - C. protractor
 - D. pair of dividers

JUNE 2016

MATHEMATICS 1

Objective Test

SOLUTIONS

1. D. {3, 6, 9, 12}
2. D. 8
3. A. {2, 3, 4}
4. C. GHc 47.50
5. C. $2^2 \times 3 \times 5$
6. B. 48,900
7. B. 22.281
8. C. $\frac{31}{45}$
9. A. -10, -7, -4, 2, 9
10. B. 10,200
11. C. 5178.34
12. A. GHc 6,000.00
13. D. 20 hours
14. C. GHc 11,375.00
15. D. $2^3 \times 5^4$
16. C. 6
17. C. 16
18. A. $\frac{1}{6}$
19. B. $P = 2R - Q$
20. A. 3.0
21. A. $x + 5$
22. C. 14
23. B. $x \leq 10$
24. B. 13
25. D. a reflex angle
26. B. 2
27. C. 17 cm

28. B. $38\frac{1}{2}\text{ cm}^2$
29. A. 6
30. C. 5
31. B. 65°
32. D. 6 cm
33. D. $\frac{1}{3}$
34. B. 64
35. D. 43
36. C. $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$
37. A. 016°
38. C. $\frac{1}{2}$
39. A. $(-3, -7)$
40. C. protractor

JUNE 2016

MATHEMATICS 2

PAPER 2

ESSAY

1 HOUR

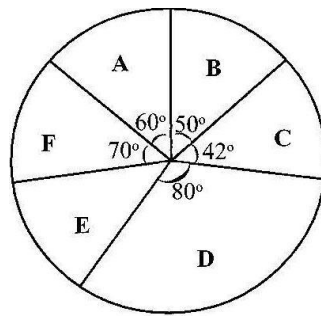
*Answer **four** questions **only**.*

*All questions carry **equal** marks.*

*All working **must** be clearly shown.*

*Marks will **not** be awarded for correct answers without corresponding working*

1. (a) In an examination, 50 candidates sat for either Mathematics or English Language. 60% passed in Mathematics and 48% passed in English Language. If each candidate passed in at least one of the subjects, how many candidates passed in :
- (i) Mathematics?
- (ii) English Language?
- (b) Illustrate the information given in (a) on a Venn diagram.
- (c) Using the Venn diagram, find the number of candidates who passed in
- (i) both subjects;
- (ii) Mathematics only.
- (d) If $\mathbf{a} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2x \\ 3 + y \end{pmatrix}$ are equal vectors, find the values of x and y
2. (a) The cost (P), in Ghana cedis, of producing n items is given by the formula,
 $P = \frac{3}{4}n + 1800$. Find the:
- (i) cost of producing 2,000 items;
- (ii) number of items that will be produced with GHC 2,400.00;
- (iii) cost when no items are produced.
- (b) A passenger travelling by air is allowed a maximum of 20 kg luggage.
A man has four bags weighing 3.5 kg, 15 kg, 2 kg and 1.5 kg.
- (i) Find the excess weight of his luggage
- (ii) Express the excess weight as a percentage of the maximum weight allowed.
3. (a) A doctor treated 2,000 patients over a period of time. If he worked for 5 hours a day and spent 15 minutes on each patient, how many days did the doctor spend to treat all the patients?
- (b) The pie chart shows the distribution of textbooks to six classes A, B, C, D, E and F in a school.



NOT DRAWN TO SCALE

- (i) If Class D was given 720 textbooks, how many textbooks were distributed to each of the remaining classes?
- (ii) What is the average number of textbooks distributed to the classes?
- (iii) How many classes had less than the average number of textbooks distributed?

4. (a) Using a scale of 2 cm to 1 unit on both axes, draw on a graph sheet, two perpendicular axes OX and OY for $-5 \leq x \leq 5$ and $-5 \leq y \leq 5$.
 - (i) Plot, indicating the coordinates of all points P(1, 1), Q(1, 2), R(2, 2) and S(2, 1) on a graph sheet. Join the points to form square PQRS.
 - (ii) Draw and indicate clearly all coordinates, the image $P_1Q_1R_1S_1$ of square PQRS under an enlargement from the origin with a scale factor of 2, where $P \rightarrow P_1$, $Q \rightarrow Q_1$, $R \rightarrow R_1$ and $S \rightarrow S_1$.
 - (iii) Draw and indicate clearly all coordinates, the image $P_2Q_2R_2S_2$ of square $P_1Q_1R_1S_1$ under a reflection in the x-axis where $P_1 \rightarrow P_2$, $Q_1 \rightarrow Q_2$, $R_1 \rightarrow R_2$ and $S_1 \rightarrow S_2$
- (b) Using the graph in 4(a), find the gradient of line R_2S .
5. (a) Given that $u = 4$, $t = 5$, $a = 10$ and $s = ut + \frac{1}{2}at^2$, find the value of s .
- (b) The selling price of a gas cooker is GHC450.00. If a customer is allowed a discount of 20%, calculate the :
 - (i) discount;
 - (ii) amount paid by the customer.
- (c) A crate of minerals containing ten bottles of Coca Cola and fourteen bottles of Fanta was given to some children for a birthday party. If a child chose a drink at random from the crate, find the probability that it was Fanta.
6. (a) Using a ruler and a pair of compasses only, construct:
 - (i) triangle XYZ with $|XY| = 9$ cm, $|YZ| = 12$ cm and $|XZ| = 8$ cm;
 - (ii) the perpendicular bisector of line XY;
 - (iii) the perpendicular bisector of line XZ.
- (b) (i) Label the point of intersection of the two bisectors as T;
- (ii) With point T as centre, draw a circle of radius 6 cm.
- (c) Measure:
 - (i) $|TX|$
 - (ii) angle XYZ

JUNE 2016

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) (i) **Number of candidates who passed in Mathematics**

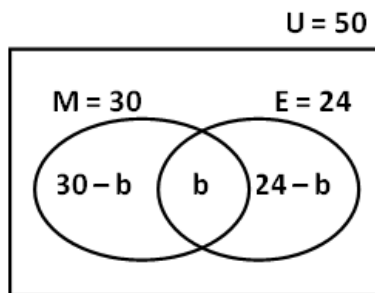
$$\begin{aligned} &= 60\% \text{ of } 50 \text{ candidates} \\ &= \frac{60}{100} \times 50 \\ &= 6 \times 5 \\ &= \underline{30} \end{aligned}$$

(ii) **Number of candidates who passed in English Language**

$$\begin{aligned} &= 48\% \text{ of } 50 \text{ candidates} \\ &= \frac{48}{100} \times 50 \\ &= \frac{48}{2} \\ &= \underline{24} \end{aligned}$$

(b) **Venn diagram**

Let U = Total number of Candidates,
 M = Number of candidates who passed in Mathematics and
 E = Number of candidates who passed in English
 b = Number of candidates who passed in both Mathematics and English



(c) (i) From the Venn diagram above,

$$\begin{aligned} 30 - b + b + 24 - b &= 50 \\ \Rightarrow 54 - b &= 50 \\ \Rightarrow \underline{b} &= \underline{4} \end{aligned}$$

Hence, 4 candidates passed in both subjects

(ii) **Mathematics only**

$$\begin{aligned} &= 30 - b \\ &= 30 - 4 \\ &= \underline{26} \end{aligned}$$

(d) If $a = b$, then

$$\begin{aligned}\text{taking the horizontal component, } 4 &= 2x \\ \Rightarrow x &= 4 \div 2 \\ \Rightarrow \underline{x} &= \underline{2}\end{aligned}$$

$$\begin{aligned}\text{Now, taking the vertical component, } -5 &= 3 + y \\ \Rightarrow y &= -5 - 3 \\ \Rightarrow \underline{y} &= \underline{-8}\end{aligned}$$

2. (a) (i) Since Cost, $P = \frac{3}{4}n + 1800$, where n = the number of items,

Cost of producing 2,000 items

$$= \frac{3}{4} \times 2000 + 1800 \quad [\text{Substituting } n = 2000]$$

$$= 3 \times 500 + 1800 \quad [\text{Simplifying}]$$

$$= 1500 + 1800$$

$$= 3300$$

$$\text{Cost of producing 2,000 items} = \underline{\text{GHC 3,300.00}}$$

(ii) Method 1 (Substitution and solving)

$$\text{From } P = \frac{3}{4}n + 1800$$

$$2400 = \frac{3}{4}n + 1800 \quad [\text{Substituting } P = 2400]$$

$$\Rightarrow 4 \times 2400 = \left(4 \times \frac{3}{4}n\right) + (4 \times 1800) \quad [\text{multiplying through by 4}]$$

$$\Rightarrow 9600 = 3n + 7200 \quad [\text{Simplifying}]$$

$$\Rightarrow 9600 - 7200 = 3n \quad [\text{Subtracting 7200 from both sides}]$$

$$\Rightarrow 2400 = 3n \quad [\text{Simplifying}]$$

$$\Rightarrow \frac{2400}{3} = \frac{3n}{3} \quad [\text{Dividing through by 3}]$$

$$\Rightarrow 800 = n \quad [\text{Simplifying}]$$

$$n = 800$$

Hence, the number of items = 800

(ii) Method 2 (Making n the subject, substituting and simplifying)

$$\text{From } P = \frac{3}{4}n + 1800$$

$$\Rightarrow 4P = \left(4 \times \frac{3}{4}n\right) + (4 \times 1800) \quad [\text{Multiplying through by 4}]$$

$$\Rightarrow 4P = 3n + 7200 \quad [\text{Simplifying}]$$

$$\Rightarrow 4P - 7200 = 3n \quad [\text{Subtracting 7200 from both sides}]$$

$$\Rightarrow \frac{4P-7200}{3} = \frac{3n}{3} \quad [\text{Dividing through by 3}]$$

$$\Rightarrow n = \frac{4P-7200}{3} \quad [\text{Simplifying}]$$

$$\Rightarrow n = \frac{4 \times 2400 - 7200}{3} \quad [\text{Now, substituting } P = 2400]$$

$$\Rightarrow n = \frac{9600 - 7200}{3} = \frac{2400}{3} \quad [\text{Simplifying}]$$

$n = 800$
Hence, the number of items = 800

(iii) **When no items are produced, $n = 0$**

From $P = \frac{3}{4}n + 1800$

$$= \left(\frac{3}{4} \times 0\right) + 1800 \quad [\text{Substituting } n = 0]$$

$$= 0 + 1800 \quad [\text{Simplifying}]$$

$$P = 1800$$

Cost when no items are produced = GHC 1,800.00

(b) (i) Total weight of four bags = $3.5 + 15 + 2 + 1.5$
 = 22 kg
 Hence, **excess weight** = $22 - 20$
 = 2 kg

| |
|------------|
| 3.5 |
| 15.0 |
| 2.0 |
| <u>1.5</u> |
| 22.0 |

(ii) **Excess weight as a percentage of maximum weight allowed**

$$= \frac{2}{20} \times 100\%$$

$$= 2 \times 5\%$$

$$= \underline{10\%}$$

3. (a) If doctor works 5 hours a day and spends 15 minutes on each patient, then

$$\text{Number of patients treated a day} = \frac{5 \text{ hours}}{15 \text{ minutes}}$$

$$= \frac{5 \times 60 \text{ minutes}}{15 \text{ minutes}}$$

$$= \frac{5 \times 60}{15} = 5 \times 4$$

$$= 20$$

Hence, he treats 20 patients each day

$$\text{Number of days used} = \frac{2000 \text{ patients}}{20 \text{ patients}}$$

$$= \frac{2000}{20}$$

$$= 100$$

Hence, he treats 2000 patients in 100 days

NOTE: Alternatively the idea of ratio or simple proportion can be applied to solve the question.

- (b) (i) **If Class D (80°) \rightarrow 720 textbooks**
Then Class A (60°) \rightarrow ? (less)

If less, then more (80°) divides

$$\begin{aligned}\Rightarrow & \frac{60^\circ}{80^\circ} \times 720 \\ & = 60 \times 9 = \underline{\underline{540 \text{ textbooks}}}\end{aligned}$$

Now, if number of textbooks of Class A (60°) = 60×9 ,

$$\text{then, Class B } (50^\circ) = 50 \times 9 = \underline{\underline{450 \text{ textbooks}}}$$

$$\text{Class C } (42^\circ) = 42 \times 9 = \underline{\underline{378 \text{ textbooks}}}$$

$$\text{Class F } (70^\circ) = 70 \times 9 = \underline{\underline{630 \text{ textbooks}}}$$

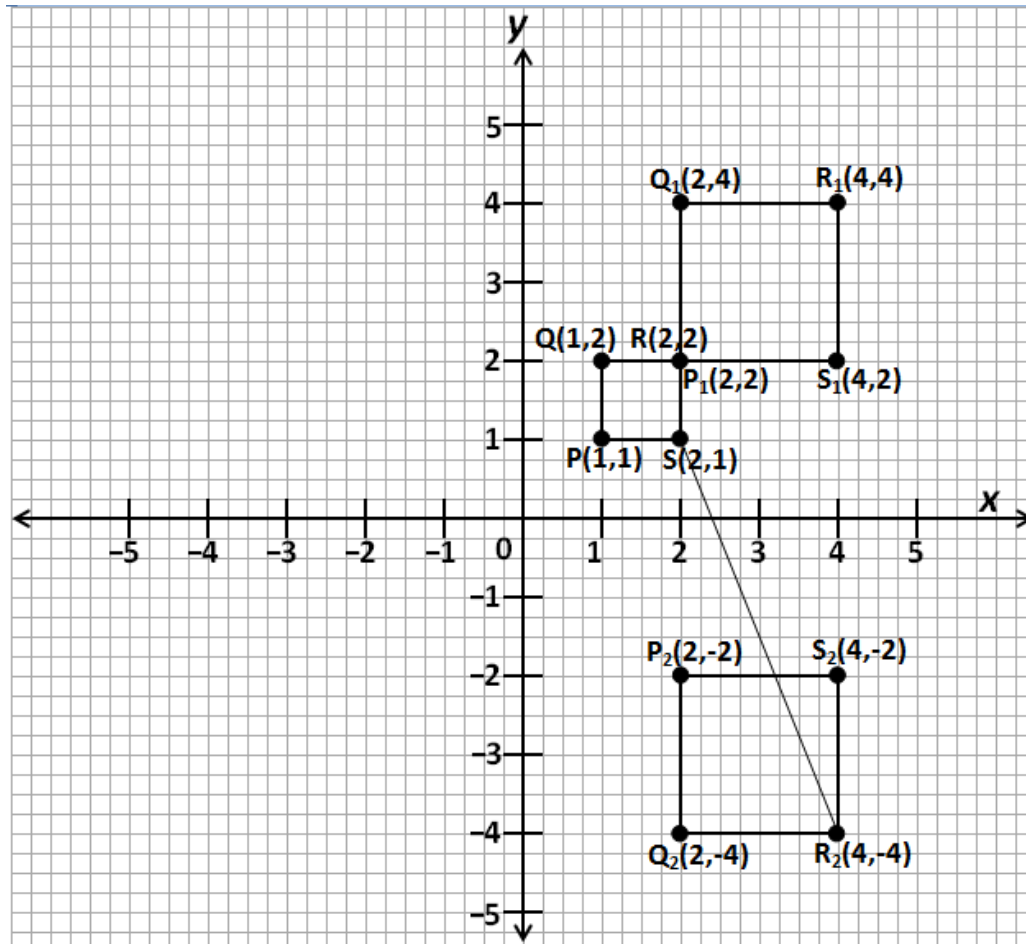
$$\begin{aligned}\text{Now, angle for Class E} &= 360^\circ - (70^\circ + 60^\circ + 50^\circ + 42^\circ + 80^\circ) \\ &= 360^\circ - 302^\circ \\ &= 58^\circ\end{aligned}$$

$$\text{Hence, Class E } (58^\circ) = 58 \times 9 = \underline{\underline{522 \text{ textbooks}}}$$

$$\begin{aligned}\text{(ii) Average number of textbooks} &= \frac{\text{Total number of textbooks}}{\text{Total number of classes}} \\ &= \frac{720 + 540 + 450 + 378 + 630 + 522}{6} \\ &= \frac{3240}{6} \\ &= \underline{\underline{540}}\end{aligned}$$

- (iii) **Number of classes which had less than average**
 $= \underline{\underline{3}}$ (Classes B, C and E had less than 540 textbooks)

4. (a)



$$\begin{aligned}
 \text{(b) Gradient of line } R_2S &= \frac{\text{Vertical interval}}{\text{Horizontal interval}} \\
 &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{1 - (-4)}{2 - 4} = \frac{1 + 4}{2 - 4} = \frac{5}{-2} \\
 &= \underline{\underline{-2.5}} \text{ or } -2\frac{1}{2}
 \end{aligned}$$

5. (a)

$$\begin{aligned}
 \text{From } s &= ut + \frac{1}{2}at^2 \\
 &= (4)(5) + \frac{1}{2}(10)(5)^2 \\
 &= 20 + \left(\frac{1}{2} \times 10 \times 25\right) \\
 &= 20 + 125
 \end{aligned}$$

$$\text{Hence } s = \underline{\underline{145}}$$

$$\begin{aligned}
 \text{(b) (i) Discount} &= 20\% \text{ of GHC } 450.00 \\
 &= \frac{20}{100} \times 450 \\
 &= 2 \times 45 \\
 \text{Discount} &= \underline{\text{GHC } 90}
 \end{aligned}$$

(ii) Method 1

$$\begin{aligned}
 \text{Amount paid} &= \text{Original Selling Price} - \text{Discount} \\
 &= 450 - 90 \\
 &= \underline{360}
 \end{aligned}$$

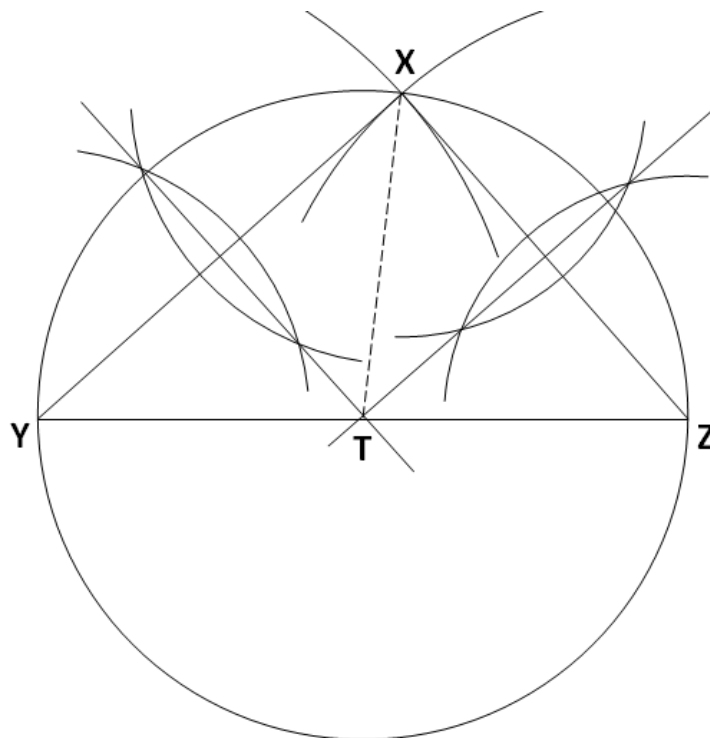
Method 2

$$\begin{aligned}
 \text{Amount paid} &= 80\% \text{ of GHC } 450.00 && [100\% - 20\% = 80\%] \\
 &= \frac{80}{100} \times 450 \\
 &= 8 \times 45 \\
 &= 360
 \end{aligned}$$

$$\text{The amount paid by the customer} = \underline{\text{GHC } 360.00}$$

$$\begin{aligned}
 \text{(c) Probability of randomly choosing Fanta} &= \frac{\text{Number of Fanta drinks}}{\text{Total number of drinks}} \\
 &= \frac{14}{10+14} = \frac{14}{24} \\
 &= \frac{7}{12}
 \end{aligned}$$

6. (a), (b)



(c) (i) $|TX| = \underline{\underline{6\text{ cm}}} (\pm 0.1\text{cm})$

(ii) $\text{angle XYZ} = \underline{\underline{40^\circ}} (\pm 1^\circ)$

JUNE 2015

MATHEMATICS 1

Objective Test

1 Hour

1. List the members of the set $Q = \{\text{prime factors of } 30\}$
 - A. $\{2, 3, 5\}$
 - B. $\{2, 6, 10\}$
 - C. $\{3, 5, 15\}$
 - D. $\{3, 6, 15\}$
2. Given that set $P = \{m, n, o, p\}$, find the number of subsets of P .
 - A. 4
 - B. 8
 - C. 10
 - D. 16
3. If $M = \{\text{multiples of } 4 \text{ between } 10 \text{ and } 25\}$ and $N = \{\text{even numbers between } 11 \text{ and } 23\}$, find $M \cup N$
 - A. $\{12, 16, 20\}$
 - B. $\{14, 18, 22\}$
 - C. $\{12, 14, 16, 18, 22\}$
 - D. $\{12, 14, 16, 18, 20, 22, 24\}$
4. What is the place value of 7 in 24.376 ?
 - A. Unit
 - B. Ten
 - C. Tenth
 - D. Hundredth
5. Find the Highest Common Factor of 24, 42 and 72
 - A. 4
 - B. 6
 - C. 7
 - D. 12
6. Express 120_5 as a number in base 10
 - A. 25
 - B. 27
 - C. 32
 - D. 35
7. If $p \times q \times r = 1197$, and $p = 19$, $q = 3$, find r
 - A. 21

- B. 49
- C. 57
- D. 61

8. How many integers are within the interval $-5 < x < 7$?

- A. 10
- B. 11
- C. 12
- D. 13

9. Divide 1.612 by 0.4

- A. 4.3
- B. 4.03
- C. 0.403
- D. 0.43

10. Arrange the following fractions in ascending order: $\frac{5}{8}, \frac{11}{20}, \frac{7}{10}$

- A. $\frac{5}{8}, \frac{11}{20}, \frac{7}{10}$
- B. $\frac{7}{10}, \frac{5}{8}, \frac{11}{20}$
- C. $\frac{11}{20}, \frac{5}{8}, \frac{7}{10}$
- D. $\frac{5}{8}, \frac{7}{10}, \frac{11}{20}$

11. Abena spent $\frac{1}{5}$ of her money on sweets, $\frac{4}{7}$ on provisions and the rest on gari. What fraction of her money did she spend on gari?

- A. $\frac{27}{35}$
- B. $\frac{13}{35}$
- C. $\frac{8}{35}$
- D. $\frac{5}{35}$

12. If 5 boys took 14 days to cultivate a piece of land, how long will it take 7 boys working at the same rate to cultivate the land ?

- A. 14 days
- B. 12 days
- C. 10 days
- D. 8 days

13. A man invested GHC 800.00 in a bank at a simple interest rate of 5% per annum. Find his total amount in the bank at the end of one year.

- A. GHC 840.00

- B. GHC 860.00
- C. GHC 900.00
- D. GHC 960.00

14. John sold a car for GHC 60,000.00 and made a profit of 20%. What is the cost price of the car?

- A. GHC 48,000.00
- B. GHC 50,000.00
- C. GHC 72,000.00
- D. GHC 132,000.00

15. What is the value of x if $10^x = 1000$?

- A. 1
- B. 2
- C. 3
- D. 4

16. Express 625.13 in standard form

- A. 6.2513×10^{-2}
- B. 6.2513×10^{-4}
- C. 6.2513×10^2
- D. 6.2513×10^4

17. Find the median of the numbers 17, 12, 15, 16, 8, 18, 13 and 14

- A. 8
- B. 12
- C. 14.5
- D. 15.5

18. The ages in years of 10 children at a party are 2, 3, 3, 3, 4, 4, 5, 5, 5 and 6. If a child is chosen at random, what is the probability that he / she is **not** less than 5 years old ?

- A. $\frac{2}{3}$
- B. $\frac{2}{5}$
- C. $\frac{3}{10}$
- D. $\frac{1}{2}$

19. Expand $(2x + y)(2x - y)$

- A. $2x^2 - y^2$
- B. $4x^2 - y^2$
- C. $2x^2 + 4xy - y^2$
- D. $4x^2 + 4xy - y^2$

20. Find the value of n , if $25.003 = (2 \times 10) + (5 \times 1) + (3 \times n)$

- A. 0.001
- B. 0.011
- C. 0.01

D. 0.1

21. Evaluate $(3m)^2 - 3m^2$, when $m = 2$.

- A. 12
- B. 18
- C. 20
- D. 24

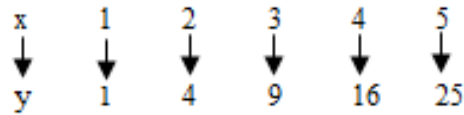
22. A wrist watch is priced GHC 2,000.00. A shopkeeper allows a discount of 2% on the cost price. Find the discount on 20 of such wrist watches.

- A. GHC 500.00
- B. GHC 600.00
- C. GHC 800.00
- D. GHC 1,000.00

23. Find the value of m , if $4(m + 4) = -8$.

- A. -6
- B. -2
- C. 2
- D. 6

24. Find the rule for the following mapping



- A. $y \rightarrow x+2$
- B. $y \rightarrow 2x$
- C. $y \rightarrow x^2$
- D. $y \rightarrow 2x+2$

25. How many vertices has a cuboid?

- A. 6
- B. 7
- C. 8
- D. 14

26. The circumference of a circle is 440 m. Find the area of the circle. [Take $\pi = \frac{22}{7}$]

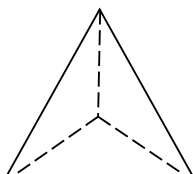
- A. 14,400 m²
- B. 15,400 m²
- C. 16,400 m²
- D. 18,000 m²

27. What name is given to a triangle which has all its sides equal?

- A. Isosceles triangle
- B. Scalene triangle
- C. Equilateral triangle
- D. Right-angle triangle

28. At eight o'clock, which of the following is the angle between the hour and the minute hands of the clock?
- 150°
 - 120°
 - 90°
 - 60°
29. A rectangular field 50 m wide and y m long requires 260 m of fencing. Find y .
- 15 m
 - 40 m
 - 80 m
 - 105 m
30. Which of the following best describes the statement: '*The locus of a point which moves so that its distance from two fixed points are always equal*'?
- Bisector of an angle
 - Perpendicular bisector
 - Circle
 - Two parallel lines
31. The point K (1, 5) is rotated through 90° anti-clockwise about the origin. Find the coordinates of the image of K.
- (5, -1)
 - (-5, 1)
 - (-1, 5)
 - (1, -5)
32. Kwame is facing west. Through how many degrees should he turn anti-clockwise to face north?
- 90°
 - 180°
 - 270°
 - 360°
33. Given that vectors $\mathbf{u} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$, find $2\mathbf{v} - \mathbf{u}$
- $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$
 - $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$
 - $\begin{pmatrix} -7 \\ -11 \end{pmatrix}$
 - $\begin{pmatrix} 7 \\ -11 \end{pmatrix}$

34.



What is the name of the figure above?

- A. Cuboid
- B. Kite
- C. Triangle
- D. Pyramid

| | | |
|----|----|----|
| 13 | 12 | 17 |
| E | F | 10 |
| 11 | 16 | G |

Use the magic square above to answer questions **35** to **37**

35. Find the value of F

- A. 14
- B. 15
- C. 18
- D. 23

36. Find the value of E.

- A. 14
- B. 15
- C. 18
- D. 23

37. Evaluate $E + G$

- A. 29
- B. 30
- C. 33
- D. 38

38. The hypotenuse and a side of a right-angled triangle are 13 cm and 5 cm respectively. Find the length of the third side.

- A. 8 cm
- B. 9 cm
- C. 12 cm
- D. 17 cm

39. Find the missing number in the sequence below:

11, 16, 22, 29, __, 46, 56

- A. 30
- B. 36
- C. 37
- D. 39

- 40.** A hall which is 20 m long is represented on a diagram as 10 cm long. What is the scale of the diagram?
- A. 1:200
 - B. 1:250
 - C. 1:400
 - D. 1:500

JUNE 2015

MATHEMATICS 1

Objective Test

SOLUTIONS

1. A. $\{2, 3, 5\}$
2. D. 16
3. D. $\{12, 14, 16, 18, 20, 22, 24\}$
4. D. Hundredth
5. B. 6
6. D. 35
7. A. 21
8. B. 11
9. B. 4.03
10. C. $\frac{11}{20}, \frac{5}{8}, \frac{7}{10}$
11. C. $\frac{8}{35}$
12. C. 10 days
13. A. GHC 840.00
14. B. GHC 50,000.00
15. C. 3
16. C. 6.2513×10^2
17. C. 14.5
18. B. $\frac{2}{5}$
19. B. $4x^2 - y^2$
20. A. 0.001
21. D. 24
22. C. GHC 800.00
23. A. -6
24. C. $y \rightarrow x^2$
25. C. 8
26. B. 15,400 m²

- 27. C. Equilateral triangle
- 28. B. 120°
- 29. C. 80 m
- 30. B. Perpendicular bisector
- 31. B. $(-5, 1)$
- 32. C. 270°
- 33. D. $\begin{pmatrix} 7 \\ -11 \end{pmatrix}$
- 34. D. Pyramid
- 35. A. 14
- 36. C. 18
- 37. C. 33
- 38. C. 12
- 39. C. 37
- 40. A. 1:200

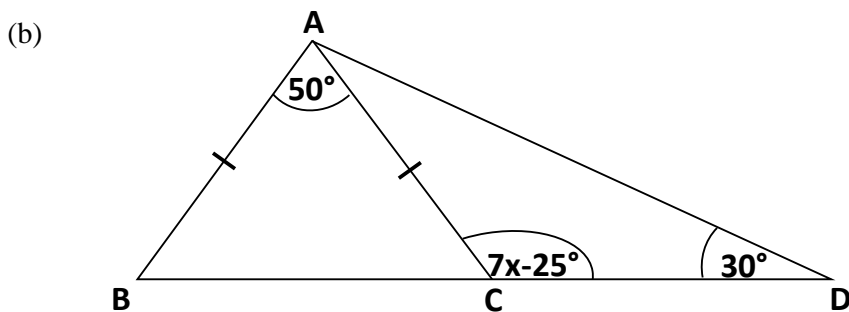
JUNE 2015 (First Sitting)

MATHEMATICS 2

ESSAY

1 HOUR

1. (a) Find the difference between the product of 2.5 and 7.5 and the sum of 2.75 and 9.55.
- (b) Solve $\frac{3x+2}{3} - \frac{3-x}{8} = \frac{1}{6}$
- (c) A container is 24 m long, 9 m wide and 8 m high. How many books can it hold if each book is 20 cm long, 16 cm wide and 6 cm thick.
2. (a) In a test consisting of 90 questions, Ama answered 75% of the first 40 questions correctly. If she had to get a score of 80% in the test,
- (i) how many questions did she answer correctly out of the first 40 questions?
- (ii) how many questions should she answer correctly out of the 90 questions ?
- (iii) what percentage of the remaining 50 questions should she answer correctly in order to get the 80% ?
- (b) Three interior angles of a pentagon are 100° , 120° and 108° . Find the size of each of the remaining two interior angles, if one of them is three times the other.
3. (a) Given that vectors $\mathbf{p} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} x \\ y \end{pmatrix}$, find :
- (i) \mathbf{q} if $\mathbf{q} - \mathbf{p} = \begin{pmatrix} 12 \\ 9 \end{pmatrix}$;
- (ii) the magnitude of the vector $\mathbf{q} - \mathbf{p}$



NOT DRAWN TO SCALE

In the diagram $|AB| = |AC|$, angle $ADC = 30^\circ$ and angle $ACD = 7x - 25^\circ$. Find

- (i) the value of x ;
- (ii) angle DAC ;
- (iii) angle BAD .

4. (a) The Value Added Tax (VAT) paid by a man on a deep freezer was GHC 90.00. If VAT was charged at 15%,
 (i) what was the price of the deep freezer?
 (ii) How much did the man pay including VAT?

- (b) The average of the numbers 5, 7, 2, 6, x , $(x+1)$, 7 and 4 is 5. Find the value of x .

- (c) Simplify:
$$\frac{mn+mp+nq+pq}{n+p}$$

5. (a) A cylinder which has a height of 90 cm and diameter 14 cm is closed at both ends.
 Find:
 (i) its total surface area;
 (ii) the volume of the cylinder

[Take $\pi = 22/7$]

- (b) (i) Using a ruler and a pair of compasses only, construct triangle PQR such that
 $|PQ| = 8\text{cm}$, angle $PQR = 120^\circ$ and $|QR| = 6\text{ cm}$.

- (ii) Measure:

(α) $|PR|$;

(β) angle QPR

6. The table shows the distribution of grades of candidates in an examination.

| Grade | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------|---|---|---|---|---|----|
| Frequency | 2 | 3 | 6 | 5 | 4 | 10 |

- (a) Using a graph sheet, draw a bar chart for the distribution
 (b) If all candidates who obtained grades above grade 3 were awarded credit, find the probability that a candidate selected at random obtained credit.
 (c) Calculate, correct to the nearest whole number, the mean grade of the candidates.

END OF ESSAY TEST

JUNE 2015 (First Sitting)

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) Product of 2.5 and 7.5

$$= 2.5 \times 7.5$$

$$= \frac{25}{10} \times \frac{75}{10}$$

$$= \frac{1875}{100}$$

$$= 18.75$$

Sum of 2.75 and 9.55

$$\begin{array}{r} = 2.75 \\ + 9.55 \\ \hline 12.30 \end{array}$$

Difference between 18.75 and 12.30

$$\begin{array}{r} = 18.75 \\ - 12.30 \\ \hline 6.45 \end{array}$$

(b) Solving $\frac{3x+2}{3} - \frac{3-x}{8} = \frac{1}{6}$

$$\Rightarrow 24\left(\frac{3x+2}{3}\right) - 24\left(\frac{3-x}{8}\right) = 24\left(\frac{1}{6}\right)$$

$$\Rightarrow 8(3x+2) - 3(3-x) = 4(1)$$

$$\Rightarrow 24x + 16 - 9 + 3x = 4$$

$$\Rightarrow 24x + 3x = 4 - 16 + 9$$

$$\Rightarrow 27x = -3$$

$$\Rightarrow \frac{27x}{27} = \frac{-3}{27}$$

$$\Rightarrow \quad x = -\frac{1}{9}$$

$$\begin{aligned} \text{(c) Volume of container} &= \text{length} \times \text{width} \times \text{height} \\ &= 24\text{m} \times 9\text{m} \times 8\text{m} \\ &= 2400\text{cm} \times 900\text{cm} \times 800\text{cm} \\ &= \underline{1728000000 \text{ cm}^3} \end{aligned}$$

$$\begin{aligned} \text{Volume of each book} &= 20 \text{ cm} \times 16 \text{ cm} \times 6 \text{ cm} \\ &= 320 \text{ cm}^2 \times 6 \text{ cm} \\ &= \underline{1920 \text{ cm}^3} \end{aligned}$$

$$\begin{aligned} \text{No. of books the container can hold} &= \frac{\text{Volume of container}}{\text{Volume of each book}} \\ &= \frac{1728000000 \text{ cm}^3}{1920 \text{ cm}^3} \\ &= \mathbf{900,000 \text{ books}} \end{aligned}$$

$$\begin{aligned} 2. \quad (a) \quad (i) \quad &\text{No. of questions Ama answered correctly out of first 40 questions} \\ &= 75\% \text{ of first 40 questions} \\ &= \frac{75}{100} \times 40 \\ &= \frac{75 \times 4}{10} \\ &= \underline{30 \text{ questions}} \end{aligned}$$

$$\begin{aligned} (ii) \quad &\text{To score 80\% in the test, then she needs to answer} \\ &= 80\% \times 90 \text{ questions} \\ &= \frac{80}{100} \times 90 \\ &= 8 \times 9 \\ &= \underline{72 \text{ questions correctly}} \end{aligned}$$

$$\begin{aligned} (iii) \quad &\text{No. of questions she must answer correctly in the remaining 50 questions} \\ &= 72 - 30 \text{ questions} \\ &= 42 \text{ questions} \end{aligned}$$

Percentage of 42 out of 50 questions

$$\begin{aligned} &= \frac{42}{50} \times 100\% \\ &= 42 \times 2\% \\ &= \underline{84\%} \end{aligned}$$

(b) Sum of interior angles of a pentagon (5-sided polygon)

$$\begin{aligned}
&= (n-2) \times 180^\circ, && \text{where } n = \text{no. of sides} \\
&= (5-2) \times 180^\circ && [n = 5 \text{ sides}] \\
&= 3 \times 180^\circ \\
&= \underline{540^\circ}
\end{aligned}$$

$$\begin{aligned}
\text{Let size of smaller missing angle} &= x \\
\text{then, size of bigger missing angle} &= 3x
\end{aligned}$$

$$\begin{aligned}
\text{Now, if sum of interior angles} &= 540^\circ, \\
\Rightarrow 100^\circ + 120^\circ + 108^\circ + x + 3x &= 540^\circ \\
\Rightarrow 328^\circ + 4x &= 540^\circ \\
\Rightarrow 4x &= 540^\circ - 328^\circ \\
\Rightarrow 4x &= 212^\circ \\
\Rightarrow x &= \frac{212}{4} \\
\Rightarrow x &= 53^\circ
\end{aligned}$$

$$\begin{aligned}
\text{Hence, the other missing angle} &= 3x \\
&= 3 \times 53^\circ \\
&= 159^\circ
\end{aligned}$$

$$\text{The sizes of the two remaining interior angles} = \underline{53^\circ \text{ and } 159^\circ}$$

3. (a) (i) If $\mathbf{q} - \mathbf{p} = \begin{pmatrix} 12 \\ 9 \end{pmatrix}$

Then, $\begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 12 \\ 9 \end{pmatrix}$

$$\begin{aligned}
\Rightarrow \begin{pmatrix} x \\ y \end{pmatrix} &= \begin{pmatrix} 12 \\ 9 \end{pmatrix} + \begin{pmatrix} 2 \\ 2 \end{pmatrix} \\
\Rightarrow \begin{pmatrix} x \\ y \end{pmatrix} &= \begin{pmatrix} 12+2 \\ 9+2 \end{pmatrix} \\
\Rightarrow \begin{pmatrix} x \\ y \end{pmatrix} &= \begin{pmatrix} 14 \\ 11 \end{pmatrix} \\
\Rightarrow \mathbf{q} &= \begin{pmatrix} 14 \\ 11 \end{pmatrix}
\end{aligned}$$

(ii) Magnitude of vector $\mathbf{q} - \mathbf{p}$

$$\begin{aligned}
&= \text{magnitude of } \begin{pmatrix} 12 \\ 9 \end{pmatrix} \\
&= \sqrt{12^2 + 9^2} \\
&= \sqrt{144 + 81} \\
&= \sqrt{225} \\
&= \underline{15 \text{ units}}
\end{aligned}$$

(b) (i) Since $|AB| = |AC|$

\Rightarrow angle ABC = angle ACB [Base angles of isosceles triangle equal]

Let angle ABC = angle ACB = y

$$\text{Then, } y + y + 50^\circ = 180^\circ \quad [\text{interior angles of a triangle} = 180^\circ]$$

$$\begin{aligned}
 \Rightarrow 2y &= 180^\circ - 50^\circ \\
 \Rightarrow 2y &= 130^\circ \\
 \Rightarrow y &= \frac{130}{2} \\
 \Rightarrow \underline{y} &= \underline{65^\circ}
 \end{aligned}$$

$$\begin{aligned}
 \text{Now, } 65^\circ + (7x - 25^\circ) &= 180^\circ & [\text{angles at a point on a straight line} = 180^\circ] \\
 \Rightarrow 7x + 65^\circ - 25^\circ &= 180^\circ \\
 \Rightarrow 7x + 40 &= 180^\circ \\
 \Rightarrow 7x &= 180^\circ - 40^\circ \\
 \Rightarrow 7x &= 140^\circ \\
 \Rightarrow x &= \frac{140^\circ}{7} \\
 \Rightarrow \underline{x} &= \underline{20^\circ}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) Angle DAC} + 7x - 25^\circ + 30^\circ &= 180^\circ & [\text{interior angles of a triangle} = 180^\circ] \\
 \text{Let angle DAC} &= a \\
 \Rightarrow a + 7x - 25^\circ + 30^\circ &= 180^\circ \\
 \Rightarrow a + 7(20^\circ) - 25^\circ + 30^\circ &= 180^\circ \\
 \Rightarrow a + 140^\circ - 25^\circ + 30^\circ &= 180^\circ \\
 \Rightarrow a + 115^\circ + 30^\circ &= 180^\circ \\
 \Rightarrow a + 145^\circ &= 180^\circ \\
 \Rightarrow a &= 180^\circ - 145^\circ \\
 \Rightarrow a &= 35^\circ \\
 \Rightarrow \text{angle DAC} &= \underline{35^\circ}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii) angle BAD} &= \text{angle BAC} + \text{angle DAC} \\
 &= 50^\circ + 35^\circ \\
 &= \underline{85^\circ}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad (a) \quad (i) \quad \text{If (VAT) } 15\% &\rightarrow \text{GH¢ } 90.00 \\
 \text{Then (Original price) } 100\% &\rightarrow ? \text{ (more)}
 \end{aligned}$$

If more, less (15%) divides, hence

$$\begin{aligned}
 &= \frac{100\%}{15\%} \times \text{GH¢ } 90 \\
 &= 100 \times \text{GH¢ } 6 \\
 &= \text{GH¢ } 600 \\
 \text{Original price} &= \underline{\text{GH¢ } 600.00}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) Total amount paid} &= \text{Original price} + \text{VAT} \\
 &= \text{GH¢ } 600.00 + \text{GH¢ } 90.00 \\
 &= \underline{\text{GH¢ } 690.00}
 \end{aligned}$$

$$(b) \quad \text{If the average of 8 no.s: } 5, 7, 2, 6, x, (x+1), 7 \text{ and } 4 = 5, \text{ then}$$

$$\Rightarrow \frac{5+7+2+6+x+x+1+7+4}{8} = 5$$

$$\Rightarrow \frac{32+2x}{8} = 5$$

$$\Rightarrow 8\left(\frac{32+2x}{8}\right) = 8(5)$$

$$\Rightarrow 32 + 2x = 40$$

$$\Rightarrow 2x = 40 - 32$$

$$\Rightarrow 2x = 8$$

$$\Rightarrow x = 8/2$$

$$\Rightarrow \underline{\underline{x = 4}}$$

(c) Simplification of $\frac{mn+mp+nq+pq}{n+p}$

$$= \frac{m(n+p)+q(n+p)}{n+p}$$

$$= \frac{(n+p)(m+q)}{n+p}$$

$$= \frac{\cancel{(n+p)}(m+q)}{\cancel{n+p}}$$

$$= \underline{\underline{m+q}}$$

5. (a) (i) h = 90cm, d = 14 cm,

$$\Rightarrow r = 14\text{cm} \div 2$$

$$r = 7\text{cm}$$

Total Surface Area of closed cylinder

$$= 2\pi r^2 + 2\pi rh, \quad \text{where } r = \text{radius, } h = \text{height}$$

$$= \left(2 \times \frac{22}{7} \times 7 \times 7\right) + \left(2 \times \frac{22}{7} \times 7 \times 90\right)$$

$$= (2 \times 22 \times 7) + (2 \times 22 \times 90)$$

$$= 308 + 3960$$

$$= \underline{\underline{4268 \text{ cm}^2}}$$

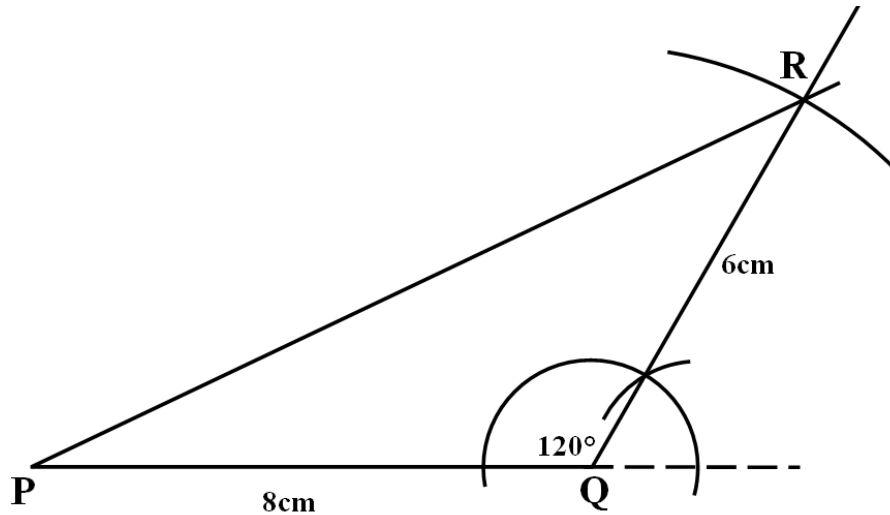
(ii) **Volume of cylinder**

$$= \pi r^2 h, \quad \text{where } r = \text{radius, } h = \text{height}$$

$$= \frac{22}{7} \times 7 \times 7 \times 90$$

$$\begin{aligned}
 &= 22 \times 7 \times 90 \\
 &= 154 \times 90 \\
 &= \underline{\underline{13860 \text{ cm}^3}}
 \end{aligned}$$

(b) (i)



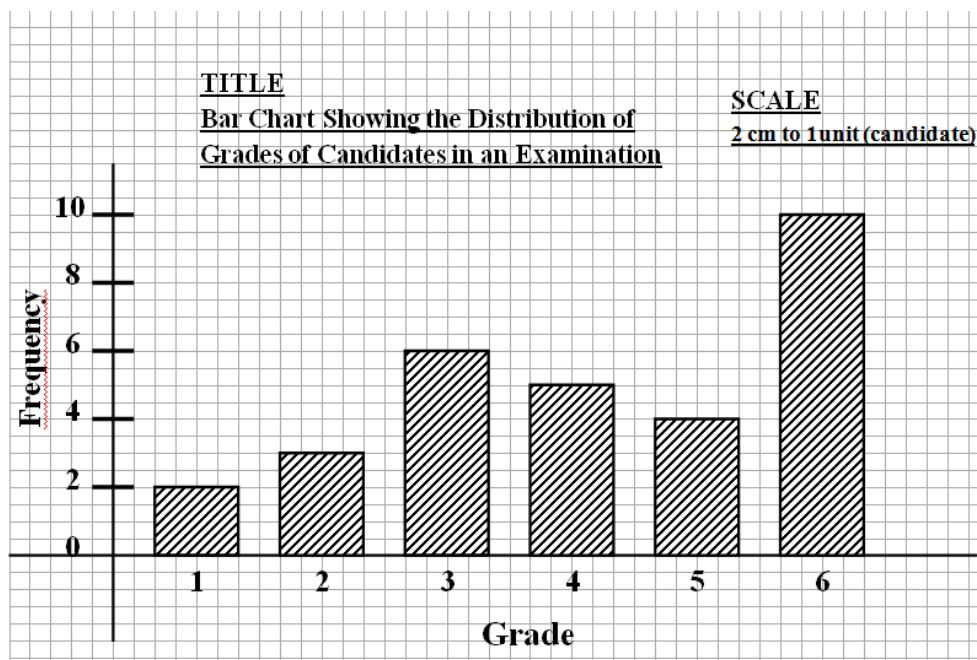
(ii) Measure:

(α) $|PR| = \underline{\underline{12.1 \text{ cm } (\pm 0.1 \text{ cm})}}$

(β) angle QPR = $\underline{\underline{25^\circ (\pm 1^\circ)}}$

6. (a) Bar chart for the frequency distribution table below

| | | | | | | |
|-----------|---|---|---|---|---|----|
| Grade | 1 | 2 | 3 | 4 | 5 | 6 |
| Frequency | 2 | 3 | 6 | 5 | 4 | 10 |



(b) **Number of candidates who obtained credit** (grades above grade 3 for the distribution)

= Frequencies of Grade 1 and Grade 2

= 2 + 3

= 5

Total number of candidates = 2 + 3 + 6 + 5 + 4 + 10
= 30

Probability of selecting a candidate who obtained credit

=
$$\frac{\text{No. of candidates who obtained credit}}{\text{Total no. of candidates}}$$

=
$$\frac{5}{30} = \frac{1}{6}$$

(c) **Mean grade** =
$$\frac{\text{Sum of all grades}}{\text{Total no. of candidates}}$$

=
$$\frac{(1 \times 2) + (2 \times 3) + (3 \times 6) + (4 \times 5) + (5 \times 4) + (6 \times 10)}{2 + 3 + 6 + 5 + 4 + 10}$$

=
$$\frac{2 + 6 + 18 + 20 + 20 + 60}{2 + 3 + 6 + 5 + 4 + 10}$$

=
$$\frac{126}{30} = \frac{42}{10} = 4 \frac{2}{10}$$

=
$$4 \frac{1}{5}$$
 or 4.2

≈ 4 (to nearest whole number)

JUNE 2015 (Second Sitting)

MATHEMATICS 2

ESSAY

1 hour

1. (a) In a class of 70 students, 40 belong to the Red Cross Society, 27 belong to the Girls' Guide Society and 12 belong to both the Red Cross Society and the Girls' Guide Society. The remaining students do not belong to any of the two societies.
 - (i) Illustrate the information on a Venn diagram
 - (ii) How many students belong to the Red Cross Society only?
 - (iii) How many students do **not** belong to any of the two societies?
 - (b) A farmer uses $\frac{1}{3}$ of his land to plant cassava, $\frac{2}{5}$ of the remaining land to plant maize and the rest vegetables. If vegetables cover an area of 10 acres, what is the total area of the farmer's land.
-
2. (a) Solve for x, if $2 - \frac{3}{5}x \leq 1\frac{1}{3}$
 - (b) At a rally attended by 520 people, 30% were Fantes, 25% Ewes, 15% Nzemas, 20% Gas and the rest Gonjas
 - (i) How many Gonjas were at the rally?
 - (ii) How many more Fantes than Nzemas were at the rally ?
 - (iii) Draw a pie chart to illustrate the information.
-
3. (a) Mr. Mensah's farm is 20 km from his house. He uses his car to travel y km of the distance from his house and then walks $1\frac{1}{2}$ hours at the rate of 3 km per hour to get to his farm. Find y
 - (b) The perimeter of a square field is the same as that of a rectangular field. If the length of the rectangular field is 8 km and the width is 5 km, calculate the area of the square field.
 - (c) Find the gradient of the line which passes through the points.
M (2, -1) and K (-3, 6)

4. (a) Using a ruler and a pair of compasses only, construct triangle PST with angle PST = 30° , $|ST| = 9$ cm and $|PS| = 12$ cm
- (b) With T as centre, draw a circle of radius 6 cm
- (c) Construct the perpendicular bisector (mediator) of line PS.
- (d) Label the intersections of the circle and the mediator Q_1 and Q_2 .
- (e) (i) Measure $|Q_1Q_2|$
(ii) Measure angle Q_1TQ_2
5. (a) Anita bought 51 tubers of yam at 3 for GHC 10.00. If she sold them and made a loss of 40%, how much did she sell each tuber of yam?
- (b) The volume of a cylinder closed at one end is 1056 cm^3 . If its height is 21 cm, find its
(i) diameter
(ii) total surface area.
6. (a) (i) Copy and complete the following mapping:
- | | | | | | | | |
|---|---|---|---|---|---|---|----|
| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 5 | 7 | 9 | - | - | - | 17 |
- (ii) Determine the rule for the mapping
- (b) Draw two perpendicular axes Ox and Oy on a graph sheet.
- (c) Using a scale of 2cm to 1 unit on the x-axis and 2cm to 2 units on the y-axis, mark the x-axis from 0 to 8 and the y-axis from 0 to 20.
- (d) Plot the point for each ordered pair (x, y) and join them with a straight line.
- (e) Find:
(i) y, when x is 0;
(ii) x, when y is 14

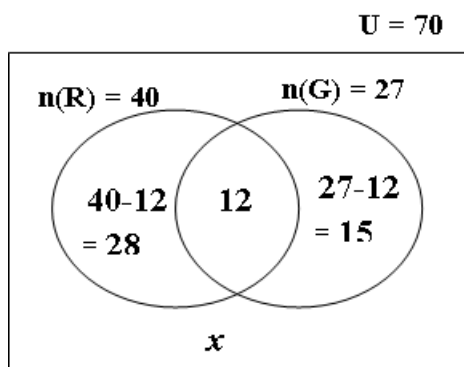
JUNE 2015 (Second Sitting)

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) (i) Let $n(R)$ = Number of Red Cross Society members
 $n(G)$ = Number of Girls' Guide Society members
 U = Universal set (total number in class)
 x = Remaining students (not belonging any of the two)



- (ii) No. of students in Red Cross Society only
= $40 - 12$
= 28
- (iii) No. of students who do not belong to any of the two societies
= $70 - (28 + 12 + 15)$
= $70 - 55$
= 15
- (b) Cassava Fraction = $\frac{1}{3}$
Remaining fraction = $1 - \frac{1}{3} = \frac{2}{3}$
Maize fraction = $\frac{2}{5}$ of remaining
= $\frac{2}{5} \times \frac{2}{3}$
= $\frac{4}{15}$
Vegetable fraction = Remaining fraction – maize fraction
= $\frac{2}{3} - \frac{4}{15}$
= $\frac{5(2) - 1(4)}{15}$
= $\frac{10 - 4}{15}$

$$= \frac{6}{15} = \frac{2}{5}$$

Now, by simple proportion,

If (vegetable) $\frac{2}{5} \rightarrow 10$ acres,

Then, (total area) $1 \rightarrow ?$ (more)

If more, less $(2/5)$ divides

$$\Rightarrow \frac{1}{2/5} \times 10 \text{ acres}$$

$$\Rightarrow \frac{5}{2} \times 10 \text{ acres}$$

$$= 5 \times 5 \text{ acres}$$

$$\text{Total area} = \underline{25 \text{ acres}}$$

NB

Other methods such as

(i) ratio

(ii) linear equation

(iii) diagram

could also be used to solve the problem

2. (a) Solving for x in $2 - \frac{3}{5}x \leq 1\frac{1}{3}$

$$\Rightarrow 2 - \frac{3}{5}x \leq \frac{4}{3}$$

$$\Rightarrow 15(2) - 15\left(\frac{3}{5}x\right) \leq 15\left(\frac{4}{3}\right)$$

$$\Rightarrow 15(2) - 3(3x) \leq 5(4)$$

$$\Rightarrow 30 - 9x \leq 20$$

$$\Rightarrow 30 - 20 \leq 9x$$

$$\Rightarrow 10 \leq 9x$$

$$\Rightarrow \frac{10}{9} \leq \frac{9x}{9}$$

$$\Rightarrow \frac{10}{9} \leq x$$

$$\Rightarrow x \geq \frac{10}{9}$$

(b) (i) Percentage of Gonjas = Total percentage – Sum of other percentages
 $= 100\% - (30\% + 25\% + 15\% + 20\%)$
 $= 100\% - 90\%$
 $= 10\%$

Number of Gonjas at the rally = $10\% \times \text{Total number at rally}$
 $= 10\% \times 520$
 $= \frac{10}{100} \times 520$
 $= \underline{52}$

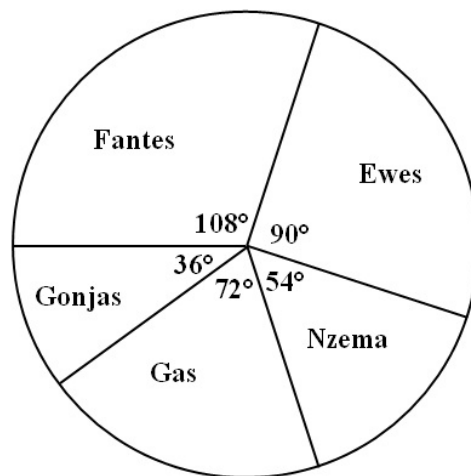
(ii) Number of Fantes = $30\% \text{ of } 520$
 $= \frac{30}{100} \times 520$
 $= 3 \times 52$
 $= 156$

$$\begin{aligned}
 \text{Number of Nzemas} &= 15\% \text{ of } 520 \\
 &= \frac{15}{100} \times 520 \\
 &= \frac{3}{2} \times 52 \\
 &= 78
 \end{aligned}$$

$$\begin{aligned}
 \text{Number of Fantes more than Nzemas} &= \text{No. of Fantes} - \text{No. of Nzemas} \\
 &= 156 - 78 \\
 &= \underline{78}
 \end{aligned}$$

(iii)

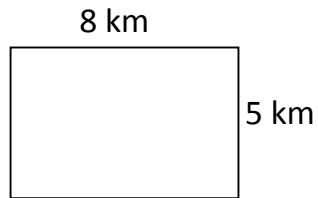
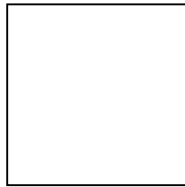
| People | Angle of sector |
|---------------|---|
| <u>Fantes</u> | $\frac{30}{100} \times 360^\circ = 3 \times 36^\circ = 108^\circ$ |
| Ewes | $\frac{25}{100} \times 360^\circ = \frac{1}{4} \times 360^\circ = 90^\circ$ |
| <u>Nzemas</u> | $\frac{15}{100} \times 360^\circ = \frac{3}{2} \times 36^\circ = 54^\circ$ |
| Gas | $\frac{20}{100} \times 360^\circ = 2 \times 36 = 72^\circ$ |
| <u>Gonjas</u> | $\frac{10}{100} \times 360^\circ = 1 \times 36 = 36^\circ$ |



$$\begin{aligned}
 3. \quad (a) \quad \text{Distance travelled by car} &= y \text{ km} \\
 \text{Distance walked} &= \text{one and half hr} \times 3 \text{ km / h} \\
 &= 4.5 \text{ km} \\
 \text{Total distance} &= 20 \text{ km}
 \end{aligned}$$

$$\begin{aligned}
 \text{Dist.by car} + \text{Dist. walked} &= \text{Total distance} \\
 y + 4.5 &= 20 \\
 y &= 20 - 4.5 \\
 &= \underline{15.5}
 \end{aligned}$$

(b)



$$\begin{aligned}
 \text{Perimeter of square} &= \text{Perimeter of rectangle} \\
 &= 2 \times \text{length} + 2 \times \text{width} \\
 &= 2 \times 8 \text{ km} + 2 \times 5 \text{ km} \\
 &= 16 \text{ km} + 10 \text{ km} \\
 &= 26 \text{ km}
 \end{aligned}$$

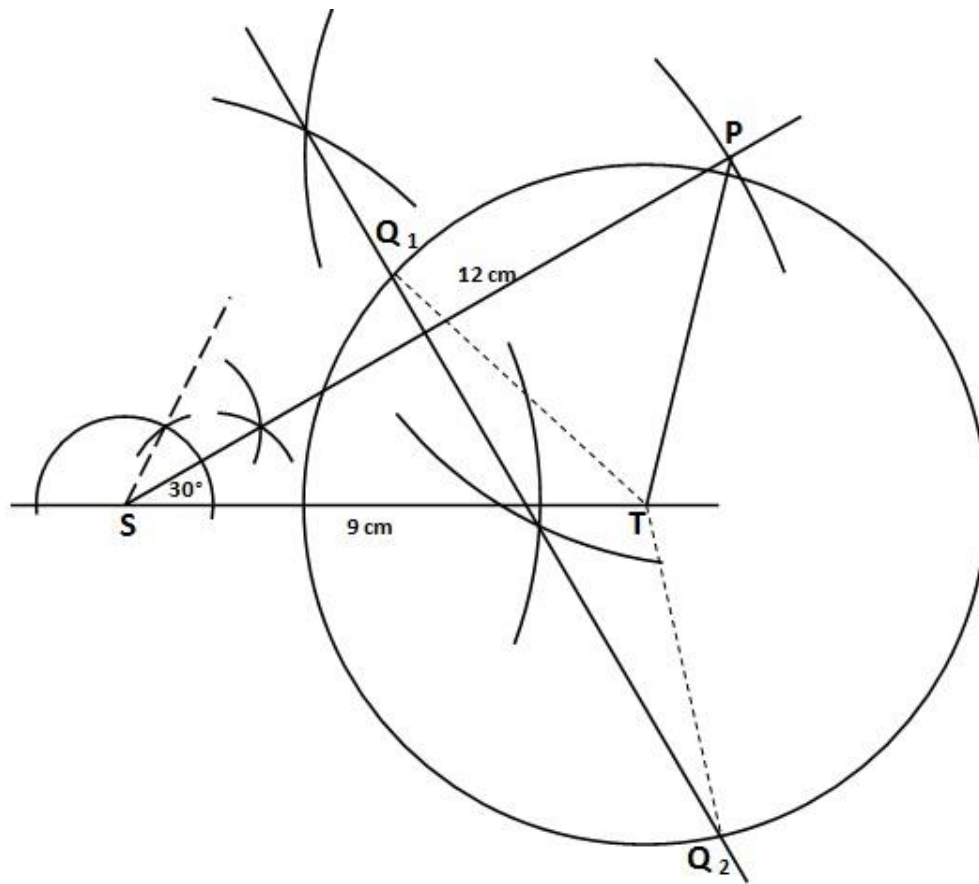
$$\begin{aligned}
 \text{Hence perimeter of square} &= 26 \text{ km} \\
 \text{Now perimeter of square} &= 4 \times \text{Length} \\
 \text{Length of square} &= 26 \text{ km} \div 4 \\
 &= 6.5 \text{ km}
 \end{aligned}$$

$$\begin{aligned}
 \text{Now, area of square} &= \text{Length} \times \text{length} \\
 &= 6.5 \times 6.5 \\
 &= \underline{42.25 \text{ cm}^2}
 \end{aligned}$$

(c) Gradient of line

$$\begin{aligned}
 &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{6 - (-1)}{-3 - 2} \\
 &= \frac{6 + 1}{-3 - 2} \\
 &= \frac{7}{-5} \\
 &= -\frac{7}{5}
 \end{aligned}$$

4. (a)



- (e) (i) $|Q_1Q_2| = \underline{11.3\text{cm} (\pm 1\text{cm})}$
- (ii) $\text{angle } Q_1TQ_2 = \underline{145^\circ (\pm 1^\circ)}$

5. (a) Cost Price of the 51 tubers $= \frac{51}{3} \times \text{GHc } 10$

$= 17 \times \text{GHc } 10$

$= \text{GHc } 170$

Selling Price percentage $= 100\% - 40\% = 60\%$

If (Cost Price) 100% \rightarrow GHc 170

Then (Selling Price) 60% \rightarrow ? (less)

If less, then more (100) divides

$\Rightarrow \frac{60}{100} \times \text{GHc } 170$

$\Rightarrow 6 \times \text{GHc } 17$

$\Rightarrow \text{GHc } 102$

Hence selling price of all 51 tubers $= \text{GHc } 102$

\Rightarrow **Selling price of each tuber** $= \text{GHc } 102 \div 51$

$= \underline{\text{GHc } 2.00}$

- (b) (i) The volume of cylinder closed at one end $= 1056 \text{ cm}^3$

$$\begin{aligned}
\Rightarrow \pi r^2 h &= 1056 \\
\Rightarrow \frac{22}{7} \times r^2 \times 21 &= 1056 \\
\Rightarrow 22 \times r^2 \times 3 &= 1056 \\
\Rightarrow 66 \times r^2 &= 1056 \\
\Rightarrow \frac{66 r^2}{66} &= \frac{1056}{66} \\
\Rightarrow r^2 &= 16 \\
\Rightarrow r &= \sqrt{16} \\
\Rightarrow r &= 4\text{cm}
\end{aligned}$$

$$\begin{aligned}
\text{Hence, diameter} &= 2 \times \text{radius} \\
&= 2 \times 4\text{cm} \\
&= \underline{8\text{cm}}
\end{aligned}$$

$$\begin{aligned}
\text{(ii) Total surface area of cylinder closed at one end} \\
&= \text{Circular Bottom} + \text{Curved surface} \\
&= \pi r^2 + 2 \pi r h \\
&= \left(\frac{22}{7} \times 4^2\right) + \left(2 \times \frac{22}{7} \times 4 \times 21\right) \\
&= \left(\frac{22}{7} \times 4 \times 4\right) + \left(2 \times \frac{22}{7} \times 4 \times 21\right) \\
&= \left(\frac{22 \times 4 \times 4}{7}\right) + (2 \times 22 \times 4 \times 3) \\
&= \frac{352}{7} + 528 \\
&= 50.29 + 528.00 \\
&= \underline{578.29 \text{ cm}^2}
\end{aligned}$$

6. (a) (i)

| | | | | | | | |
|---|---|---|---|-----------|-----------|-----------|----|
| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 5 | 7 | 9 | <u>11</u> | <u>13</u> | <u>15</u> | 17 |

$$\text{(ii) Gradient} = \frac{7-5}{2-1} = \frac{2}{1} = 2$$

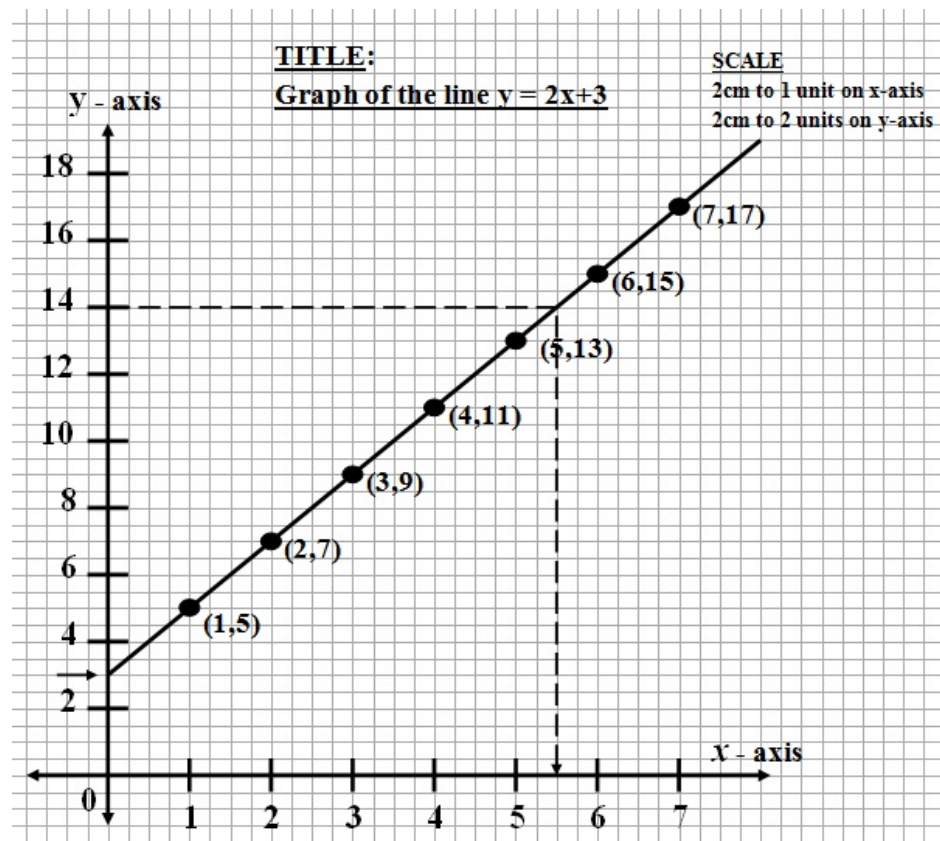
$$\text{Constant} = 3 \quad (\text{The image of 0})$$

Hence from general equation $y = mx + c$, where $m = \text{gradient}$, $c = \text{constant}$

$$\text{Equation} = y = 2x + 3$$

$$\text{Therefore Rule} = \underline{x \rightarrow 2x + 3}$$

(b), (c), (d)



- (e) (i) When x is 0, $y = 3$
- (ii) When y is 14, $x = 5.5$

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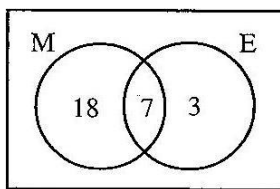
MATHEMATICS 1

Objective Test

1 Hour

1. If set **N** is a subset of set **M**, then
- A. sets **M** and **N** have the same number of elements
 - B. some members of set **N** can be found in set **M**
 - C. no member of set **N** is in set **M**
 - D. all members of set **N** are in set **M**

The Venn diagram shows the number of pupils who offer Mathematics (M) and / or English in a class.



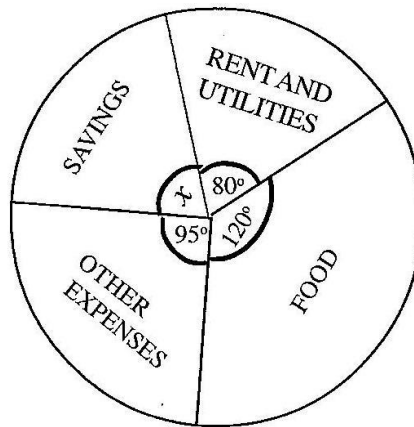
Use this information to answer Questions 2 and 3.

2. How many pupils offer Mathematics?
- A. 10
 - B. 18
 - C. 25
 - D. 28
3. How many pupils offer only one subject?
- A. 3
 - B. 7
 - C. 18
 - D. 21
4. Simplify: $12 - 7 - (-5)$
- A. -10
 - B. -2
 - C. 0
 - D. 10
5. Express 72 as a product of its prime factors
- A. 2×3^3
 - B. $2^2 \times 3^3$
 - C. $2^3 \times 3$
 - D. $2^3 \times 3^2$

6. Find the **smallest** number which is divisible by 16 and 20?
- 40
 - 80
 - 120
 - 160
7. Convert 243_{five} to a base ten numeral.
- 40
 - 43
 - 45
 - 73
8. A pineapple which was bought for GH¢ 1.00 was sold at GH¢ 1.30. Calculate the profit percent.
- 10%
 - 20%
 - 23%
 - 30%
9. Simplify $35x^5y^3 \div 7xy^2$
- $5x^4y$
 - $5x^4y^5$
 - $5x^6y$
 - $5x^6y^5$
10. Two bells P and Q ring at intervals of 3 hours and 4 hours, respectively. After how many hours will the two bells **first** ring simultaneously (at the same time)?
- 6 hours
 - 8 hours
 - 12 hours
 - 24 hours
11. A boy scores $\frac{17}{25}$ in a French test. Express his score as a percentage.
- 17%
 - 34%
 - 68%
 - 85%
12. Arrange the following fractions in ascending order of magnitude $\frac{2}{5}, \frac{5}{12}$ and $\frac{3}{4}$,
- $\frac{2}{5}, \frac{3}{4}, \frac{5}{12}$
 - $\frac{2}{5}, \frac{5}{12}, \frac{3}{4}$
 - $\frac{5}{12}, \frac{2}{5}, \frac{3}{4}$
 - $\frac{3}{4}, \frac{2}{5}, \frac{5}{12}$

13. Kofi paid rent of GH¢ 1,800.00 each year. If the rent is 0.3 of his annual income, find his annual income.
- A. GH¢ 600.00
 - B. GH¢5,400.00
 - C. GH¢ 6,000.00
 - D. GH¢ 18,000.00
14. I gave a storekeeper a GH¢10.00 note for goods I bought. He asked me for another 15Gp for ease of change. If he then gave me 50 Gp, how much did I pay for the goods?
- A. GH¢ 9.35
 - B. GH¢ 9.45
 - C. GH¢ 9.65
 - D. GH¢ 10.65
15. Kojo can buy 15 shirts at GH¢ 4.00 each. If the price is increased to GH¢ 5.00, how many shirts can he now buy?
- A. 12
 - B. 15
 - C. 19
 - D. 20
16. A hall which is 8m long is represented on a diagram as 4 cm long. What is the scale of the diagram?
- A. 1:200
 - B. 1:250
 - C. 1:400
 - D. 1:800
17. Jane arrived at work at 7:55 am and left at 4:15 pm. For how long was she at work?
- A. 7 hr 20 min
 - B. 7 hr 45 min
 - C. 8 hr 20 min
 - D. 8 hr 40 min
18. Given that $(3.14 \times 18) \times 17.5 = 3.14 \times (3p \times 17.5)$, find the value of p
- A. 3.0
 - B. 5.8
 - C. 6.0
 - D. 9.0

The pie chart shows how Kwaku spends his monthly salary.



Use this information to answer Questions 19 to 21

19. Find the value of x
 - A. 65°
 - B. 75°
 - C. 85°
 - D. 100°
20. Kwaku earns GH¢ 630.00 a month. How much of this does he spend on food?
 - A. GH¢ 140.00
 - B. GH¢ 157.00
 - C. GH¢ 210.00
 - D. GH¢ 350.00
21. What percentage of his salary does he spend on rent and utilities?
 - A. 12.1%
 - B. 12.5%
 - C. 22.2%
 - D. 33.3%
22. In an enlargement with scale factor 2, which of the following statements is not true?
 - A. Each length is multiplied by 2
 - B. Each angle remains the same
 - C. The shape of the figure does not change.
 - D. The size of the figure does not change.
23. Kofi, Kojo and Ama shared GH¢ 480,000.00 in the ratio 3:5:4. How much did Ama receive?
 - A. GH¢ 160,000.00
 - B. GH¢ 200,000.00
 - C. GH¢ 218,181.81
 - D. GH¢ 342,859.14
24. If $w = 12$, $x = 5$, $y = 6$ and $z = 4$, find the value of $wx - yz$.
 - A. 18
 - B. 27
 - C. 36
 - D. 84

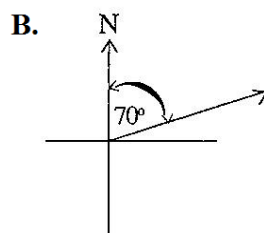
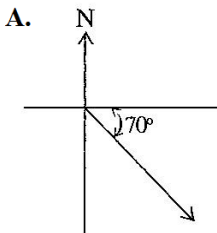
25. A man was 24 years old when his son was born. Now he is three times as old as his son. Find the age of the son.
- A. 6 years
 - B. 12 years
 - C. 18 years
 - D. 36 years

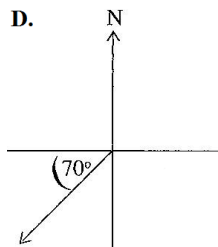
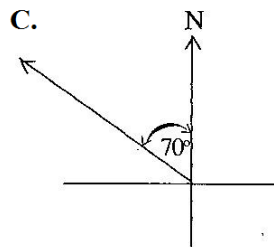
26. There are 20 identical balls in a box. Twelve are blue and the rest are green. If one ball is taken at random from the box, find the probability that the ball is green.
- A. $\frac{1}{20}$
 - B. $\frac{2}{5}$
 - C. $\frac{3}{5}$
 - D. $\frac{3}{4}$

27. Using the following mapping, find the missing numbers p and q.

| | | | | | | |
|---|---|---|---|---|----|---|
| x | 1 | 2 | 3 | 4 | 5 | 6 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 3 | 5 | p | 9 | 11 | q |

- A. p = 6, q = 12
 - B. p = 6, q = 13
 - C. p = 7, q = 12
 - D. p = 7, q = 13
28. The perimeter of a rectangle is 24 cm. If the length is 7 cm, find its width.
- A. 3 cm
 - B. 5 cm
 - C. 10 cm
 - D. 12 cm
29. A boy walks on a bearing 070°. Which of the following diagrams show his direction?





30. How many faces has a cube?

- A. 4
- B. 6
- C. 8
- D. 12

31. The diameter of a circular tray is 28 cm. Find the area of the tray.

[Take $\pi = \frac{22}{7}$]

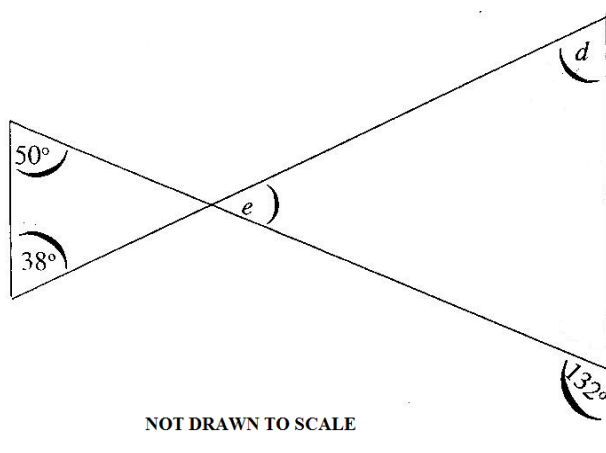
- A. 44 cm²
- B. 88 cm²
- C. 154 cm²
- D. 616 cm²

32. Calculate the volume of a cylinder with radius 7 cm and height 10 cm.

[Take $\pi = \frac{22}{7}$]

- A. 220 cm³
- B. 440 cm³
- C. 1,540 cm³
- D. 3,080 cm³

Use the diagram below to answer questions 33 and 34



33. Find the value of e .

- A. 38°
- B. 40°
- C. 88°
- D. 92°

34. Find the angle marked d

- A. 38°
- B. 40°
- C. 48°
- D. 88°

35. A 3.6 m long string is to be cut into pieces, each of length 40 cm. How many pieces can be cut from the string?

- A. 4
- B. 6
- C. 8
- D. 9

36. Solve the inequality $2x + 10 \geq \frac{7x}{2} - 5$

- A. $x \leq 10$
- B. $x \geq 10$
- C. $x \leq 40$
- D. $x \geq 40$

37. The point P (5, 4) is reflected in the y-axis. Find its image.

- A. $(-5, 4)$
- B. $(5, -4)$
- C. $(-4, 5)$
- D. $(4, -5)$

38. If $\begin{pmatrix} 4 \\ 11 \end{pmatrix} = \begin{pmatrix} x-3 \\ 11 \end{pmatrix}$, find the value of x.

- A. -1
- B. 1
- C. 7
- D. 12

39. Find the gradient of the line which passes through the points M(-1, 2) and N(6, -3)

- A. $\frac{-5}{7}$
- B. $\frac{-7}{5}$
- C. $\frac{5}{7}$
- D. $\frac{7}{5}$

40. Find the next two terms in the sequence 11, 7, 3, -1, ____, ____.

- A. 5, 9
- B. 3, 7
- C. -4, -9
- D. -5, -9

END OF PAPER

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MATHEMATICS 1

Objective Test

SOLUTIONS

1. D. all members of set N are in set M
2. C. 25
3. D. 21
4. D. 10
5. D. $2^3 \times 3^2$
6. B. 80
7. D. 73
8. D. 30%
9. A. $5x^4y$
10. C. 12 hours
11. C. 68%
12. B. $\frac{2}{5}$, $\frac{5}{12}$, $\frac{3}{4}$
13. C. GHC 6,000
14. C. GHC 9.65
15. A. 12
16. A. 1:200
17. C. 8hr 20 min
18. C. 6.0
19. A. 65°
20. C. 210°
21. C. 22.2%
22. D. The size of the figure does not change
23. A. GHC 160,000.00
24. C. 36
25. B. 12 years
26. B. $\frac{2}{5}$
27. D. $p = 7$, $q = 13$
28. B. 5 cm

29. B.
30. B. 6
31. D. 616 cm^2
32. C. 1540 cm^3
33. D. 92°
34. B. 40°
35. D. 9
36. A. $x \leq 10$
37. A. $(-5, 4)$
38. C. 7
39. A. $\frac{-5}{7}$
40. D. $-5, -9$

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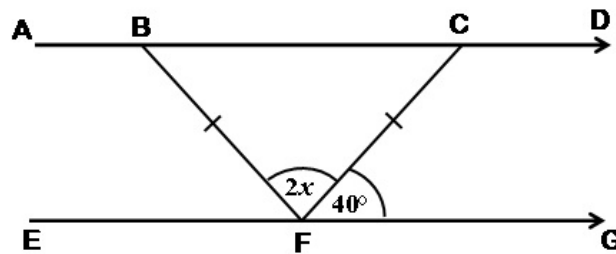
MATHEMATICS 2

Essay

1 hour

1. (a) $P = \{\text{factors of } 30\}$
 $Q = \{\text{Multiples of } 5 \text{ less than } 40\}$
Find $P \cap Q$
- (b) A trader saved GH¢ 200.00 for 3 years at 12% simple interest per annum.
What will be the total amount in the trader's account at the end of the 3 years?
- (c) Evaluate $\frac{4.56 \times 3.6}{0.12}$ and leave your answer in standard form.
2. (a) (i) Ama scored 82, 74 and 90 in three tests. What mark should she score in the fourth test so that her average mark for the four tests would be 85?
- (ii) What was her median score in the four tests?

(b)



In the diagram \overline{AD} is parallel to \overline{EG} , angle $CFG = 40^\circ$ and triangle BCF is isosceles.

Find the value of :

- (i) angle CBF
(ii) angle DCF ;
(iii) x

3. (a) Solve for x , if

$$\frac{1}{3}x + 1\frac{2}{3} < -\frac{3}{4}x - \frac{1}{2}$$

- (b) The following shows the distribution of marks of students in an examination.

| | | | | |
|----|----|----|----|----|
| 6 | 43 | 26 | 18 | 27 |
| 42 | 8 | 22 | 31 | 39 |
| 55 | 44 | 37 | 47 | 59 |
| 10 | 12 | 36 | 53 | 48 |

- Make a stem-and-leaf plot of the marks above
- Find the probability of selecting a student who scored between 40 and 50.
- Find the number of students who passed the examination, if the pass mark was 30.

4. (a) A box has length 8.0 cm, width 5.0 cm and height 10.0 cm.

Find the:

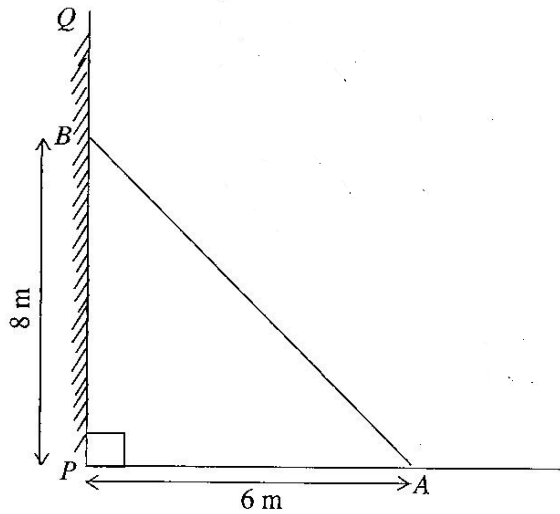
- total surface area of the box
 - the volume of the box.
- (b) (i) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes Ox and Oy on a graph sheet.
- (ii) On the same graph sheet mark the x-axis from -5 to 5 and the y-axis from -6 to 6
- (iii) Plot and join the points A(0, 3), B(2, 3), C(4, 5) to form triangle ABC.
- (iv) Draw the image $A_1B_1C_1$ of triangle ABC under a translation by the vector $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$
- (v) Draw the image $A_2B_2C_2$ of triangle ABC under a reflection in the x - axis

5. (a) Using a ruler and a pair of compass only;

- construct triangle PQR such that $\overline{PR} = 8\text{cm}$, $\overline{PQ} = 6\text{cm}$ and $\overline{QR} = 5\text{cm}$;
 - construct the perpendicular bisector of \overline{PR} and label it ℓ_1 ;
 - construct the perpendicular bisector of \overline{QR} and label it ℓ_2 ;
 - Label the point of intersection of ℓ_1 and ℓ_2 as N;
 - With N as centre and radius equal to |PN|, draw a circle.
- (b) (i) Measure the radius of the circle.
- (ii) Calculate the circumference of the circle, correct to 3 significant figures.
[Take $\pi = 3.14$]

6. (a) Factorize completely $6xy - 3y + 4x - 2$

(b)



NOT DRAWN TO SCALE

The diagram shows a ladder AB which leans against a vertical wall PQ at B.

If $|PB|$ is 8 m, and the other end of the ladder is 6 m away from the foot of the wall (at P), find the length of the ladder ($|AB|$)

- (c) Kojo had 1800 bags of rice in stock for sale. In January, he sold $\frac{2}{3}$ of it.
In February, he sold $\frac{3}{4}$ of what was left.
- (i) What fraction of the stock of rice did he sell
 - (α) in February?
 - (β) in January and February?
 - (ii) How many bags of rice were left unsold, by the end of February?

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MATHEMATICS 2

Essay

SOLUTIONS

1. (a) $P = \{1, 2, 3, 5, 6, 10, 15, 30\}$
 $Q = \{5, 10, 15, 20, 25, 30, 35\}$
 $P \cap Q = \{5, 10, 15, 30\}$

1. (b) Total amount = Simple Interest + Principal

$$\text{Simple interest} = \text{Principal} \times \text{Rate} \times \text{Time}$$

$$\text{Simple interest} = 200 \times 12\% \times 3$$

$$= 200 \times \frac{12}{100} \times 3$$

$$= 2 \times 12 \times 3$$

$$\text{Simple interest} = \text{GHC } 72.00$$

$$\text{Total amount} = \text{Interest} + \text{Principal}$$

$$= \text{GHC } 72.00 + \text{GHC } 200.00$$

$$= \underline{\underline{\text{GHC } 272.00}}$$

1. (c)
$$\frac{4.56 \times 3.6}{0.12}$$

1st Method

$$= \frac{(4.56 \times 3.6)}{0.12} \times \frac{1000}{1000}$$

$$= \frac{456 \times 36}{120}$$

$$= \frac{456 \times 3}{10} = \frac{1368}{10}$$

$$= 136.8$$

$$= \underline{\underline{1.368 \times 10^2}}$$

STEPS (1st Method)

1. Multiply both numerator and denominator by 1000

(or shift the decimal point 3 places to the right in both numerator and denominator – to convert to whole numbers)

2. Divide ('cancel') both 36 and 120 by 12 to get 3 and 10 resp.

3. Multiply 456 by 3 to get 1368

4. Shift the decimal point 1 place to the left (because of division by 10)

5. Convert to standard form by shifting decimal point 2 places to the left and multiplying by 10 to the power 2 (because decimal point was shifted 2 times)

1 (c)

2nd Method

$$\begin{aligned}
 & \frac{4.56 \times 3.6}{0.12} \\
 = & (4.56 \times 3.6) \div 0.12 \\
 = & \frac{456}{100} \times \frac{36}{10} \div \frac{12}{100} \\
 = & \frac{456}{100} \times \frac{36}{10} \times \frac{100}{12} \\
 = & \frac{456}{1} \times \frac{3}{10} \times \frac{1}{1} \\
 = & \frac{456 \times 3}{10} = \frac{1368}{10} \\
 = & 136.8 \\
 = & \underline{\underline{1.368 \times 10^2}}
 \end{aligned}$$

STEPS (2nd Method)

- Express using the \div sign
- Change all decimals to fractions
- Change the \div sign to \times and
 $\frac{12}{100}$ turn the divisor () upside down to () $\frac{100}{12}$
- Divide ('cancel') 36 and 12 by 12 to get 3 and 1 resp. &
 Divide ('cancel') 100 (numerator) by 100 (denominator) to get 1 and 1 respectively
- Multiply 456 by 3 to get 1368
- Shift the decimal point 1 place to the left (because of division by 10)
- Convert to standard form by shifting decimal point 2 places to the left and multiplying by 10 to the power 2 (because decimal point was shifted 2 times to the left)

1 (c)

3rd Method

$$\begin{aligned}
 & \frac{4.56 \times 3.6}{0.12} \\
 = & \frac{456 \times 10^{-2} \times 36 \times 10^{-1}}{12 \times 10^{-2}} \\
 = & \frac{456 \times 36 \times 10^{-1} \times 10^{-2}}{12 \times 10^{-2}} \\
 = & \frac{456 \times 3 \times 10^{-1} \times 10^{-2}}{10^{-2}} \\
 = & 1368 \times 10^{-1} \\
 = & 1.368 \times 10^3 \times 10^{-1} \\
 = & 1.368 \times 10^{3+(-1)} \\
 = & \underline{\underline{1.368 \times 10^2}}
 \end{aligned}$$

STEPS (3rd Method)

- Change decimals to whole numbers by shifting decimal point to the right and multiplying by 10 raised to negated same no. of times the point was shifted.
- Rearrange to group similar number forms
- Divide 36 (numerator) by 12 (denominator) to get 3
- Divide 10^{-2} (numerator) by 10^{-2} (denominator) to get 1
- Multiply 456 by 3 to get 1368
- Express 1368 in standard form to get 1.368×10^3
- Simplify $10^3 \times 10^{-1}$ by adding the powers [$3 + (-1) = 3-1 = 2$]

2. (a) (i) Let x = Ama's score in the fourth test

Method 1

$$\text{Mean} = \frac{82 + 74 + 90 + x}{4} = 85$$

$$\Rightarrow \frac{246 + x}{4} = 85$$

$$\Rightarrow 246 + x = 4 \times 85$$

$$\Rightarrow x = 340 - 246$$

$$\Rightarrow \underline{\underline{x = 94}}$$

1. Write an expression for her mean score, using the given scores,
2. Multiplying both sides by 4 (to clear fraction)
Or 'Cross-multiply'
3. Subtract 246 from both sides
(send 246 across the '=' sign and negate it)
4. Simplify to get answer.

2. (a) (i) **Method 2**

$$\begin{aligned} \text{Total marks} &= \text{No. of marks} \times \text{mean mark} \\ &= 4 \times 85 \\ &= 340 \end{aligned}$$

$$\begin{aligned} \text{Sum of first 3 marks} &= 82 + 74 + 90 \\ &= 246 \end{aligned}$$

$$\begin{aligned} \text{Ama's fourth mark} &= \text{Total mark} - \text{sum of first three} \\ &= 340 - 246 \\ &= \underline{\underline{94}} \end{aligned}$$

- (a) (ii) **Median score**

Scores arranged in order gives 74, 82, 90, 94

$$\begin{aligned} \text{Median} &= \frac{82 + 90}{2} = \frac{172}{2} \\ &= \underline{\underline{86}} \end{aligned}$$

- (b) (i) Since angles BCF and CFG are alternate angles,

$$\Rightarrow \text{Angle BCF} = 40^\circ$$

Now, since base angles of isosceles triangle BFC are equal,

$$\Rightarrow \underline{\underline{\text{Angle CBF} = 40^\circ}}$$

- (ii) angle DCF + angle BCF = 180° (angles at a point on a straight line = 180°)

$$\Rightarrow \text{angle DCF} + 40^\circ = 180^\circ$$

$$\begin{aligned} \Rightarrow \text{angle DCF} &= 180^\circ - 40^\circ \\ &= \underline{\underline{140^\circ}} \end{aligned}$$

- (iii) $2x + 40^\circ + 40^\circ = 180^\circ$ (Sum of interior angles of a triangle = 180°)

$$2x + 80^\circ = 180^\circ$$

$$2x = 180^\circ - 80^\circ$$

$$2x = 100^\circ$$

$$\frac{2x}{2} = \frac{100}{2}$$

$$\underline{x = 50}$$

3. (a) Solve for x,

$$\frac{1}{3}x + 1\frac{2}{3} < -\frac{3}{4}x - \frac{1}{2}$$

Method 1

$$\frac{1}{3}x + \frac{5}{3} < -\frac{3}{4}x - \frac{1}{2}$$

$$12\left(\frac{1}{3}x\right) + 12\left(\frac{5}{3}\right) < -12\left(\frac{3}{4}x\right) - 12\left(\frac{1}{2}\right)$$

$$4(x) + 4(5) < -3(3x) - 6(1)$$

$$4x + 20 < -9x - 6$$

$$4x + 9x < -20 - 6$$

$$13x < -26$$

$$\frac{13x}{13} < \frac{-26}{13}$$

$$\underline{x < -2}$$

STEPS (Method 1)

1. Change mixed fraction ($1\frac{2}{3}$) to improper fraction ($\frac{5}{3}$)
2. Multiply both sides by 12 (LCM of denominators)
3. Simplify each term
4. Group like terms on same side
5. Simplify
6. Divide both sides by 13

3. (a)

Method 2

$$\frac{1}{3}x + \frac{5}{3} < -\frac{3}{4}x - \frac{1}{2}$$

$$\frac{1(x) + 1(5)}{3} < \frac{-1(3x) - 2(1)}{4}$$

$$\frac{x + 5}{3} < \frac{-3x - 2}{4}$$

$$12\left(\frac{x + 5}{3}\right) < 12\left(\frac{-3x - 2}{4}\right)$$

$$4(x + 5) < 3(-3x - 2)$$

$$4x + 20 < -9x - 6$$

$$4x + 9x < -20 - 6$$

$$13x < -26$$

$$\frac{13x}{13} < \frac{-26}{13}$$

$$\underline{x < -2}$$

STEPS (Method 2)

1. Simplify (add / subtract) fractions on both sides
2. Multiply both sides by 12 (LCM of denominators)
3. Simplify ('cancel')
4. Expand and simplify
5. Group like terms on same side
6. Simplify
7. Divide both sides by 13

3.(b)(i) Stem-and-leaf plot

| Stem | Leaf |
|------|---------------|
| 0 | 6, 8 |
| 1 | 0, 2, 8 |
| 2 | 2, 6, 7 |
| 3 | 1, 6, 7, 9 |
| 4 | 2, 3, 4, 7, 8 |
| 5 | 3, 5, 9 |

- (ii) Probability of selecting a student who scored between 40 and 50

$$\begin{aligned}
 &= \frac{\text{No. of students who scored between 40 and 50}}{\text{Total no. of students}} \\
 &= \frac{5 \text{ students}}{20 \text{ students}} = \frac{5}{20} \\
 &= \frac{1}{4}
 \end{aligned}$$

- (iii) Number of students who passed, if the pass mark was 30
 = n (31, 36, 37, 39, 42, 43, 44, 47, 48, 53, 55, 59)
 = 12 students

4. (a) (i) Let length = l, width = w, height = h

$$\begin{aligned}
 \text{Total surface area} &= 2lw + 2lh + 2wh, \\
 &= (2 \times 8\text{cm} \times 5\text{cm}) + (2 \times 8\text{cm} \times 10\text{cm}) + (2 \times 5\text{cm} \times 10\text{cm}) \\
 &= 80\text{cm}^2 + 160\text{cm}^2 + 100\text{cm}^2 \\
 &= \underline{340 \text{ cm}^2}
 \end{aligned}$$

- (ii) Volume = $l \times w \times h$
 = $8\text{cm} \times 5\text{cm} \times 10\text{cm}$
 = 400 cm^3

4 (b)

$$= \underline{25.12 \text{ cm}}$$

$$\begin{aligned} \text{Or if } r &= 4.1 \text{ cm} \\ C &= 2 \times 3.14 \times 4.1 \text{ cm} \\ &= \underline{25.748 \text{ cm}} \end{aligned}$$

$$\begin{aligned} 6. \quad (a) \quad &6xy - 3y + 4x - 2 \\ &3y(2x - 1) + 2(2x - 1) \\ &\underline{(2x - 1)(3y + 2)} \end{aligned}$$

- (b) The length of the ladder AB forms the hypotenuse of the right-angled triangle ABP
From the Pythagorean theorem,

$$\begin{aligned} |AB|^2 &= |AP|^2 + |BP|^2 \\ &= (6)^2 + (8)^2 \\ &= 36 + 64 \\ |AB|^2 &= 100 \\ \Rightarrow |AB| &= \sqrt{100} \\ &= \underline{10 \text{ m}} \end{aligned}$$

The length of the ladder AB is 10 m

6. (c) Method 1

$$\begin{aligned} \text{No. of bags sold in January} &= \frac{2}{3} \times 1800 \\ &= 2 \times 600 \\ &= \underline{1200} \end{aligned}$$

$$\begin{aligned} \text{No. of bags left} &= 1800 - 1200 \\ &= \underline{600} \end{aligned}$$

$$\begin{aligned} \text{No. of bags sold in February} &= \frac{3}{4} \times 600 \\ &= 3 \times 150 \\ &= \underline{450} \end{aligned}$$

$$\begin{aligned} (i) \quad (\alpha) \quad \text{Fraction of bags sold in February} &= \frac{\text{No. of bags sold in February}}{\text{Total no. of bags}} \\ &= \frac{450}{1800} \\ &= \underline{\underline{\frac{1}{4}}} \end{aligned}$$

$$\begin{aligned} (i) \quad (\beta) \quad \text{Fraction of bags sold in Jan and Feb} &= \frac{1200 + 450}{1800} \\ &= \frac{1650}{1800} \end{aligned}$$

$$= \frac{11}{12}$$

$$\begin{aligned} \text{(ii) No. of bags left unsold by the end of February} &= 1800 - 1650 \\ &= \underline{\underline{150}} \end{aligned}$$

6. (c)

Method 2

$$\text{Fraction sold in January} = \frac{2}{3}$$

$$\begin{aligned} \text{Fraction left} &= 1 - \frac{2}{3} \\ &= \frac{1}{1} - \frac{2}{3} \\ &= \frac{3-2}{3} \\ &= \frac{1}{3} \end{aligned}$$

$$\text{(i) } (\alpha) \quad \text{Fraction sold in February} = \frac{3}{4} \text{ of fraction left}$$

$$\begin{aligned} &= \frac{3}{4} \times \frac{1}{3} \\ &= \frac{1}{4} \times \frac{1}{1} \end{aligned}$$

$$\text{Fraction sold in Feb.} = \frac{1}{4}$$

$$\text{(i) } (\beta) \quad \text{Fraction sold In January and February}$$

$$\begin{aligned} &= \frac{2}{3} + \frac{1}{4} \\ &= \frac{4(2) + 3(1)}{12} \\ &= \frac{8+3}{12} = \frac{11}{12} \end{aligned}$$

$$\text{(ii) No. of bags left unsold by end of February}$$

$$= \text{Fraction left unsold} \times \text{Total no. of bags}$$

$$\begin{aligned} \text{But fraction left unsold} &= 1 - \frac{11}{12} \\ &= \frac{12}{12} - \frac{11}{12} \end{aligned}$$

$$= \frac{1}{12}$$

Therefore No. of bags left unsold by end of February

$$= \frac{1}{12} \times 1800 \text{ bags}$$

$$= 1 \times 150 \text{ bags}$$

$$= \underline{\underline{150 \text{ bags}}}$$

June 2013

MATHEMATICS 1

Objective Test

1 Hour

1. If $A = \{5, 10, 15, 20, 25, 125\}$ and $B = \{5, 10, 15, 20, 25, 625\}$, list the elements of $A \cup B$
 - A. $\{5, 25\}$
 - B. $\{10, 20, 125, 625\}$
 - C. $\{5, 15, 25, 125, 625\}$
 - D. $\{5, 10, 15, 20, 25, 125, 625\}$
2. Express 1.25 as a percentage
 - A. 25%
 - B. 75%
 - C. 125%
 - D. 175%
3. Arrange the following in ascending order of magnitude: 0.301, 0.3, 0.33, 0.03
 - A. 0.03, 0.3, 0.301, 0.33
 - B. 0.03, 0.301, 0.3, 0.33
 - C. 0.33, 0.3, 0.301, 0.03
 - D. 0.33, 0.301, 0.3, 0.03
4. Evaluate $53 - (-7) + (-15)$
 - A. 31
 - B. 45
 - C. 61
 - D. 75
5. Given that $A = \{a, e, i, o, u\}$ and $B = \{r, s, t\}$. How many elements are in $A \cap B$?
 - A. 0
 - B. 1
 - C. 2
 - D. 3
6. Convert 2114_{five} to a base ten numeral.
 - A. 194
 - B. 280
 - C. 284
 - D. 300
7. Simplify $\frac{2^2 \times 3^2}{4^2 \times 3^3}$
 - A. $\frac{1}{12}$
 - B. $\frac{1}{6}$

C. $\frac{1}{4}$

D. $\frac{1}{3}$

8. A car uses 150 litres of petrol in 45 minutes. How many litres of petrol will it use in 1 hour?

- A. 375 litres
B. 230 litres
C. 225 litres
D. 200 litres

9. Simplify $\frac{36a^3b^2x}{27ab^3y}$

A. $\frac{4a^2x}{3by}$

B. $\frac{4abx}{3y}$

C. $\frac{4a^2bx}{3y}$

D. $\frac{4a^4b^5x}{3y}$

10. Find the rule of the mapping

| | | | | | |
|---|---|----|----|----|---|
| 1 | 2 | 3 | 4 | 5 | x |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 5 | 8 | 11 | 14 | 17 | y |

- A. $x + 2$
B. $x + 4$
C. $2x + 3$
D. $3x + 2$

11. Given that $-1 = 2 - m$, find m

- A. -3
B. -1
C. 1
D. 3

12. The perimeter of a rectangle is 48 cm. If the length is 14 cm, find its width.

- A. 24 cm
B. 20 cm
C. 10 cm
D. 3.4 cm

13. Make d the subject of the relation $n = 2d + 3$

A. $d = \frac{3n}{2}$

B. $d = \frac{n+3}{2}$

C. $d = \frac{n-3}{2}$

D. $d = \frac{3-n}{2}$

14. Calculate the gradient of the straight line joining the points A(3, 5) and B(-2, 3)

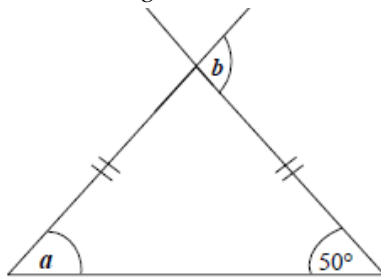
A. $\frac{5}{2}$

B. $\frac{2}{5}$

C. $-\frac{2}{5}$

D. $-\frac{5}{2}$

Use the diagram below to answer Questions 15 and 16



15. Find the angle marked a

A. 70°

B. 50°

C. 40°

D. 30°

16. Find the angle marked b

A. 150°

B. 140°

C. 110°

D. 100°

17. If $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, find the probability that a number selected at random from S is odd.

A. $\frac{3}{8}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. $\frac{5}{8}$

18. Find the vector which translates the point (4, -5) to (3, -2)

A. $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$

B. $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$

C. $\begin{pmatrix} -1 \\ 7 \end{pmatrix}$

D. $\begin{pmatrix} 7 \\ 3 \end{pmatrix}$

19. Factorize completely the expression $2xy - 6y + 7x - 21$

A. $(x - 3)(2y + 7)$

B. $(x + 3)(2y - 7)$

C. $(y - 3)(2x + 7)$

D. $(y + 3)(2x - 7)$

20. The area of a circle is 154 cm^2 . Find the diameter. [Take $\pi = \frac{22}{7}$]

A. 7 cm

B. 14 cm

C. 21 cm

D. 49 cm

21. Maame Esi rides her bicycle to school and back everyday. If the distance from her home to the school is 2345 m, how many kilometers does she cover everyday?

A. 4.98 km

B. 4.69 km

C. 3.96 km

D. 3.68 km

22. The length of a rectangular fence is 25 m. The ratio of the length to the width is 5:3. Find the width of the rectangular fence.

A. 9 m

B. 13 m

C. 15 m

D. 16 m

23. Evaluate $\frac{20}{a} - b$, if $a = 30$ and $b = 1$.

A. $-1\frac{2}{3}$

B. $-\frac{1}{3}$

C. $\frac{1}{3}$

D. $1\frac{2}{3}$

24. How many 15Gp Christmas cards can be bought with GH¢18.00?

A. 120

B. 150

C. 180

D. 270

25. If $u = \begin{pmatrix} 6 \\ 9 \end{pmatrix}$ and $v = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$, find $u + v$

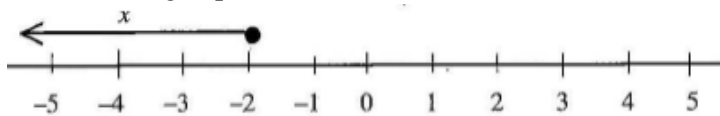
A. $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$

- B. $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$
 C. $\begin{pmatrix} 10 \\ -14 \end{pmatrix}$
 D. $\begin{pmatrix} 10 \\ 4 \end{pmatrix}$

26. If $4956 \times 25 = 123,900$, evaluate 495.6×2.5 leaving the answer in standard form.

- A. 1.239×10^2
 B. 1.239×10^3
 C. 1.239×10^4
 D. 1.239×10^5

27. Which of the following expressions is illustrated on the number line?



- A. $x \leq -2$
 B. $x < -2$
 C. $x \geq -2$
 D. $x > -2$

28. If 180 oranges were shared among Kwame and Ama in the ratio 7:5, respectively, how many oranges did Ama receive?

- A. 45
 B. 60
 C. 75
 D. 90

29. Calculate the simple interest on GH¢ 450.00 for 2 years at 12% per annum.

- A. GH¢ 191.00
 B. GH¢ 108.00
 C. GH¢ 54.00
 D. GH¢ 27.00

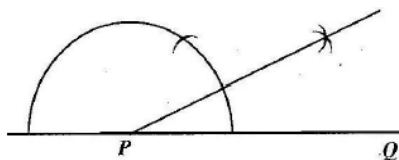
30. If 15% of the length of a rope is 75 cm, find half of the length of the rope.

- A. 500 cm
 B. 250 cm
 C. 150 cm
 D. 100 cm

31. In an office, $\frac{2}{3}$ of the telephone bill is paid by Tom, by $\frac{1}{5}$ by Azuma and the remaining by Tina. What fraction is paid by Tina?

- A. $\frac{2}{15}$
 B. $\frac{1}{4}$
 C. $\frac{1}{3}$
 D. $\frac{7}{15}$

32.



NOT DRAWN TO SCALE

Which of the following best describes the construction?

- A. Constructing a perpendicular at P
- B. Constructing the bisector of line PQ
- C. Constructing an angle of 30° at P
- D. Constructing an angle of 45° at P

33. Express 0.055 as a common fraction

- A. $\frac{11}{40}$
- B. $\frac{5}{18}$
- C. $\frac{1}{40}$
- D. $\frac{11}{200}$

The table below shows the distribution of workers in some trades

| Trade | Shoe making | Mining | Road transport | Agriculture | Manufacturing goods |
|-------------------|-------------|--------|----------------|-------------|---------------------|
| Number of workers | 300,000 | 25,000 | 160,000 | 225,000 | 165,000 |

Use this information to answer Questions 34 and 35

34. Which trade employed the most number of workers?

- A. Agriculture
- B. Manufacturing goods
- C. Shoe making
- D. Road transport

35. How many people are employed under all the trades?

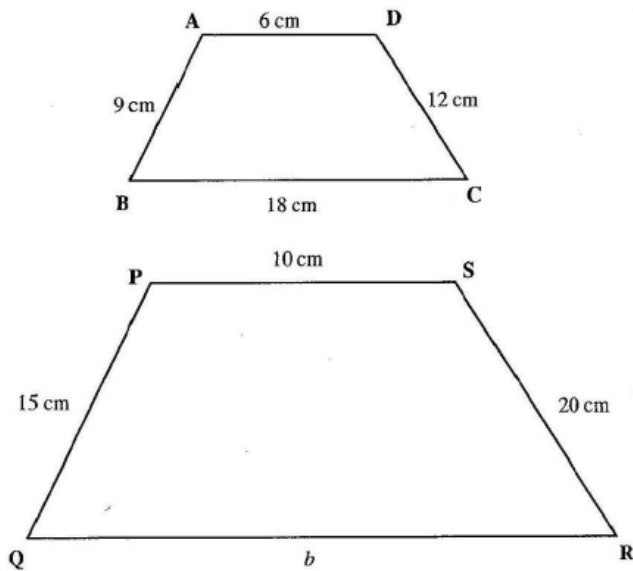
- A. 325,000
- B. 485,000
- C. 650,000
- D. 875,000

36. Aba bought a carton of fish at GH¢ 80.00 and sold it at a profit of GH¢ 13.60. Find the selling price.

- A. GH¢ 66.40
- B. GH¢ 93.60

- C. GH¢ 103.60
- D. GH¢ 144.00

37.



If the two figures ABCD and PQRS are similar, find the value of b .

- A. 60 cm
 - B. 40 cm
 - C. 33 cm
 - D. 30 cm
38. A man shared an amount of money between his two children, Esi and Ato in the ratio 2:3 respectively. If Ato received GH¢ 45.00, what was the total amount shared?
- A. GH¢ 18.00
 - B. GH¢ 27.50
 - C. GH¢ 75.00
 - D. GH¢ 112.50
39. How many edges has a cuboid?
- A. 16
 - B. 12
 - C. 8
 - D. 4
40. Two sets whose intersection is an empty set are
- A. disjoint sets
 - B. equivalent sets
 - C. finite sets
 - D. empty sets

June 2013

MATHEMATICS 1

Objective Test

SOLUTIONS

1. D. {5, 10, 15, 20, 25, 125, 625}
2. C. 125%
3. A. 0.03, 0.3, 0.301, 0.33
4. B. 45
5. A. 0
6. C. 284
7. A. $\frac{1}{12}$
8. D. 200 litres
9. A. $\frac{4a^2x}{3by}$
10. D. $3x + 2$
11. D. 3
12. C. 10cm
13. C. $d = \frac{n-3}{2}$
14. B. $\frac{2}{5}$
15. B. 50°
16. D. 100°
17. C. $\frac{1}{2}$
18. B. $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$
19. A. $(x - 3)(2y + 7)$
20. A. 14 cm
21. B. 4.96 km
22. C. 15 m
23. B. $-\frac{1}{3}$
24. A. 120
25. D. $\begin{pmatrix} 10 \\ 4 \end{pmatrix}$
26. B. 1.239×10^3

27. A. $x \leq -2$
28. C. 75
29. B. GHc 108.00
30. B. 250 cm
31. A. $\frac{2}{15}$
32. C. Constructing an angle of 30° at P
33. D. $\frac{11}{200}$
34. C. Shoe making
35. D. 875,000
36. B. GHS 93.60
37. D. 30 cm
38. C. GHS 75.00
39. B. 12
40. A. disjoint sets

June 2013

MATHEMATICS 2

Essay

1 hour

1. (a) Fifty students in a class took an examination in French and Mathematics. If 14 of them passed French only, 23 passed in both French and Mathematics and 5 of them failed in both subjects, find
- (i) the number of students who passed in French
 - (ii) the probability of selecting a student who passed in Mathematics
- (b) Solve the inequality $2x - 1\frac{1}{2} \geq 5x - 6$
2. (a) Convert 444_{five} to a base two numeral
- (b) A man had three GH¢ 50.00, seven GH¢ 20.00 and five GH¢ 10.00 notes in his pocket. If he bought a bicycle for GH¢ 150.00 and two mobile phones at GH¢ 80.00 each, how many GH¢ 20.00 and GH¢ 10.00 notes did he have left?
3. (a) Using a ruler and a pair of compasses only,
- (i) construct a triangle XYZ with length $|XY| = 7\text{cm}$, length $YZ = 5\text{cm}$ and angle $XYZ = 45^\circ$
 - (ii) Measure and write down the length of XZ
- (b) Given that the circumference of a circle is 44 cm, find
- (i) the radius of the circle
 - (ii) the area of the circle [Take $\pi = \frac{22}{7}$]
4. The table shows the distribution of marks of students in a class test

| | | | | | | |
|-----------|---|---|---|---|---|---|
| Mark | 1 | 2 | 3 | 4 | 5 | 6 |
| Frequency | 5 | 6 | 5 | 3 | 4 | 2 |

- (a) Using a graph sheet, draw a bar chart for the distribution.
- (b) Calculate the mean mark of the distribution correct to the nearest whole number.

5. (a) Simplify $6(3\frac{5}{6} - 1\frac{1}{4})$

- (b) Copy and complete the magic square so that the sum of numbers in each row or column or diagonal is 18

| | | |
|---|---|--|
| | 4 | |
| | | |
| 7 | 8 | |

- (c) Find the sum of all the factors of 24.

(d) Given that $\mathbf{m} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$, $\mathbf{n} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} 18 \\ -6 \end{pmatrix}$, find $\mathbf{m} + \mathbf{n} + \mathbf{r}$

6. (a) Copy and complete the table for the relation $y = 2x + 5$

| | | | | | | | | |
|---|----|----|----|---|---|---|---|----|
| X | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| y | -1 | 1 | | 5 | | | | 13 |

- (b) (i) Using a scale of 2 cm to 2 units on both axes, draw two perpendicular axes OX and OY on a graph sheet.
(ii) Mark the x-axis from -6 to 10 and y-axis from -6 to 14.
(iii) Using the table, plot all the points of the relation $y = 2x + 5$ on the graph.
(iv) Draw a straight line through the points.

- (c) Use the graph to find
(i) y when x = 1.6
(ii) x when y = 10

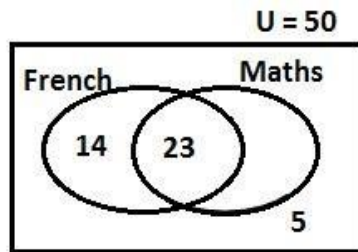
June 2013

MATHEMATICS 2

Objective Test

SOLUTIONS

1. (a) Venn Diagram



(a) (i) Number of students who passed in French (F)

$$= \text{F only} + \text{Both F and M}$$

$$= 14 + 23$$

$$= \underline{37}$$

(a) (ii) Probability of selecting a student who passed in Maths.

Approach 1

$$= \frac{\text{No. of students who passed in Maths}}{\text{Total no. of students}}$$

$$= \frac{50 - (14 + 5)}{50}$$

$$= \frac{50 - 19}{50}$$

$$= \frac{31}{50}$$

(a) (ii) Probability of selecting a student who passed in Maths.

Approach 2

Let m = number of students who passed in Maths only

$$\text{Then } 14 + 23 + m + 5 = 50$$

$$\Rightarrow 14 + 23 + 5 + m = 50$$

$$\Rightarrow 42 + m = 50$$

$$\Rightarrow m = 50 - 42$$

$$m = 8$$

Therefore, the number of students who passed in Maths

$$= 23 + 8 = 31$$

$$\text{Probability} = \frac{\text{No.of students who passed in Maths}}{\text{Total no.of students}}$$

$$= \frac{31}{50}$$

(b) Solving $2x - 1\frac{1}{2} \geq 5x - 6$

Approach 1

$$= 2x - \frac{3}{2} \geq 5x - 6 \quad [\text{Changing } 1\frac{1}{2} \text{ to } 3/2]$$

$$= 6 - \frac{3}{2} \geq 5x - 2x \quad [\text{Grouping like terms}]$$

$$= \frac{6}{1} - \frac{3}{2} \geq 5x - 2x \quad [\text{Expressing 6 as } 6/1]$$

$$= \frac{12-3}{2} \geq 3x \quad [\text{Simplifying}]$$

$$= \frac{9}{2} \geq 3x$$

$$= \frac{9}{2 \times 3} \geq \frac{3x}{3} \quad [\text{Dividing both sides by 3}]$$

$$= \frac{3}{2} \geq x \quad [\text{Simplifying}]$$

$$= x \leq \frac{3}{2} \quad [\text{Rearranging (Turning around)}]$$

$$= x \leq 1\frac{1}{2} \text{ or } 1.5$$

(b) **Approach 2**

$$= 2x - \frac{3}{2} \geq 5x - 6 \quad [\text{Changing } 1\frac{1}{2} \text{ to } 3/2]$$

$$= 2 \times (2x) - 2 \times \frac{3}{2} \geq 2 \times (5x) - 2 \times (6) \quad [\text{Multiplying thro' by 2}]$$

$$= 4x - 3 \geq 10x - 12 \quad [\text{Simplifying}]$$

$$= 4x - 10x \geq 3 - 12 \quad [\text{Grouping like terms}]$$

$$= -6x \geq -9 \quad [\text{Simplifying}]$$

$$= \frac{-6x}{-6} \leq \frac{-9}{-6} \quad [\text{Dividing by } -6 \text{ and changing } \geq \text{ to } \leq]$$

$$= x \leq \frac{3}{2} \quad [\text{Simplifying}]$$

$$= x \leq 1\frac{1}{2} \text{ or } 1.5$$

2. (a) Converting 444 five to base ten

$$\begin{aligned} & (4 \times 5^2) + (4 \times 5^1) + (4 \times 5^0) \\ = & (4 \times 25) + (4 \times 5) + (4 \times 1) \\ = & 100 + 20 + 4 \\ = & \underline{124} \end{aligned}$$

Now, converting 124 to a base 2 numeral

=

| 2 | 124 | Remainder |
|---|-----|-----------|
| | 62 | 0 |
| | 31 | 0 |
| | 15 | 1 |
| | 7 | 1 |
| | 3 | 1 |
| | 1 | 1 |
| | 0 | 1 |



$$= \underline{1111100}_{\text{two}}$$

(b) Amount in man's pocket

$$\begin{aligned} &= 3 \times (\text{GH}¢ 50) + 7 \times (\text{GH}¢ 20) + 5 \times (\text{GH}¢ 10) \\ &= \text{GH}¢ 150 + \text{GH}¢ 140 + \text{GH}¢ 50 \\ &= \text{GH}¢ 340 \end{aligned}$$

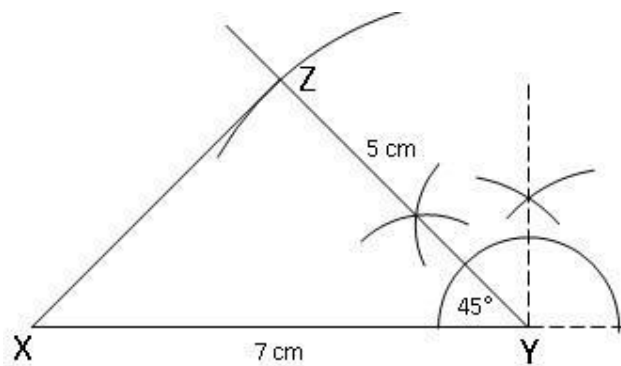
Purchases = 1 bicycle + 2 mobile phones

$$\begin{aligned}
 &= \text{GHC } 150 + 2 \times \text{GHC } 80 \\
 &= \text{GHC } 150 + \text{GHC } 160 \\
 &= \text{GHC } 310
 \end{aligned}$$

$$\begin{aligned}
 \text{Amount left} &= \text{GHC } 340 - \text{GHC } 310 \\
 &= \text{GHC } 30
 \end{aligned}$$

He had one GHC 20.00 and one GHC 10.00 left

3. (a) (i)



$$(ii) \quad |XZ| = 5\text{cm} \quad (\text{or } 5.1\text{cm or } 4.9\text{cm})$$

$$(b) \quad (i) \quad C = 44\text{cm}, \pi = 22/7, \quad r = ?$$

Approach 1

$$C = 2\pi r$$

$$\Rightarrow 44 = 2 \times \frac{22}{7} \times r \quad [\text{Substituting}]$$

$$\Rightarrow 44 \times 7 = 2 \times 22 \times r \quad [\text{Multiplying both sides by 7}]$$

$$\Rightarrow \frac{44 \times 7}{2 \times 22} = \frac{2 \times 22 \times r}{2 \times 22} \quad [\text{Dividing both sides by } 2 \times 22]$$

$$\Rightarrow 7 = r \quad [\text{Simplifying}]$$

$$\Rightarrow \underline{\underline{r = 7\text{cm}}}$$

$$(b) \quad (i) \quad C = 44\text{cm}, \pi = 22/7, \quad r = ?$$

Approach 2

$$C = 2\pi r$$

$$\Rightarrow r = \frac{C}{2\pi} \quad \text{[Making r the subject]}$$

$$\Rightarrow r = \frac{44}{2 \times \frac{22}{7}} \quad \text{[Substituting]}$$

$$\Rightarrow r = \frac{44 \times 7}{2 \times 22} \quad \text{[Simplifying]}$$

$$\Rightarrow r = 7 \text{ cm}$$

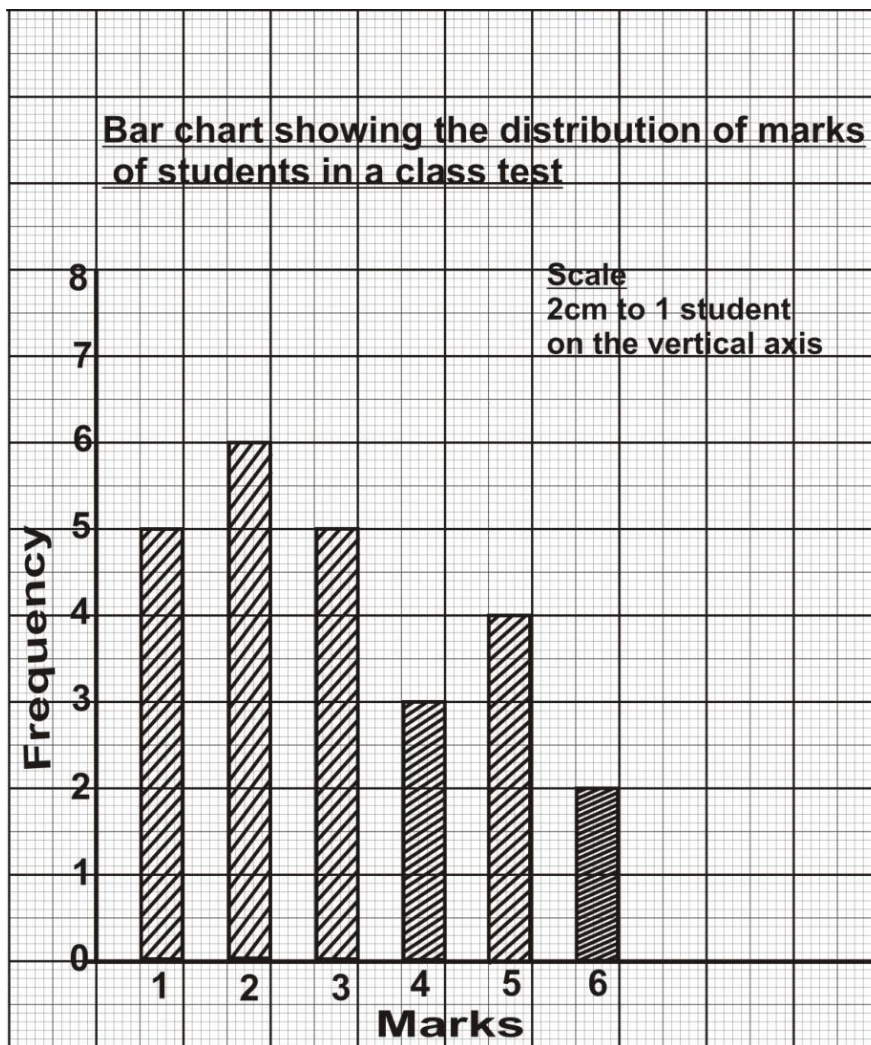
(ii) $\pi = 22/7$, $r = 7$, Area = ?

$$\begin{aligned} \text{Area} &= \pi r^2 \\ &= \frac{22}{7} \times 7^2 \quad \text{[Substituting]} \end{aligned}$$

$$\begin{aligned} &= \frac{22}{7} \times 7 \times 7 \\ &= 22 \times 7 \quad \text{[Simplifying]} \end{aligned}$$

$$= \underline{\underline{154 \text{ cm}^2}}$$

4. (a) Bar chart



(b) Finding the mean (Approach 1)

$$\begin{aligned}
 \text{Mean} &= \frac{(1 \times 5) + (2 \times 6) + (3 \times 5) + (4 \times 3) + (5 \times 4) + (6 \times 2)}{5 + 6 + 5 + 3 + 4 + 2} \\
 &= \frac{5 + 12 + 15 + 12 + 20 + 12}{25} \\
 &= \frac{76}{25} \\
 &= 3\frac{1}{25} \text{ or } 3.04
 \end{aligned}$$

(b) Finding the mean (Approach 2)

| Mark (x) | Frequency (f) | fx |
|-------------|------------------|----|
| 1 | 5 | 5 |
| 2 | 6 | 12 |
| 3 | 5 | 15 |
| 4 | 3 | 12 |

| | | |
|---|-----------------|------------------|
| 5 | 4 | 20 |
| 6 | 2 | 12 |
| | $\Sigma f = 25$ | $\Sigma fx = 76$ |

$$\text{Mean} = \frac{76}{25} = 3\frac{1}{25} \text{ or } 3.04$$

5. (a)

$$\begin{aligned}
 & 6 \left(3\frac{5}{6} - 1\frac{1}{4} \right) \\
 &= 6 \times \left(\frac{23}{6} - \frac{5}{4} \right) \\
 &= 6 \times \left(\frac{2(23) - 3(5)}{12} \right) \\
 &= 6 \times \left(\frac{46 - 15}{12} \right) \\
 &= 6 \times \frac{31}{12} \\
 &= \frac{31}{2} \\
 &= 15\frac{1}{2} \text{ or } 15.5
 \end{aligned}$$

(b) Magic square with magic number 18

| | | |
|---|---|----|
| 9 | 4 | 5 |
| 2 | 6 | 10 |
| 7 | 8 | 3 |

| | | |
|---|---|--|
| NB Horizontal addition: 9+4+5 = 18 2+6+10 = 18 7+8+3 = 18 | NB Vertical addition: 9+2+7 = 18 4+6+8 = 18 5+10+3 = 18 | NB Diagonal addition: 9+6+3 = 18 5+6+7 = 18 |
|---|---|--|

(c) Factors of 24 = { 1, 2, 3, 4, 6, 8, 12, 24 }

$$\begin{aligned}
 \text{Sum of factors} &= 1 + 2 + 3 + 4 + 6 + 8 + 12 + 24 \\
 &= 60
 \end{aligned}$$

NB

$$\begin{aligned}
 1 \times 24 &= 24 \\
 2 \times 12 &= 24 \\
 3 \times 8 &= 24 \\
 4 \times 6 &= 24
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad & \mathbf{m} + \mathbf{n} + \mathbf{r} \\
 = & \begin{pmatrix} 3 \\ -1 \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix} + \begin{pmatrix} 18 \\ -6 \end{pmatrix} \\
 = & \begin{pmatrix} 3 + (-1) + 18 \\ -1 + 2 + (-6) \end{pmatrix} \\
 = & \begin{pmatrix} 3 - 1 + 18 \\ -1 + 2 - 6 \end{pmatrix} \\
 = & \begin{pmatrix} 2 + 18 \\ 1 - 6 \end{pmatrix} \\
 = & \begin{pmatrix} 20 \\ -5 \end{pmatrix}
 \end{aligned}$$

6. (a) **Relation:** $y = 2x - 5$

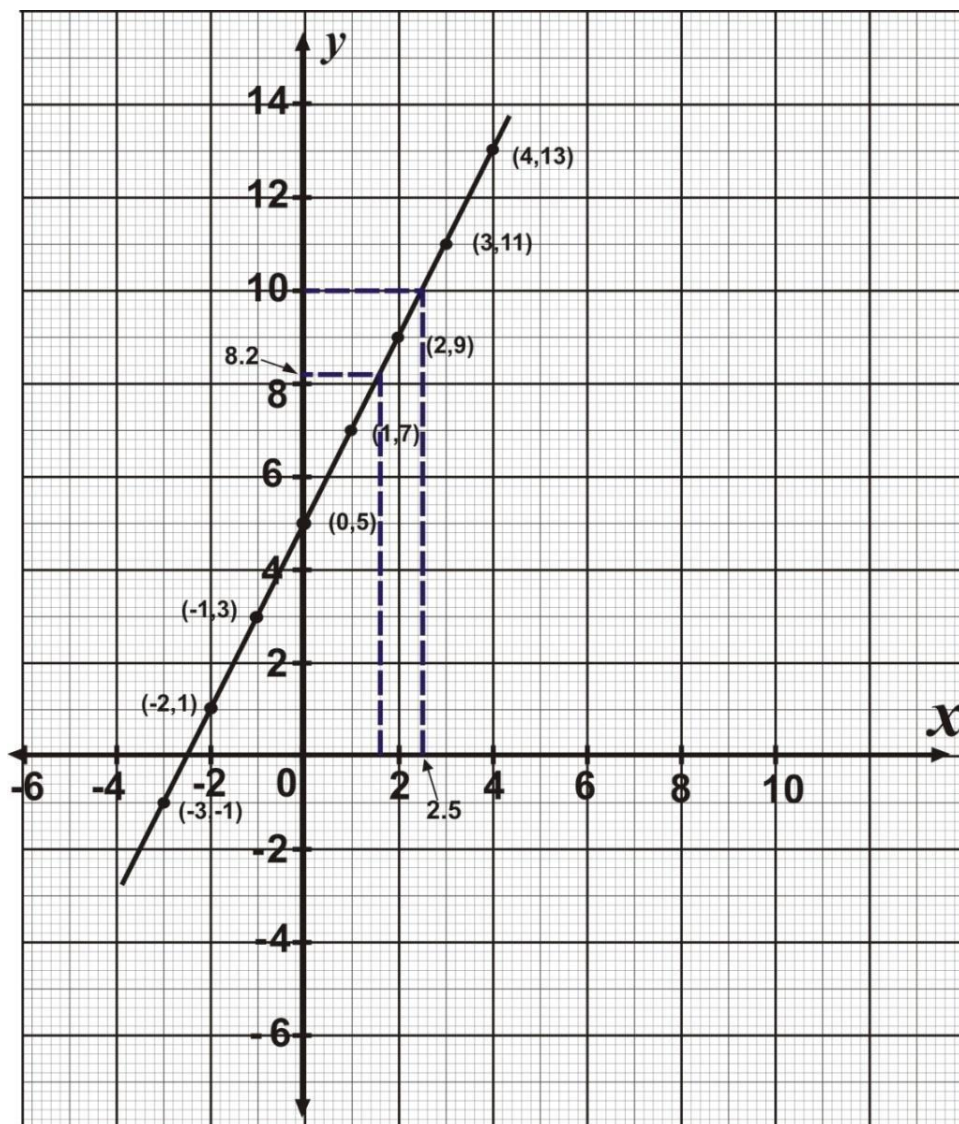
When

$$\begin{array}{llll}
 x = -1, & y = 2(-1) + 5 & \Rightarrow & -2 + 5 = 3 \\
 x = 1, & y = 2(1) + 5 & \Rightarrow & 2 + 5 = 7 \\
 x = 2, & y = 2(2) + 5 & \Rightarrow & 4 + 5 = 9 \\
 x = 3, & y = 2(3) + 5 & \Rightarrow & 6 + 5 = 11
 \end{array}$$

Table of values

| | | | | | | | | |
|---|----|----|----|---|---|---|----|----|
| x | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| y | -1 | 1 | 3 | 5 | 7 | 9 | 11 | 13 |

(b) **Graph of the relation** $y = 2x - 5$



- (c) (i) When $x = 1.6$, $y = 8.2$
(ii) When $y = 10$, $x = 2 \frac{1}{2}$ or 2.5

April 2012

MATHEMATICS 1

Objective Test

1 hour

1. If $P = \{2, 3, 5, 7\}$ and $Q = \{2, 4, 6, 8\}$, find $P \cap Q$
 - A. $\{2\}$
 - B. $\{3\}$
 - C. $\{4\}$
 - D. $\{5\}$
2. Which of the following numbers is an integer?
 - A. $-\frac{5}{4}$
 - B. $-\frac{2}{3}$
 - C. 0.5
 - D. 1
3. Find the Lowest Common Multiple (LCM) of $2^2 \times 3 \times 5^2$ and $2^3 \times 3^2 \times 5$
 - A. $2^2 \times 3 \times 5$
 - B. $2^2 \times 3^3 \times 5^2$
 - C. $2^3 \times 3 \times 5$
 - D. $2^3 \times 3^2 \times 5^2$
4. How many diagonals are in a rectangle?
 - A. 1
 - B. 2
 - C. 3
 - D. 4
5. Simplify $-4(3 - 5) + 10 - 3(7 + 4) + 30$
 - A. -1
 - B. 15
 - C. 56
 - D. 65
6. An iron rod 15 m long is divided into 12 equal parts. How long is each part?
 - A. 0.80 m
 - B. 1.25 m
 - C. 1.50 m

D. 3.00 m

7. Convert 42 to a base two numeral.

A. 1001010_{two}

B. 1010010_{two}

C. 1010100_{two}

D. 101010_{two}

8. Simplify $\frac{5^7 \times 5^4}{5^2}$

A. 5^7

B. 5^8

C. 5^9

D. 5^{13}

9. A tank contains 400 litres of water. If 100 litres is used, what percentage is left?

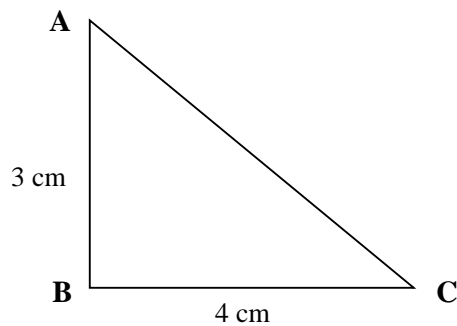
A. 25%

B. 30%

C. 40%

D. 75%

10.



NOT DRAWN TO SCALE

Triangle ABC is a right-angled triangle. Find the length of AC.

A. 1 cm

B. 5 cm

C. 7 cm

D. 12 cm

11. Arrange the following fractions in descending order of magnitude:

$$\frac{2}{3}, \frac{5}{7}, \frac{2}{5}, \frac{1}{2}$$

A. $\frac{5}{7}, \frac{2}{5}, \frac{2}{3}, \frac{1}{2}$

B. $\frac{5}{7}, \frac{2}{3}, \frac{1}{2}, \frac{2}{5}$

C. $\frac{1}{2}, \frac{2}{5}, \frac{5}{7}, \frac{2}{3}$

D. $\frac{1}{2}, \frac{5}{7}, \frac{2}{3}, \frac{2}{5}$

12. Find the image of 3 under the mapping, $x \rightarrow 10 - 2x$

- A. 4
- B. 5
- C. 8
- D. 16

13. Simplify $\frac{1}{3} + \frac{1}{9} + \frac{1}{27}$

- A. $\frac{5}{27}$
- B. $\frac{7}{27}$
- C. $\frac{11}{27}$
- D. $\frac{13}{27}$

14. If $2x = 5(x - 2) + 7$, find the value of x

- A. $-5\frac{2}{3}$
- B. -1
- C. 1
- D. $5\frac{2}{3}$

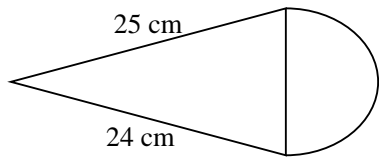
The table below shows the day and night temperatures of a town during a week.
Use it to answer Questions 15 and 16

| Week day | Temperatures (°C) | |
|-----------|-------------------|-------|
| | Day | Night |
| Monday | 33 | 24 |
| Tuesday | 29 | 25 |
| Wednesday | 32 | 23 |
| Thursday | 34 | 26 |
| Friday | 32 | 24 |
| Saturday | 30 | 24 |
| Sunday | 30 | 25 |

15. Find, correct to **one** decimal place, the average day temperature for the week

- A. 24.4 °C
- B. 30.2 °C
- C. 31.4 °C
- D. 32.2 °C

16. On which day was the change in temperature the **least**?
- Monday
 - Saturday
 - Sunday
 - Tuesday
17. A box contains 30 identical balls of which 16 are white and the rest yellow. If a girl picks a ball at random from the box, what is the probability that it is a yellow ball?
- $\frac{1}{16}$
 - $\frac{7}{15}$
 - $\frac{8}{15}$
 - $\frac{7}{8}$
18. Find the truth set of $\frac{1}{4}(x + 3) \leq 2x - 1$
- $\{x: x \leq -3\}$
 - $\{x: x \leq -1\}$
 - $\{x: x \geq 1\}$
 - $\{x: x \geq 3\}$
19. The perimeter of the figure below is 71 cm. Find the diameter of the semi-circular portion.
[Take $= \pi$]



NOT DRAWN TO SCALE

- 1.0 cm
 - 3.5 cm
 - 7.0 cm
 - 14.0 cm
20. Simplify $\frac{3x}{4} - \frac{x-y}{3}$
- $\frac{5x-4y}{12}$
 - $\frac{13x-4y}{12}$
 - $\frac{5x+4y}{12}$
 - $\frac{13x+4y}{12}$
21. Kojo is 20% heavier than Afua. If Kojo weighs 6 kg, what is Afua's weight?
- 4.8 kg

- B. 5.0 kg
- C. 6.0 kg
- D. 7.2 kg

22. Find the volume of a cylinder of height 3 cm and radius 2 cm.

- A. $6\pi \text{ cm}^3$
- B. $12\pi \text{ cm}^3$
- C. $18\pi \text{ cm}^3$
- D. $24\pi \text{ cm}^3$

23. Given the points S(5, -2) and T(3, 2), calculate the gradient of the line ST.

- A. - 2
- B. $-\frac{3}{5}$
- C. $\frac{1}{2}$
- D. 2

24. Kofi invested GH¢ 150,000 at 2.5% per annum simple interest. How long will it take this amount to yield an interest of GH¢11,250.00?

- A. 2 years
- B. 3 years
- C. 4 years
- D. 5 years

25. Express 3.75 as a mixed fraction.

- A. $3\frac{1}{5}$
- B. $3\frac{1}{4}$
- C. $3\frac{1}{3}$
- D. $3\frac{3}{4}$

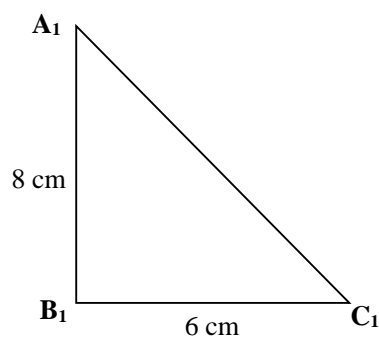
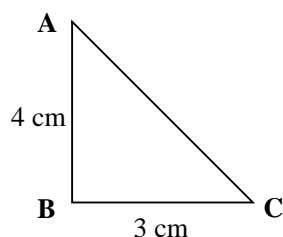
26. A map is drawn to the scale 1:100,000. What distance in kilometres is represented by 5 cm on the map?

- A. 0.5 km
- B. 5.0 km
- C. 50.0 km
- D. 500.0 km

27. Given that $\mathbf{r} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$ and $\mathbf{s} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$, find $\mathbf{r} - 2\mathbf{s}$

- A. $\begin{pmatrix} -5 \\ 1 \end{pmatrix}$
- B. $\begin{pmatrix} -5 \\ 10 \end{pmatrix}$
- C. $\begin{pmatrix} -2 \\ 10 \end{pmatrix}$
- D. $\begin{pmatrix} -1 \\ 10 \end{pmatrix}$

28. Esi went to the market and bought 500 g of meat, 850 g of fish and 900 g of eggs. What is the total weight of the items she bought in kilograms?
- A. 2.20 kg
B. 2.25 kg
C. 2.35 kg
D. 22.50 kg
29. A watch gains $1\frac{1}{2}$ minutes per hour. What is the total time gained from 12 noon to 12 midnight in a day?
- A. 9 minutes
B. 15 minutes
C. 18 minutes
D. 36 minutes
30. A printing machine prints 600 books in 3 hours. How many books will the machine print in 5 hours?
- A. 360 books
B. 1000 books
C. 1800 books
D. 3000 books
31. The bearing of Atoru from Busase is 275° . What is the bearing of Busase from Atoru?
- A. 180°
B. 175°
C. 095°
D. 075°
32. In a class of 24 pupils, 10 study French only and 8 study English only. If each pupil studies at least one of the two subjects, how many study English?
- A. 12
B. 14
C. 16
D. 18
33. Convert 84 to a base five numeral.
- A. 4130_{five}
B. 3014_{five}
C. 314_{five}
D. 114_{five}
34. In the diagrams below, triangle $A_1B_1C_1$ is an enlargement of triangle ABC. Determine the scale factor.



NOT DRAWN TO SCALE

- A. 0.50
- B. 0.75
- C. 2.00
- D. 4.00

35. Find the least number that must be added to 308 to make it divisible by 19.

- A. 4
- B. 7
- C. 15
- D. 18

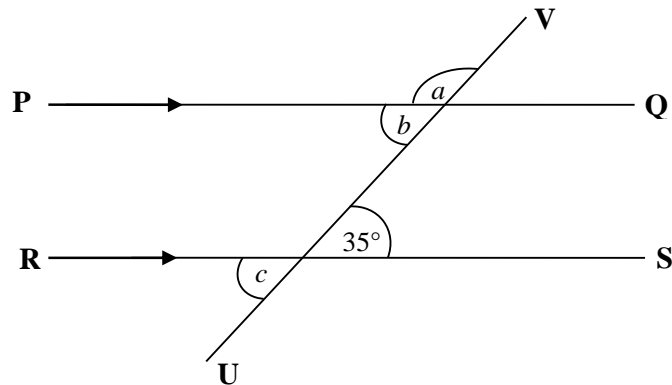
36. In a school of 940 pupils, the number of girls exceeds the number of boys by 150. How many girls are there in the school?

- A. 620
- B. 545
- C. 470
- D. 395

37. Which of the following fractions is equivalent to $\frac{3}{5}$?

- A. $\frac{21}{30}$
- B. $\frac{12}{20}$
- C. $\frac{15}{45}$
- D. $\frac{6}{15}$

In the diagram below, line PQ is parallel to RS and UV is a line drawn through PQ and RS.
Use the diagram to answer Questions 38 and 39.



NOT DRAWN TO SCALE

38. Find angle a .

- A. 35°
- B. 55°
- C. 135°

D. 145°

39. Angle b and angle c are

- A. alternate angles
- B. vertically opposite angles
- C. corresponding angles
- D. interior opposite angles

40. Expand $-x(3 - 2x)$

- A. $-2x^2 - 3x$
- B. $2x^2 - 3x$
- C. $-2x^2 + 3x$
- D. $2x^2 + 3x$

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MATHEMATICS 1

OBJECTIVE TEST

SOLUTIONS

1. A. $\{2\}$
2. D. 1
3. D. $2^3 \times 3^2 \times 5^2$
4. B. 2
5. B. 15
6. B. 1.25 m
7. D. 101010_{two}
8. C. 5^9
9. D. 75%
10. B. 5 cm
11. B. $\frac{5}{7}, \frac{2}{3}, \frac{1}{2}, \frac{2}{5}$
12. A. 4
13. D. $\frac{13}{27}$
14. C. 1
15. C. 31.4 °C
16. D. Tuesday
17. B. $\frac{7}{15}$
18. C. $\{x: x \geq 1\}$
19. D. 14.0 cm

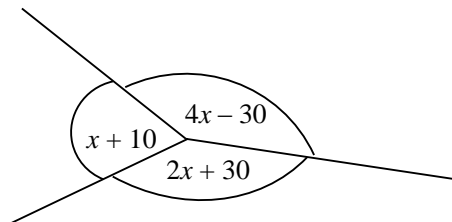
20. C. $\frac{5x+4y}{12}$
21. B. 5.0 kg
22. B. $12\pi \text{ cm}^3$
23. A. - 2
24. B. 3 years
25. D. $3\frac{3}{4}$
26. B. 5.0 km
27. B. $\begin{pmatrix} -5 \\ 10 \end{pmatrix}$
28. B. 2.25 kg
29. C. 18 minutes
30. B. 1000 books
31. C. 095°
32. B. 14
33. C. 314_{five}
34. C. 2.00
35. C. 15
36. B. 545
37. B. $\frac{12}{20}$
38. D. 145°
39. C. corresponding angles
40. B. $2x^2 - 3x$

April 2012

MATHEMATICS 2

Essay 1 hour

1. (a) Evaluate $\frac{0.035 \times 1.02}{0.00015}$, leaving the answer in standard form.
- (b) An amount of GH¢4,200.00 was shared between Aba and Kwame. If Aba had $\frac{5}{7}$ of the amount,
- (i) how much did Kwame receive?
- (ii) what percentage of Aba's share did Kwame receive?
- (c) Find the value of x in the diagram below.



2. (a) A car consumes a gallon of petrol for every 30 km drive. The driver of the car set out on a journey of 420 km with 10 gallons of petrol in the fuel tank.
- (i) How many more gallons of petrol will be needed to complete the journey?
- (ii) Find the cost of the petrol used for the journey of 420 km if a gallon of petrol costs GH¢5.50
- (b) The average number of spectators at a football competition for the first five days was 3,144. The attendance on the sixth day was 3,990. Find the
- (i) The total attendance on the first five days
- (i) The average attendance for the 6 days
- (c) The area enclosed by a square garden is 121 m^2 . What is the distance around the garden?

3. (a) The table below shows the number of students who scored more than 80% in the listed subjects

| Subject | Number of students |
|-----------|--------------------|
| Biology | 26 |
| Physics | 30 |
| Chemistry | 32 |
| French | 38 |
| Geography | 24 |
| History | 30 |

- (i) Draw a pie chart for the distribution
(ii) What is the probability that a student chosen at random from the distribution offers Chemistry?
- (b) A woman bought 210 oranges for GH¢7.50. She sold all of them at 3 for 15 Gp. Find the
(i) total selling price of the oranges
(ii) percentage profit

4. The marks scored by some students in a Mathematics test are as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | 5 | 6 | 3 | 4 | 7 | 8 | 3 | 4 |
| 5 | 4 | 7 | 4 | 3 | 7 | 4 | 6 | 4 | 8 |
| 4 | 5 | 6 | 3 | 8 | 4 | 5 | 6 | 4 | 5 |

- (a) Construct a frequency distribution table for the scores.
- (b) Using the table, find for the distribution, the
(i) mode;
(ii) mean, correct to one decimal place
(iii) median

5. (a) (i) Find the least Common Multiple (L.C.M.) of 9, 18 and 16.
(ii) Arrange $\frac{8}{9}$, $\frac{7}{18}$ and $\frac{10}{16}$ in **ascending** order of magnitude
- (b) Using a ruler and a pair of compasses only,
(i) construct a triangle PQR with length $PQ = 10$ cm, angles $QPR = 45^\circ$ and $PQR = 60^\circ$.
(ii) Construct the perpendicular bisectors of PR and RQ to meet at T .
(iii) Measure the length of TP .

6. (a) (i) Using a scale of 2 cm to 1 unit on both axes, draw two perpendicular axes Ox and Oy on a graph sheet.
- (ii) Mark on the same graph sheet, the x -axis from -5 to 5 and y -axis from -6 to 6.
- (iii) Plot the points $P(4, 2)$, $Q(2, 5)$ and $R(2, 2)$. Join the points P , Q , R to form a triangle PQR
- (iv) Using the x -axis as a mirror line, draw the image $P_1Q_1R_1$ of the triangle PQR such that $P \rightarrow P_1$, $Q \rightarrow Q_1$, $R \rightarrow R_1$
- (v) Write down the coordinates of P_1 , Q_1 and R_1 .
- (vi) Translate triangle PQR by the vector $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$ such that $P \rightarrow P_2$, $Q \rightarrow Q_2$, $R \rightarrow R_2$
- (vii) Label the vertices of triangle $P_2Q_2R_2$

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MATHEMATICS 2

OBJECTIVE TEST

SOLUTIONS

1. (a)
$$\frac{0.035 \times 1.02}{0.00015}$$

Method 1 (Converting to common fractions)

$$\begin{aligned} & \frac{0.035 \times 1.02}{0.00015} \\ = & (0.035 \times 1.02) \div 0.00015 \\ = & \left(\frac{35}{1000} \times \frac{102}{100} \right) \div \frac{15}{100000} \\ = & \left(\frac{35}{1000} \times \frac{102}{100} \right) \times \left(\frac{100000}{15} \right) \\ = & \frac{35 \times 102}{15} \\ = & \frac{7 \times 34}{1} \\ = & 238 = \underline{\underline{2.38 \times 10^2}} \end{aligned}$$

NB:
 $\frac{x}{d} = x \div d$

Eg,
 $\frac{12}{3} = 12 \div 3$

1. (a)
$$\frac{0.035 \times 1.02}{0.00015}$$

Method 2 (Converting to whole numbers)

Multiplying both numerator and denominator by 100000
(to convert to whole numbers)

$$\frac{0.035 \times 1.02}{0.00015} \times \frac{100000}{100000}$$

NB
Multiplying by 100,000 shifts the decimal point 5 places to the right (in both numerator and denominator)

$$\begin{aligned}
 &= \frac{35 \times 102}{15} \\
 &= \frac{7 \times 34}{1} \\
 &= 238 \\
 &= \underline{\underline{2.38 \times 10^2}}
 \end{aligned}$$

1. (b) (i) Method 1

$$\begin{aligned}
 \text{Aba's share} &= \frac{5}{7} \text{ of the amount,} \\
 &= \frac{5}{7} \times \text{GHc } 4,200 \\
 &= 5 \times \text{GHc } 600 \\
 &= \text{GHc } 3,000
 \end{aligned}$$

NB:
7 divides ('goes into') 4,200
to give 600

$$\begin{aligned}
 \text{Therefore Kwame's share} &= \text{GHc } 4,200 - \text{GHc } 3,000 \\
 &= \underline{\underline{\text{GHc } 1,200}}
 \end{aligned}$$

(i) Method 2

$$\text{Kwame's fraction} = \frac{7}{7} - \frac{5}{7} = \frac{2}{7}$$

$$\begin{aligned}
 \text{Therefore Kwame's share} &= \frac{2}{7} \times \text{GHc } 4,200 \\
 &= 2 \times \text{GHc } 600 \\
 &= \underline{\underline{\text{GHc } 1,200}}
 \end{aligned}$$

(ii) Percentage of Aba's share that Kwame received

$$\begin{aligned}
 &= \frac{\text{Kwame's share}}{\text{Aba's share}} \times 100\% \\
 &= \frac{1200}{3000} \times 100\% \\
 &= \underline{\underline{40\%}}
 \end{aligned}$$

1.(c)

$$\begin{aligned}
 (4x - 30^\circ) + (2x + 30^\circ) + (x + 10^\circ) &= 360^\circ \\
 4x + 2x + x - 30^\circ + 30^\circ + 10^\circ &= 360^\circ \\
 7x + 10^\circ &= 360^\circ \\
 7x &= 360^\circ - 10^\circ \\
 7x &= 350^\circ
 \end{aligned}$$

NB:
One complete revolution
(circle) = 360°

$$\frac{7x}{7} = \frac{350^\circ}{7}$$

$$\underline{\underline{x = 50^\circ}}$$

2. (a) (i) Let g = no. of gallons needed for the entire journey

Approach 1 (Equivalent Fractions)

| | Distance (km) | Petrol (Gallon) |
|--------------------|---------------|-----------------|
| | 30 | 1 |
| The entire journey | 420 | g |

From the table above, $\frac{30}{420} = \frac{1}{g}$

Cross multiplying, we have $30 \times g = 1 \times 420$

$$\Rightarrow \frac{30g}{30} = \frac{1 \times 420}{30}$$

$$\Rightarrow g = 14$$

Amount needed for the entire journey = 14 gallons

He already has 10 gallons; therefore he needs **4 gallons more**

2. (a) (i)

Approach 2 (The rule: If more, less divides ...)

If 30 km \rightarrow 1

Then 420 km \rightarrow ? (more)

If more, less (i.e., 30) divides; \therefore we have

$$\frac{420}{30} \times 1 = \underline{\underline{14}}$$

Amount needed for the entire journey = 14 gallons

He already has 10 gallons, therefore he needs **4 gallons more**

2. (a) (i)

Approach 3 (Equivalent ratios)

$$30 : 1 = 420 : g$$

$$\Rightarrow \frac{30}{1} = \frac{420}{g}$$

$$\Rightarrow 30 \times g = 420 \times 1$$

$$\Rightarrow \frac{30 \times g}{30} = \frac{420 \times 1}{30}$$

$$\Rightarrow g = 14$$

Amount needed for the entire journey = 14 gallons

He already has 10 gallons, therefore he needs **4 gallons more**

2. (a) (ii) Let THE COST OF PETROL USED FOR THE JOURNEY = **c**

Approach 1 (Common Logic)

If 1 gallon \rightarrow GHc 5.50

Then 14 gallons $\rightarrow 14 \times \text{GHc } 5.50 = \underline{\text{GHc } 77.00}$

Approach 2 (Equivalent Fractions)

| | | |
|--------------------|-----------------------------|-------------------|
| | Petrol (gallons) | Cost (GH¢) |
| | 1 | 5.50 |
| The entire journey | 14 | c |

From the table above, $\frac{1}{14} = \frac{5.50}{c}$

Cross multiplying, we have $1 \times c = 5.50 \times 14$

$$\Rightarrow c = 77$$

Cost of petrol needed for the journey = **GHC 77.00**

2. (b) (i)

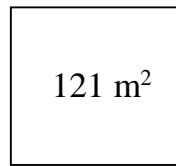
| | | |
|-------------------------------------|---|--------------------------------|
| Total attendance on first five days | = | $5 \times$ average attendance |
| | = | 5×3144 |
| | = | <u>15720 spectators</u> |

$$\begin{aligned} \text{(ii) Average attendance for the 6 days} &= \frac{\text{Total attendance for the 6 days}}{\text{No. of days}} \\ &= \frac{15720 + 3990}{6} \end{aligned}$$

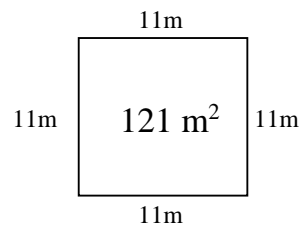
$$= \frac{19710}{6}$$

$$= \underline{\underline{3285 \text{ spectators}}}$$

2. (c)



$$\begin{aligned} \text{Area of the square} &= 121\text{m}^2 \\ L \times L &= 121\text{m}^2 \\ L^2 &= 121\text{m}^2 \\ L &= \sqrt{121\text{m}^2} \\ L &= 11 \text{ m} \end{aligned}$$

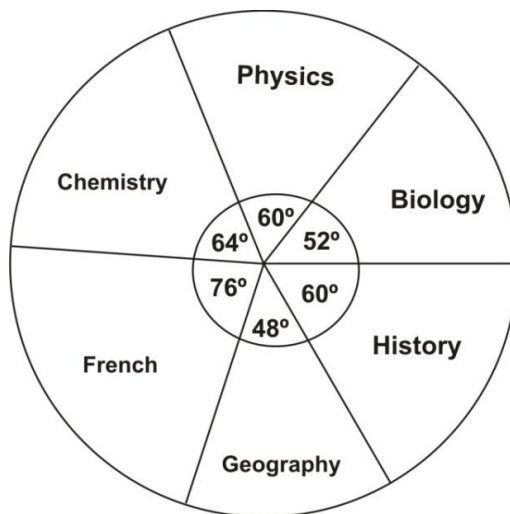


$$\begin{aligned} \text{The distance around the garden (perimeter)} &= 4 \times 11 \text{ m} \\ &= \underline{\underline{44 \text{ m}}} \end{aligned}$$

3. (a) (i)

| Subject | No. of students | Angle of sector |
|--------------|-----------------|--|
| Biology | 26 | $\frac{26}{180} \times 360^\circ = 52^\circ$ |
| Physics | 30 | $\frac{30}{180} \times 360^\circ = 60^\circ$ |
| Chemistry | 32 | $\frac{32}{180} \times 360^\circ = 64^\circ$ |
| French | 38 | $\frac{38}{180} \times 360^\circ = 76^\circ$ |
| Geography | 24 | $\frac{24}{180} \times 360^\circ = 48^\circ$ |
| History | 30 | $\frac{30}{180} \times 360^\circ = 48^\circ$ |
| TOTAL | 180 | 360° |

Pie chart showing the number of students who scored more than 80% in the listed subjects



3 (a) (ii)

$$\begin{aligned} \text{Probability} &= \frac{\text{No. of students who offer Chemistry}}{\text{Total no.}} \\ &= \frac{32}{180} \\ &= \frac{8}{45} \end{aligned}$$

Approach 2 (using angle of sector)

$$\begin{aligned} \text{Probability} &= \frac{\text{Angle for Chemistry}}{\text{Total Angle.}} \\ &= \frac{64^\circ}{360^\circ} \\ &= \frac{8}{45} \end{aligned}$$

3 (b) (i)

Approach 1 (Unitary Approach – the value of one item)

If 3 oranges sell for 15 Gp,

then 1 orange sells for $\frac{15}{3} = 5 \text{ Gp}$

hence, 210 oranges would sell for $210 \times 5 \text{ Gp}$

$= 1050 \text{ Gp} = \underline{\underline{\text{GHc } 10.50}}$

Approach 2 (Equivalent Fractions)

| No. of oranges | SP (in Gp) |
|----------------|------------|
| 3 | 15 |
| 210 | y |

From the table above, $\frac{3}{210} = \frac{15}{y}$

Cross multiplying, we have $3 \times y = 15 \times 210$

$$\Rightarrow \frac{3y}{3} = \frac{15 \times 210}{3}$$

$$\Rightarrow y = 5 \times 210$$

$$\Rightarrow y = 1050 \text{ Gp} \\ = \underline{\underline{\text{GHc } 10.50}}$$

Approach 3 (The rule: If more, less divides ...)

If 3 \rightarrow 15 Gp

Then 210 \rightarrow ? (more)

If more, less (i.e., 4) divides; \therefore we have

$$\begin{aligned} \frac{210}{3} \times 15 \text{ Gp} &\Rightarrow 70 \times 15 \text{ Gp} \\ &= \underline{\underline{1050 \text{ Gp}}} = \underline{\underline{\text{GHc } 10.50}} \end{aligned}$$

Approach 4 (Equivalent ratios)

$$\begin{aligned} 3 : 15 &= 210 : y \\ \Rightarrow \frac{3y}{3} &= \frac{15 \times 210}{3} \\ &= \underline{\underline{1050 \text{ Gp}}} = \underline{\underline{\text{GHc } 10.50}} \end{aligned}$$

$$\begin{aligned} \text{3. (b) (ii) Profit} &= \text{Total SP} - \text{Total CP} \\ &= \text{GHc } 10.50 - \text{GHc } 7.50 \\ &= \text{GHc } 3.00 \end{aligned}$$

$$\begin{aligned} \text{Percentage Profit} &= \frac{\text{Profit}}{\text{CP}} \times 100\% \\ &= \frac{3}{7.50} \times 100\% \end{aligned}$$

$$\begin{aligned}
 &= \frac{300}{7.50} \% = \frac{3000}{75} \% \\
 &= \underline{\underline{40\%}}
 \end{aligned}$$

4. (a) Frequency distribution table

| Mark (x) | Tally | Frequency (f) |
|----------|----------|---------------|
| 3 | ### / | 6 |
| 4 | ### //// | 9 |
| 5 | ### | 5 |
| 6 | //// | 4 |
| 7 | /// | 3 |
| 8 | /// | 3 |

4. (b) (i) Mode = The mark with the highest frequency = 4

(ii) Mean

| Mark (x) | Tally | Frequency (f) | fx |
|----------|----------|-----------------|-------------------|
| 3 | ### / | 6 | 18 |
| 4 | ### //// | 9 | 36 |
| 5 | ### | 5 | 25 |
| 6 | //// | 4 | 24 |
| 7 | /// | 3 | 21 |
| 8 | /// | 3 | 24 |
| | | $\Sigma f = 30$ | $\Sigma fx = 148$ |

$$\text{The mean mark} = \frac{\Sigma f x}{\Sigma f} = \frac{148}{30}$$

$$\underline{\underline{\text{Mean}}} = \underline{\underline{4.9}} \quad (\text{correct to 1 d.p.})$$

4.(b) (iii) Median

Approach 1

Listing all the given marks in ascending order, we have

3,3,3,3,3,3, 4,4,4,4,4,4,4, **4, 5**, 5,5,5,5, 6,6,6,6, 7,7,7, 8,8,8

The middle marks are 4 and 5

$$\therefore \text{The median} = \frac{4 + 5}{2} = \frac{9}{2} = \underline{\underline{4.5 \text{ or } 4}}$$

Approach 2

The median

= the mark at the $\frac{1}{2}(\Sigma f + 1)$ th position

\Rightarrow the $\frac{1}{2}(30 + 1)$ th position

= $\frac{1}{2}(31)$ = $15\frac{1}{2}$ th position

The mark at the $15\frac{1}{2}$ th position

= the average of the marks at the 15th and 16th positions

$$= \frac{4 + 5}{2} = \frac{9}{2} = \underline{\underline{4.5 \text{ or } 4}}$$

5. (a) (i) LCM of 9, 18 and 16

Approach 1 (Successive division by prime factors)

| | | | |
|---|---|----|----|
| 2 | 9 | 18 | 16 |
| 2 | 9 | 9 | 8 |
| 2 | 9 | 9 | 4 |
| 2 | 9 | 9 | 2 |
| 3 | 9 | 9 | 1 |
| 3 | 3 | 3 | 1 |
| | 1 | 1 | 1 |

NB

2 cannot divide ('go into') 9 without a remainder, therefore, 9 is repeated.

2 'into' 18 = 9,

2 'into' 16 = 8

The process is repeated till we obtain 1 for all.

$$\begin{aligned} \text{The LCM} &= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \\ &= 16 \times 9 = \underline{\underline{144}} \end{aligned}$$

(a) (i) Approach 2 (Listing multiples)

$$9 = \{9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99, 108, 117, 126, 135, \underline{144}, \dots\}$$

$$18 = \{18, 36, 54, 72, 90, 108, 126, \underline{144}, \dots\}$$

$$16 = \{16, 32, 48, 64, 80, 96, 112, 128, \underline{144}, \dots\}$$

Hence the Least Common Multiple (LCM) = 144

5. (a) (ii) $\frac{8}{9}, \frac{7}{18}$ and $\frac{10}{16}$ in ascending order of magnitude

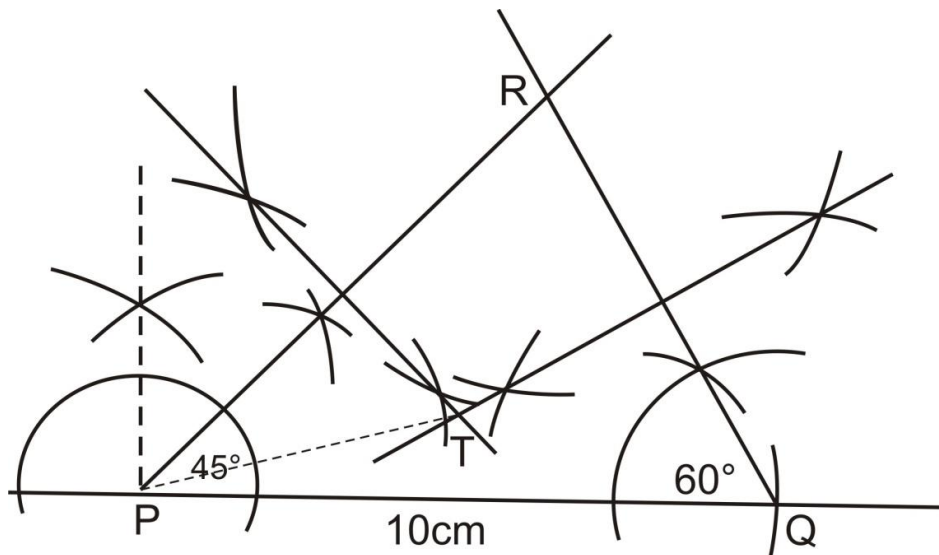
$$= \frac{8}{9}, \frac{7}{18}, \frac{10}{16}$$

$$= \frac{16(8), 8(7), 9(10)}{144}$$

$$= \frac{128, 56, 90}{144}$$

Therefore in ascending order, we have $\frac{7}{18}, \frac{10}{16}, \frac{8}{9}$

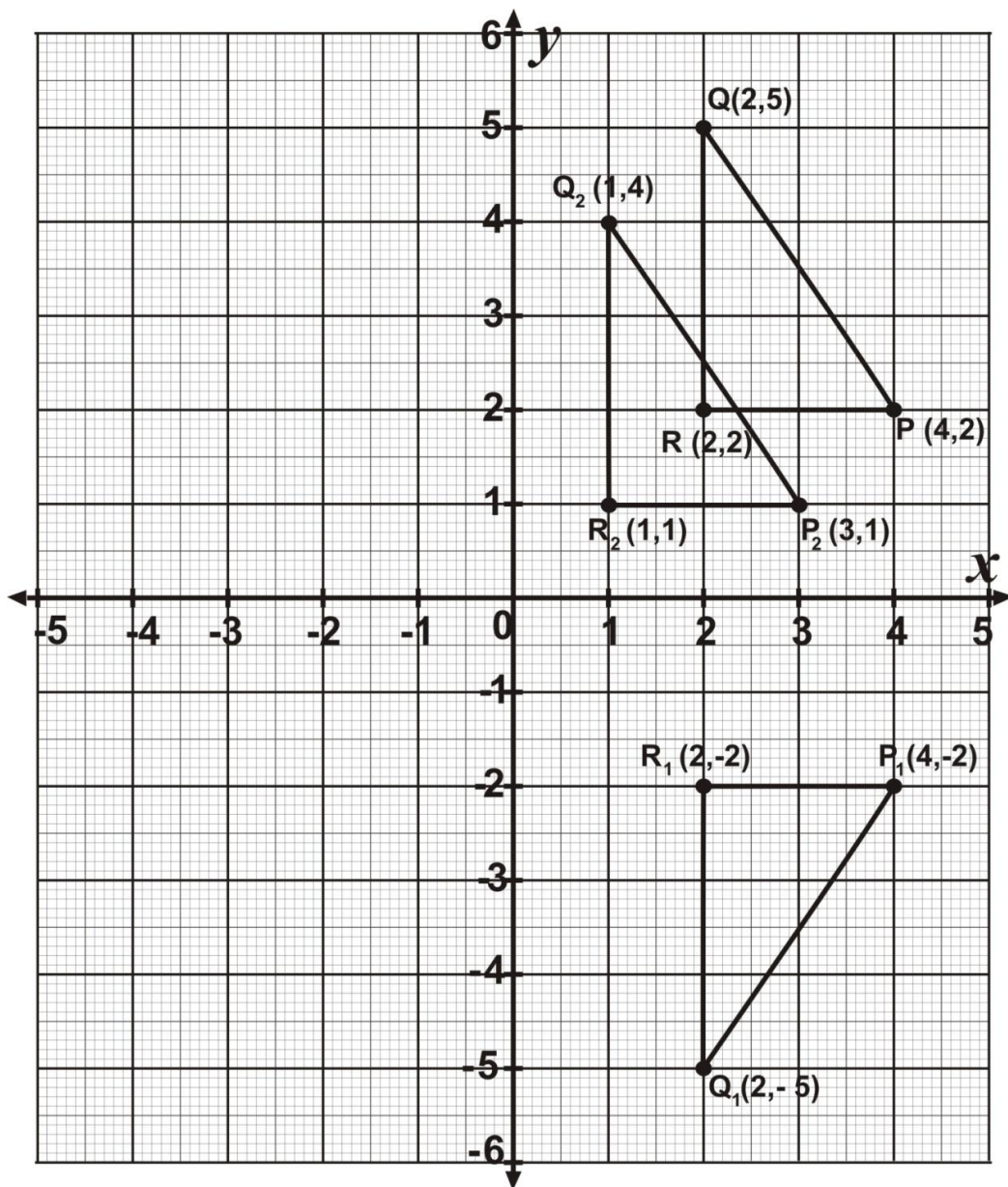
5. (b) (i), (ii)



The length of TP = 5.2 cm (approx.)

6. (a)

Approach 1 [\(By Inspection / Construction\)](#)



Approach 2 (The rule / formula)

(a) (iv) Reflecting (x, y) in the x-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x \\ -y \end{pmatrix}$$

$$\Rightarrow OP \begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OP_1 \begin{pmatrix} 4 \\ -2 \end{pmatrix}, \quad \therefore P_1(4, -2)$$

$$\Rightarrow OQ \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OQ_1 \begin{pmatrix} 2 \\ -5 \end{pmatrix}, \quad \therefore Q_1(2, -5)$$

$$\Rightarrow OR \begin{pmatrix} 2 \\ 2 \end{pmatrix} \rightarrow OR_1 \begin{pmatrix} 2 \\ -2 \end{pmatrix}, \quad \therefore R_1(2, -2)$$

- ∴ Plot and join $P_1(4, -2)$, $Q_1(2, -5)$ and $C_1(2, -2)$ as the image of triangle PQR under a reflection in the x- axis
(as shown in the diagram above)

(a) (vi) Translating PQR by vector $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$

Translating (x, y) by vector $\begin{pmatrix} a \\ b \end{pmatrix}$

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x + a \\ y + b \end{pmatrix}$$

$$OP \begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OP_2 \begin{pmatrix} 4 + -1 \\ 2 + -1 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}, \quad \therefore P_2(3, 1)$$

$$OQ \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OQ_2 \begin{pmatrix} 2 + -1 \\ 5 + -1 \end{pmatrix} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}, \quad \therefore Q_2(1, 4)$$

$$OR \begin{pmatrix} 2 \\ 2 \end{pmatrix} \rightarrow OR_2 \begin{pmatrix} 2 + -1 \\ 2 + -1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \quad \therefore R_2(1, 1)$$

- ∴ Plot and join $P_2(3, 1)$, $Q_2(1, 4)$ and $R_2(1, 1)$ as the image of triangle PQR under a translation by vector $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$

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MATHEMATICS 1

OBJECTIVE TEST

1 hour

1. Which of the following is the set of prime factors of 12?
A. $\{2, 3\}$
B. $\{1, 2, 3\}$
C. $\{1, 2, 4, 6\}$
D. $\{2, 3, 4, 6\}$
2. Expand $3a(a - 4b)$
A. $3a - 12ab$
B. $3a^2 - 12ab$
C. $3a^2 - 12b$
D. $3a^2 - 12a$
3. Express 5 as a percentage of 4
A. 125%
B. 120%
C. 25%
D. 20%
4. Express 2700 as a product of prime numbers.
A. $2^2 \times 3^2 \times 5^2$
B. $2 \times 3^3 \times 5^2$
C. $2^2 \times 3^3 \times 5^2$
D. $2 \times 3^2 \times 5^3$
5. The ratio of mangoes to oranges in a basket is 3:2. If there are 36 mangoes, how many oranges are in the basket?
A. 90
B. 60
C. 24
D. 12
6. Express 0.125 as a fraction in its lowest form.
A. $\frac{1}{8}$
B. $\frac{1}{9}$
C. $\frac{1}{12}$

D. $\frac{1}{16}$

7. Convert 222_{five} to a number in base ten.

- A. 30
- B. 52
- C. 60
- D. 62

8. If $A = \{18, 19, 20\}$ and $B = \{15, 16, 17\}$, find $A \cap B$

- A. $\{15, 16, 17, 18, 19, 20\}$
- B. $\{15, 16, 18, 19\}$
- C. $\{18, 19\}$
- D. $\{\}$

9. Simplify $3^9 \div 3^3$

- A. 3^{27}
- B. 3^{12}
- C. 3^6
- D. 3^3

10. An article which costs GH¢ 25.00 was sold for GH¢ 35.00. Find the percentage profit made.

- A. 10%
- B. 28%
- C. 40%
- D. 70%

11. Factorize completely $b^2 + fb - mb - fm$

- A. $(b - f)(b - m)$
- B. $(b + f)(b - m)$
- C. $(b + f)(m - b)$
- D. $(b + f)(m + b)$

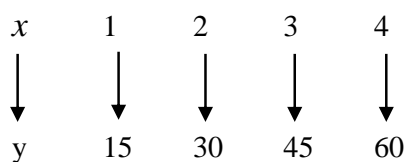
12. Simplify: $-13 - (-3) + (-10)$

- A. -26
- B. -20
- C. -10
- D. -6

13. Find the HCF of $3^3 \times 5^2$ and $3^2 \times 5^4$

- A. $3^2 \times 5^2$
- B. $3^3 \times 5^2$
- C. $3^2 \times 5^4$
- D. $3^5 \times 5^6$

14. State the rule for the mapping



- A. $x \rightarrow 15x$
- B. $x \rightarrow 15 + x$
- C. $x \rightarrow \frac{15}{x}$
- D. $x \rightarrow 10 + 5x$

15. Solve the inequality $x - \frac{1}{3} \geq \frac{2}{3} - x$

- A. $x \leq \frac{1}{2}$
- B. $x \leq \frac{2}{3}$
- C. $x \geq \frac{1}{2}$
- D. $x \geq \frac{2}{3}$

16. Find the area of a square, if its perimeter is 28 cm.

- A. 784 cm^2
- B. 196 cm^2
- C. 49 cm^2
- D. 14 cm^2

17. Simplify: $\frac{1}{3} \left(\frac{1}{2} - \frac{1}{3} \right) - \frac{1}{3} \left(\frac{1}{3} - \frac{1}{2} \right)$

- A. $-\frac{1}{9}$
- B. $-\frac{1}{18}$
- C. $\frac{1}{18}$
- D. $\frac{1}{9}$

18. Make n the subject of the relation $\theta = 180 - \frac{360}{n}$

- A. $\frac{\theta + 180}{2}$
- B. $\frac{\theta - 180}{2}$
- C. $\frac{360}{180 - \theta}$
- D. $\frac{360}{180 + \theta}$

19. If $R = \frac{h}{2} + \frac{d^2}{8h}$, find R when $d = 8$ and $h = 6$.

- A. $3\frac{1}{6}$
- B. $4\frac{1}{3}$
- C. $4\frac{3}{4}$
- D. $4\frac{9}{16}$

20. Eight copies of a book cost GH¢ 16.00. Find the cost of 5 copies.

- A. GH¢ 2.00
- B. GH¢ 3.20
- C. GH¢ 5.00
- D. GH¢ 10.00

21. Solve the equation $\frac{1}{5}(2+y) = \frac{1}{2}(y-1)$

- A. -3
- B. $\frac{3}{4}$
- C. $\frac{5}{3}$
- D. 3

22. The gradient of the straight line that passes through points A(3,2) and B(4,8) is

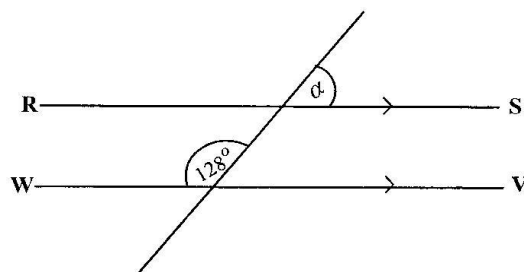
- A. $-\frac{1}{6}$
- B. $-\frac{1}{2}$
- C. 2
- D. 6

23. A car is travelling at 60 km per hour. How far does it travel in $2\frac{1}{2}$ hours?

- A. 30 km
- B. 60 km
- C. 120 km
- D. 150 km

24. In the diagram below RS and WV are parallel lines. The value of the angle marked α is

- A. 38°
- B. 52°
- C. 58°
- D. 64°



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25. Given that $\mathbf{a} = \begin{pmatrix} 5 \\ 2n \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2n-1 \\ 6 \end{pmatrix}$. If $\mathbf{a} = \mathbf{b}$, find the values of n .

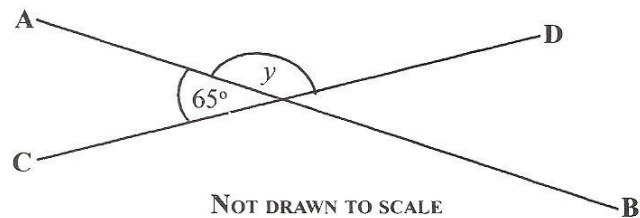
- A. 6
- B. 3
- C. 2
- D. 1

26. Find the volume of a cube of side 5 cm.

- A. 10 cm^3
- B. 15 cm^3
- C. 25 cm^3
- D. 125 cm^3

27. In the diagram below, **AB** and **CD** are two intersecting straight lines. Find the value of the angle marked y .

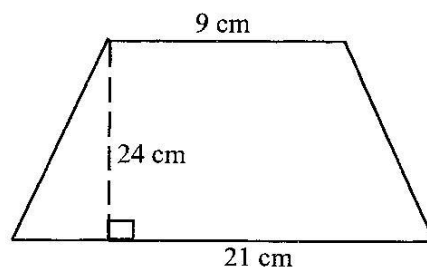
- A. 130°
- B. 115°
- C. 65°
- D. 60°



28. Kwame and Ama shared an amount of money in the ratio 5:4 respectively. If Kwame had GH¢ 9.00, how much did they share?

- A. GH¢ 16.20
- B. GH¢ 36.00
- C. GH¢ 45.00
- D. GH¢ 81.00

29.



The area of the trapezium above is

- A. 120 cm^2
- B. 180 cm^2
- C. 256 cm^2
- D. 360 cm^2

30. If $r = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$ and $s = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$, calculate $2r - 3s$

- A. $\begin{pmatrix} -10 \\ -25 \end{pmatrix}$
- B. $\begin{pmatrix} -2 \\ -25 \end{pmatrix}$
- C. $\begin{pmatrix} 10 \\ -25 \end{pmatrix}$
- D. $\begin{pmatrix} 10 \\ 25 \end{pmatrix}$

31. There are 10 red and 15 green balls in a bag. Find the probability of selecting at random a red ball from the bag.

- A. $\frac{3}{5}$
- B. $\frac{2}{5}$
- C. $\frac{1}{10}$
- D. $\frac{1}{25}$

The table below gives the distribution of ages of students in a class. Use it to answer Questions 32 – 34

| | | | | | |
|--------------------|----|----|----|----|----|
| Ages (years) | 13 | 14 | 15 | 16 | 17 |
| Number of students | 3 | 10 | 6 | 7 | 4 |

32. How many students are in the class?

- A. 20
- B. 30
- C. 45
- D. 75

33. What is the modal age?

- A. 14
- B. 15
- C. 16
- D. 17

34. If a student is chosen at random from the class, what is the probability that the student is 15 years old?

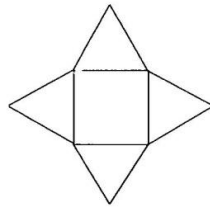
- A. $\frac{1}{5}$
- B. $\frac{1}{3}$
- C. $\frac{1}{2}$
- D. $\frac{2}{3}$

35. A length of a ribbon is 16.8 m long. How many ribbons 0.36 m long can be cut from it?
- A. 0.46
 - B. 4.60
 - C. 46
 - D. 460

36. A refrigerator was sold for GH¢ 200.00 at a loss of 10%. Find the cost price.
- A. GH¢ 180.00
 - B. GH¢ 190.00
 - C. GH¢ 220.00
 - D. GH¢ 222.22

37. The diagram below is the net of a

- A. cone
- B. cuboid
- C. rectangular prism
- D. pyramid



38. What is the value of 7 in the number 832713?
- A. Seven thousand
 - B. Seven hundred
 - C. Seventy
 - D. Seven

39. Write 3560 in standard form.

- A. 3.56×10^{-4}
- B. 3.56×10^{-3}
- C. 3.56×10^3
- D. 3.56×10^4

40. Correct 0.02751 to three decimal places

- A. 0.027
- B. 0.028
- C. 0.03
- D. 0.28

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MATHEMATICS 1

OBJECTIVE TEST

SOLUTIONS

1. A. $\{2, 3\}$
2. B. $3a^2 - 12ab$
3. A. 125%
4. C. $2^2 \times 3^3 \times 5^2$
5. C. 24
6. A. $\frac{1}{8}$
7. D. 62
8. D. $\{\}$
9. C. 3^6
10. C. 40%
11. B. $(b + f)(b - m)$
12. B. -20
13. A. $3^2 \times 5^2$
14. A. $x \rightarrow 15x$
15. C. $x \geq \frac{1}{2}$
16. C. 49 cm^2
17. D. $\frac{1}{9}$
18. C. $\frac{360}{180 - \theta}$

19. B. $4\frac{1}{3}$
20. D. GH¢ 10.00
21. D. 3
22. D. 6
23. D. 150 km
24. B. 52°
25. B. 3
26. D. 125 cm^3
27. B. 115°
28. A. GH¢ 16.20
29. D. 360 cm^2
30. C. $\begin{pmatrix} 10 \\ -25 \end{pmatrix}$
31. B. $\frac{2}{5}$
32. B. 30
33. A. 14
34. A. $\frac{1}{5}$
35. C. 46
36. D. GH¢ 222.22
37. D. pyramid
38. B. Seven hundred
39. C. 3.56×10^3
40. B. 0.028

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MATHEMATICS 2

ESSAY

1 hour

[60 marks]

*Answer **four** questions **only** from this section*

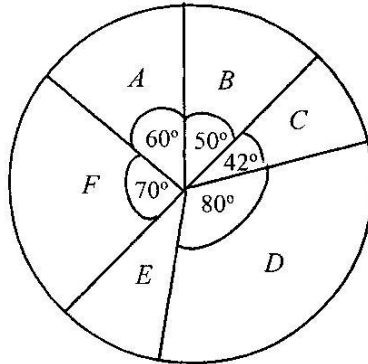
All working must be clearly shown.

*The use of calculators is **not** allowed*

*Marks will **not** be awarded for correct answers without corresponding working.*

All questions carry equal marks

1. (a) In a school of 255 students, 80 of them study Arabic only and 125 study French only. Each student studies at least one of the two subjects
 - (i) Draw a Venn diagram to represent the information
 - (ii) How many students study
 - (α) both subjects?
 - (β) French?
 - (b) Make h the subject of $v = \frac{1}{3}\pi r^2 h$
 - (c) A bookseller bought 80 copies of books at GH¢ 3.50 per copy. He sold each of them at GH¢ 4.20. Find
 - (i) the total cost price
 - (ii) his percentage profit
-
2. (a) The pie chart below shows the distribution of exercise books to six schools ABCDE and F in a town. School D was given 8000 exercise books.



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- (i) How many exercise books were given to each of the rest of the schools?
 - (ii) What is the average number of exercise books given to the schools?
 - (iii) How many schools had less than the average number of exercise books?
- (b) Solve the inequality below and illustrate the answer on the number line

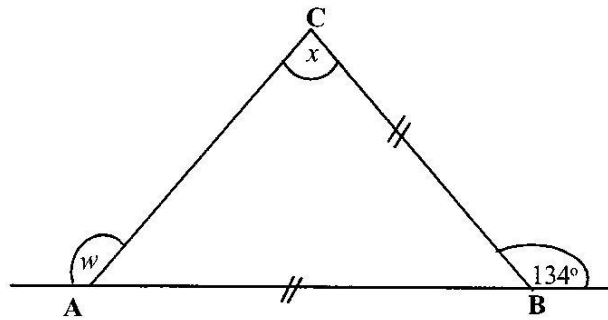
$$\frac{1}{3}x + 1 \geq \frac{1}{2}x + \frac{1}{4}(2 - x)$$

3. (a) Using a ruler and a pair of compasses only, construct
- (i) triangle ABC such that $|AB| = 8\text{cm}$, angle CBA = 45° and CAB = 60° .
 - (ii) the bisector of angle ACB to meet AB at T
- (b) Measure
- (i) $|CT|$;
 - (ii) angle CTB.
- (c) A boy spent $\frac{3}{8}$ of his money and had GH¢ 15.00 left. How much did he have?

4. (a) The perimeter of a rectangular plot of land whose length is $(2x+5)$ m and width $(x - 10)$ is 80 m. Find the
- value of x ;
 - area of the plot;
 - cost of weeding the plot at GH¢ 0.24 per m^2 .

- (b) Find the diagram

value of x and w in the below if $|AB| = |BC|$



NOT DRAWN TO SCALE

5. (a) Given that $\mathbf{a} = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$, calculate

- $\mathbf{a} + 2\mathbf{b}$;
- $\frac{1}{2}(2\mathbf{a} - \mathbf{b})$

- (b) The number of pupils in a primary school is given in the table below:

| Class | One | Two | Three | Four | Five | Six |
|------------------|-----|-----|-------|------|------|-----|
| Number of pupils | 24 | 35 | 35 | 20 | 21 | 45 |

- Find the number of pupils in the school
- What is the mean number of pupils in a class?
- What percentage of pupils is in class six?

- (c) Convert 312_{five} to a base ten numeral

6. (a) Copy and complete the table for the relation $y = \frac{x}{20}$, where y is the cost (in Ghana cedis) and x is the weight (in grammes) of rice sold in a market.

| | | | | | | |
|-----------------------|----|------|-----|-----|-------|-----|
| x (weight in grammes) | 50 | 100 | 150 | 200 | 250 | 300 |
| y (cost in GH¢) | | 5.00 | | | 12.50 | |

- (b) (i) On a graph sheet, draw two perpendicular axes OX and OY.
- (ii) Using a scale of 2 cm to 50 grammes on the x-axis and 2 cm to GH¢ 2.00 on the y-axis draw the graph of the relation $y = \frac{x}{20}$.
- (c) Using the graph, find
- (i) the cost of 175 grammes of rice
- (ii) the weight of rice that can be bought with GH¢14.00
- (d) Factorize: $3a^2 - 8bc - 12ac + 2ba$

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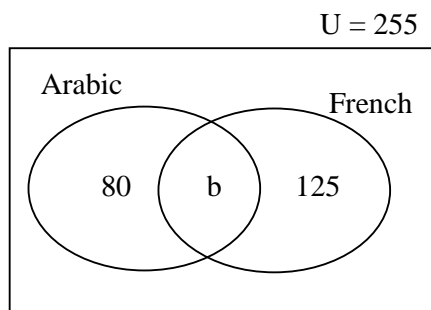
MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) (i) Let U = Number of students in the school
 b = Number of students who study both Arabic and French

The Venn diagram is shown below



- (ii) (a) From the Venn diagram above,

$$80 + b + 125 = 255$$

$$\Rightarrow b + 205 = 255$$

$$\Rightarrow b = 255 - 205 \quad [\text{Subtracting 205 from both sides (carrying + 205 to the other side)}]$$

$$\Rightarrow b = 50$$

$$\Rightarrow \underline{50 \text{ students study both Arabic and French.}}$$

$$\begin{aligned} (\beta) \text{ Number of French students} &= b + 125 \\ &= 50 + 125 \\ &= \underline{175} \end{aligned}$$

(b)

$$v = \frac{1}{3} \pi r^2 h$$

$$3 \times v = 3 \times \frac{1}{3} \pi r^2 h \quad \text{[Multiplying both sides by 3 (to clear fraction)]}$$

$$\Rightarrow 3v = \pi r^2 h \quad \text{[Simplifying]}$$

$$\Rightarrow \frac{3v}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2} \quad \text{[Dividing both sides by } \pi r^2 \text{]}$$

$$\Rightarrow \frac{3v}{\pi r^2} = h$$

$$\Rightarrow h = \frac{3v}{\pi r^2}$$

(c) (i) Total cost price = $80 \times \text{GHc } 3.50$
= GHc 280.00

(ii) Profit on each book = GHc 4.20 – GHc 3.50

= GHc 0.70 (or 70 Gp)

Cost price of each book = GHc 3.50 (or 350 Gp)

Percentage profit = $\frac{\text{Profit}}{\text{Original Cost}} \times 100\%$ [NB: 100%, not 100]

$$= \frac{70}{350} \times 100\% \quad \text{[Substituting values (of profit and original cost)]}$$
$$= \frac{1}{5} \times 100\% \quad \text{[Simplifying]}$$
$$= \underline{20\%}$$

2. (a) (i) Since School D's share = $80^\circ \equiv 8000$ books

By inspection of the above correspondence, it is obvious that

there is a factor of 100 (ie, $80 \times 100 = 8000$). Hence,

School A's share = $60^\circ \equiv 6000$ books

School B's share = $50^\circ \equiv 5000$ books

School C's share = $42^\circ \equiv 4200$ books

School F's share = $70^\circ \equiv 7000$ books

Now, School E's angle = $360^\circ - (80^\circ + 42^\circ + 50^\circ + 60^\circ + 70^\circ)$

$$= 360^\circ - 302^\circ$$

$$= 58^\circ$$

Hence, School E's share = 5800 books

(ii) Average number of books given

$$\begin{aligned}
 &= \frac{\text{Total number of books given}}{\text{Number of schools}} \\
 &= \frac{8000 + 6000 + 5000 + 4200 + 7000 + 5800}{6} \text{ books} \\
 &= \frac{36000}{6} \text{ books} \\
 &= \underline{\underline{6000 \text{ books}}}
 \end{aligned}$$

(iii) Schools B, C and E had less than 6000 books

Therefore 3 schools had less than the average number of books.

(b) $\frac{1}{3}x + 1 \geq \frac{1}{2}x + \frac{1}{4}(2 - x)$

$$\Rightarrow 12\left(\frac{1}{3}x\right) + 12(1) \geq 12\left(\frac{1}{2}x\right) + 12\left[\frac{1}{4}(2 - x)\right]$$

denominators)

$$\Rightarrow 4x + 12 \geq 6x + 3(2 - x)$$

Simplifying

$$\Rightarrow 4x + 12 \geq 6x + 6 - 3x$$

$$\Rightarrow 4x + 12 \geq 3x + 6$$

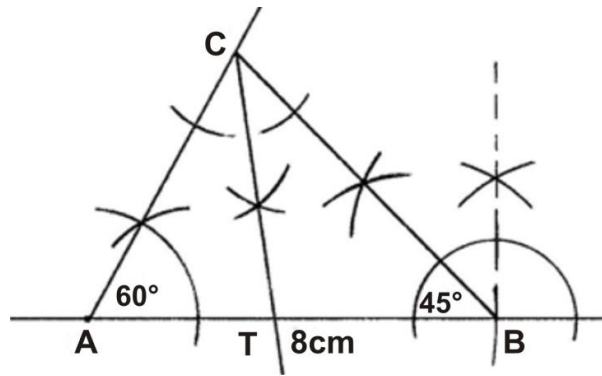
$$\Rightarrow 4x - 3x \geq 6 - 12$$

Grouping like terms on one side

$$\Rightarrow \underline{\underline{x \geq -6}}$$

3.

(a)



(b) (i) $|CT| \approx 5.1 \text{ cm}$

(ii) angle CTB $\approx \underline{97^\circ}$ (or $\underline{98^\circ}$)

(c)

| | Fraction | Amount (GH¢) |
|-------------------------------|---------------|--------------|
| Spent | $\frac{3}{8}$ | ? |
| ✓ <i>Left</i> | $\frac{5}{8}$ | 15 |
| ✓ <i>Total</i> (M. salary) | $\frac{8}{8}$ | m |

NB: Fraction left
 $= \text{'Total fraction'} - \text{Fraction spent}$
 $= 1 - \frac{3}{8}$
 $= \frac{8}{8} - \frac{3}{8} = \frac{5}{8}$

From the above table, we have $\frac{5/8}{8/8} = \frac{15}{m}$

[From the 'Left' and 'Total' rows]

$$\Rightarrow \frac{5}{8} \times m = 15 \times \frac{8}{8}$$

[Cross-multiplying]

$$\Rightarrow \frac{5}{8} \times m = 15$$

$$\Rightarrow \frac{8}{5} \times \frac{5}{8} \times m = 15 \times \frac{8}{5}$$

[Multiplying both sides by $\frac{8}{5}$ (to remove $\frac{5}{8}$)

$$\Rightarrow m = 15 \times \frac{8}{5}$$

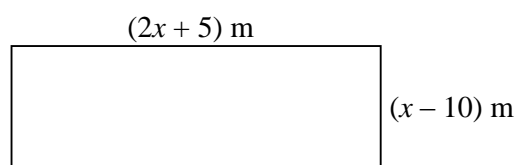
$$\Rightarrow m = 3 \times 8$$

[Simplifying]

$$\Rightarrow \underline{\underline{m = 24}}$$

Therefore he had GH¢ 24.00

4. (a)



(i) Since Perimeter = 80 m

$$\Rightarrow 2(\text{Length}) + 2(\text{width}) = 80 \text{ m}$$

$$\Rightarrow 2(2x + 5) + 2(x - 10) = 80 \quad \text{Substituting the values of length and width}$$

$$\Rightarrow 4x + 10 + 2x - 20 = 80 \quad \text{Expanding}$$

$$\Rightarrow 4x + 2x + 10 - 20 = 80 \quad \text{Grouping like terms}$$

$$\Rightarrow 6x - 10 = 80 \quad \text{Simplifying}$$

$$\Rightarrow 6x = 80 + 10 \quad \text{Adding 10 to both sides (carrying -10 to the other side)}$$

$$\Rightarrow 6x = 90$$

$$\Rightarrow \frac{6x}{6} = \frac{90}{6} \quad \text{Dividing both sides by 6 (the co-efficient of } x)$$

$$\Rightarrow x = 90 \div 6$$

$$\Rightarrow \underline{\underline{x = 15}}$$

(ii) Area of the plot = Length \times Width

$$= [2x + 5] \times [x - 10] \quad \text{Substituting the expressions of length and width}$$

$$= [2(15) + 5] \times [15 - 10] \quad \text{Substituting the value of } x \text{ (15)}$$

$$= [30 + 5] \times [15 - 10] \quad \text{Simplifying}$$

$$= 35\text{m}^2 \times 5\text{m}^2$$

$$= \underline{\underline{175\text{m}^2}}$$

(iii) If 1m^2 costs GHc 0.24

Then, 175m^2 costs $175 \times \text{GHc } 0.24$

$$\Rightarrow 175\text{m}^2 \text{ costs } \underline{\underline{\text{GHc } 42.00}}$$

\Rightarrow The cost of weeding the plot is GHc 42.00

(b) $\angle ABC = 180^\circ - 134^\circ \quad (\text{Sum of angles at a point on a straight line} = 180^\circ)$

$$= 46^\circ$$

Since $|AB| = |BC|$

$$\Rightarrow \angle BCA = x = \angle BAC \quad (\text{Base angles of isosceles triangle equal})$$

Now, $\angle BCA + \angle BAC + 46^\circ = 180^\circ \quad (\text{Sum of angles in a triangle} = 180^\circ)$

$$x + x + 46^\circ = 180^\circ \quad (\text{Substituting: } \angle BCA=x, \angle BAC=x)$$

$$2x + 46 = 180^\circ \quad [\text{Simplifying}]$$

$$2x = 180^\circ - 46^\circ \quad [\text{Grouping like terms}]$$

$$2x = 134^\circ$$

$$\frac{2x}{2} = \frac{134^\circ}{2} \quad [\text{Dividing both sides by 2 (the co-efficient of } x)]$$

$$x = 134^\circ \div 2$$

$$\underline{\underline{x = 67^\circ}}$$

$$\text{Therefore } \angle BAC = 67^\circ$$

$$\Rightarrow \angle BAC + w = 180^\circ \quad (\text{Sum of angles at a point on a straight line})$$

$$\Rightarrow 67^\circ + w = 180^\circ$$

$$\Rightarrow w = 180^\circ - 67^\circ$$

$$\Rightarrow \underline{\underline{w = 113^\circ}}$$

$$5. \quad (a) \quad (i) \quad a + 2b$$

$$= \begin{pmatrix} -3 \\ 3 \end{pmatrix} + 2 \begin{pmatrix} 4 \\ -6 \end{pmatrix} \quad \text{Substituting}$$

$$= \begin{pmatrix} -3 \\ 3 \end{pmatrix} + \begin{pmatrix} 8 \\ -12 \end{pmatrix} \quad \text{Simplifying}$$

$$= \begin{pmatrix} -3 + 8 \\ 3 + (-12) \end{pmatrix}$$

$$= \begin{pmatrix} 5 \\ -9 \end{pmatrix}$$

$$(ii) \quad \frac{1}{2} (2a - b)$$

$$= \frac{1}{2} \left[2 \begin{pmatrix} -3 \\ 3 \end{pmatrix} - \begin{pmatrix} 4 \\ -6 \end{pmatrix} \right]$$

$$= \frac{1}{2} \left[\begin{pmatrix} -6 \\ 6 \end{pmatrix} - \begin{pmatrix} 4 \\ -6 \end{pmatrix} \right]$$

$$= \frac{1}{2} \left[\begin{pmatrix} -6 - 4 \\ 6 - (-6) \end{pmatrix} \right]$$

$$= \frac{1}{2} \begin{pmatrix} -10 \\ 12 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2} \times -10 \\ \frac{1}{2} \times 12 \end{pmatrix}$$

$$= \binom{-5}{6}$$

(b) (i) The number of pupils in the school

$$= 24 + 35 + 35 + 20 + 21 + 45$$

$$= 180$$

There are 180 pupils in the school

(ii) The mean number of pupils in a class

$$= \frac{\text{Total number of pupils in the school}}{\text{Number of classes}}$$

$$= \frac{24 + 35 + 35 + 20 + 21 + 45}{6}$$

$$= \frac{180}{6}$$

$$= \underline{30 \text{ pupils}}$$

(iii) The percentage of pupils in class six

$$= \frac{\text{No. of pupils in class six}}{\text{Total no. of pupils}} \times 100\%$$

$$= \frac{45}{180} \times 100\%$$

$$= \frac{1}{4} \times 100\%$$

$$= \underline{25\%}$$

(c) 312_{five} to a base ten numeral

| | | |
|----------|----------|----------|
| 3 | 1 | 2 |
| 5^2 | 5^1 | 5^0 |

$$\Rightarrow (3 \times 5^2) + (1 \times 5^1) + (2 \times 5^0)$$

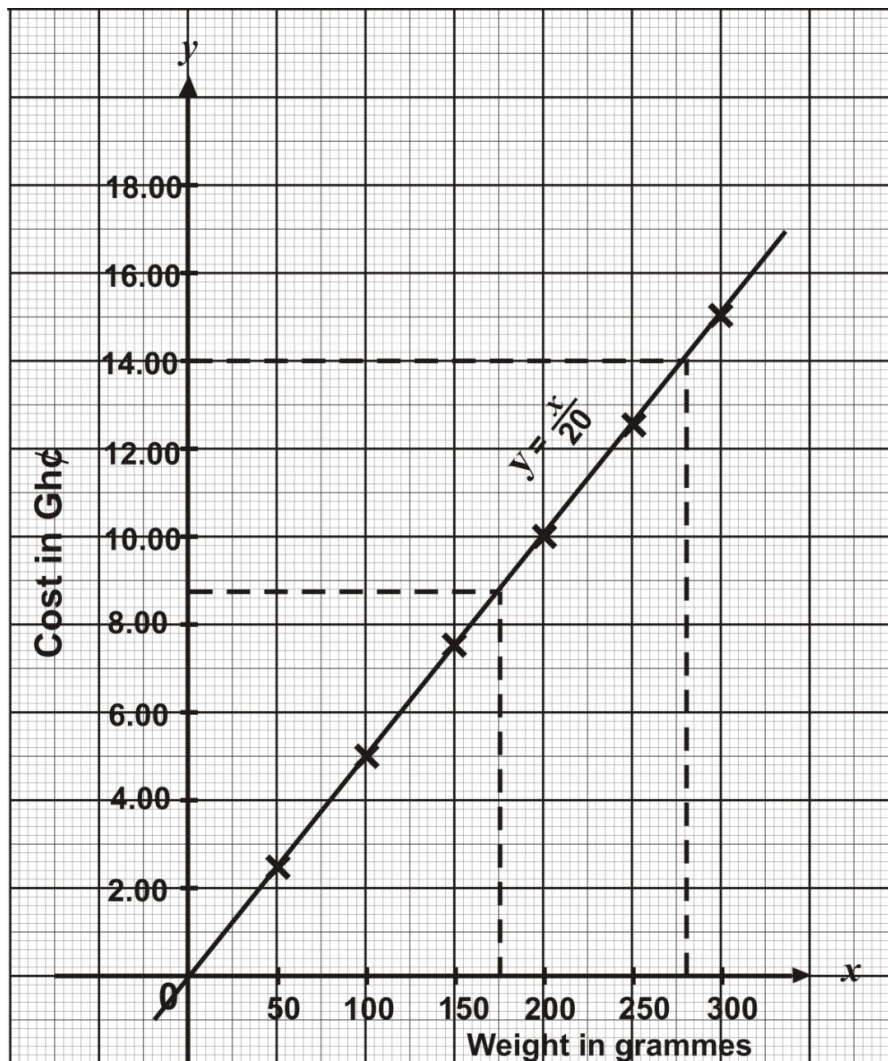
$$\begin{aligned}
 &= (3 \times 25) + (1 \times 5) + (2 \times 1) \\
 &= 75 + 5 + 2 \\
 &= \underline{\underline{82}} \quad (\text{or } \underline{\underline{82_{\text{ten}}}})
 \end{aligned}$$

6. (a) $y = \frac{x}{20}$

$$\frac{50}{20} = 2.50, \quad \frac{150}{20} = 7.50, \quad \frac{200}{20} = 10.00, \quad \frac{300}{20} = 15.00$$

| | | | | | | |
|-------------------------|-------------|------|-------------|--------------|-------|--------------|
| x (weight in grammes) | 50 | 100 | 150 | 200 | 250 | 300 |
| y (cost in GHc) | 2.50 | 5.00 | 7.50 | 10.00 | 12.50 | 15.00 |

(b) (i)



(c) (i) The cost of 175 grammes of rice = GHc 8.75

(ii) The weight of rice that can be bought with GHc 14.00 = 280 grammes

(d) $3a^2 - 8bc - 12ac + 2ba$

$$= 3a^2 - 12ac + 2ba - 8bc \quad \text{[Re-arranging terms]}$$

$$= 3a(a - 4c) + 2b(a - 4c) \quad \text{[Factorizing]}$$

$$= \underline{\underline{(a - 4c)(3a + 2b)}}$$

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MATHEMATICS 1

OBJECTIVE TEST

1 hour

1. Which of the following sets is well defined?
 - A. {Man, Kofi, Red, 14}
 - B. {Ink, Mango, Green, Nail}
 - C. {Car, Road, Glass, Book}
 - D. {Seth, Mary, Jacob, Evelyn}

2. If set B is a subset of set A, then
 - A) sets A and B have the same number of elements
 - B) some members of set B can be found in set A
 - C) no member of set B is in set A
 - D) all the members of set B are in set A

3. The least common multiple (LCM) of 16, 30 and 36 is
 - A) 3
 - B) 6
 - C) 240
 - D) 720

4. The sum of 5 and x divided by 4 is equal to 3.25. Find the value of x.
 - A) 8
 - B) 7
 - C) $2\frac{1}{4}$
 - D) $-3\frac{4}{13}$

5. The numbers 32, 33, 34, ..., ..., 42 form a sequence in base 5.
Find the missing numbers
 - A) 35, 36
 - B) 30, 31
 - C) 40, 41
 - D) 31, 41

6. Write down all the integers in the set $A = \{-10, -4, 0, \frac{1}{4}, 2\frac{1}{2}, 45, 100\}$
 - A. $\{-10, -4, 0, 45, 100\}$
 - B. $\{-10, -4\}$
 - C. $\{0, 45, 100\}$
 - D. $\{\frac{1}{4}, 2\frac{1}{2}\}$

7. Find the total cost of 25 pens and 75 books if each pen costs GH¢ 0.20 and each book costs GH¢ 0.30.
A) GH¢22.50 B) GH¢23.50 C) GH¢27.50 D) GH¢50.00
8. Simplify $-27 + 18 - (10 - 14) - (-2)$
A) -3 B) -7 C) -11 D) -35
9. Arrange the following numbers from the lowest to the highest: 0.5, 3, -5, 0.
A) 0, 0.5, -5, 3 B) 0, -5, 0.5, 3 C) -5, 0, 0.5, 3 D) -5, 0.5, 0, 3
10. Find how many pieces of cloth $5\frac{1}{2}$ m long that can be cut from a roll of cloth 121 m long.
A) $665\frac{1}{2}$ B) $115\frac{1}{2}$ C) 66 D) 22
11. Find the value of $124.3 + 0.275 + 74.06$, correcting your answer to one decimal place.
A) 198.6 B) 198.7 C) 892.0 D) 892.4
12. Esi and Kwasi are 12 and 8 years old respectively. They share 60 mangoes in the ratio of their ages. How many mangoes does Esi get?
A) 42 B) 40 C) 36 D) 18
13. It takes 6 students 1 hour to sweep their school compound. How long will it take 15 students to sweep the same compound?
A) 24 minutes B) 12 minutes C) 3 hours D) 2 hours
14. A housing agent makes a commission of GH¢ 103,500 when he sells a house for GH¢ 690,000. Calculate the percentage of his commission.
A) 15.0% B) 10.0% C) 7.5% D) 5.0%
15. A simple interest of GH¢ 37,500.00 is earned on an amount of GH¢ 500,000.00 for 3 years. Find the rate of interest per annum.
A) 20.0% B) 10.0% C) 5.0% D) 2.5%
16. Simplify: $(8x^2y^3)(\frac{3}{8}xy^4)$
A) $3x^3y^7$ B) $3x^2y^7$ C) $3x^3y^4$ D) $3xy$

17. The scores of 10 students in an examination are given as follows:
45, 12, 75, 81, 54, 51, 24, 67, 19 and 39.

What is the median of the scores?

- A) 39 B) 48 C) 51 D) 54

18. A pie chart is to be drawn from the data in the following table:

| | |
|----------|-----|
| Cassava | 20% |
| Yam | 17% |
| Plantain | 28% |
| Maize | 35% |

What will be the value of the angle of the sector for maize?

- A) 126.0° B) 100.8° C) 72.0° D) 61.2°

19. Eighteen cards are numbered from 11 to 29. If one card is chosen at random, what is the probability that it contains the digit 2?

- A) $\frac{3}{9}$ B) $\frac{7}{18}$ C) $\frac{5}{9}$ D) $\frac{11}{18}$

20. Find the value of x , if $\frac{x}{4} + 1 = 5$.

- A) 24 B) 20 C) 19 D) 16

21. Factorize: $xy + 5x + 2y + 10$

- A. $(x + 5)(2y + 10)$
B. $(x + 2)(y + 10)$
C. $(x + 5)(y + 2)$
D. $(x + 2)(y + 5)$

22. If $x \in \{2, 3, 4, 5\}$, find the truth set of $2x + 1 < 8$

- A. $\{2,3,4\}$ B. $\{2,3\}$ C. $\{3,4\}$ D. $\{4,5\}$

23. Solve the inequality: $7x - (10x + 3) \geq -9$

A) $x \geq 2$

B) $x \leq 4$

C) $x \geq 4$

D) $x \leq 2$

24. Find the rule of the mapping:

| | | | | | | |
|---|----|----|----|----|-----|-----|
| 1 | 2 | 3 | 4 | 5 | ... | x |
| ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ |
| 7 | 11 | 15 | 19 | 23 | ... | y |

A) $x \rightarrow 4x - 3$

B) $x \rightarrow 3 - 4x$

C) $x \rightarrow 4x + 3$

D) $x \rightarrow 4x + 5$

25. Find the circumference of a circle whose area is equal to $64\pi \text{ cm}^2$.

A) $32\pi \text{ cm}$

B) $16\pi \text{ cm}$

C) $8\pi \text{ cm}$

D) $4\pi \text{ cm}$

26. Which of the following geometric figures is the plane shape of a cube?

A) Circle

B) Rectangle

C) Square

D) Triangle

27. How many lines of symmetry has a rectangle?

A) 4

B) 3

C) 2

D) 1

28. A rectangular box has length 20 cm, width 6 cm and height 4 cm. Find how many cubes of side 2 cm that will fit into the box.

A) 120

B) 60

C) 30

D) 15

29. The interior angle of a regular polygon is 120° . How many sides has this polygon?

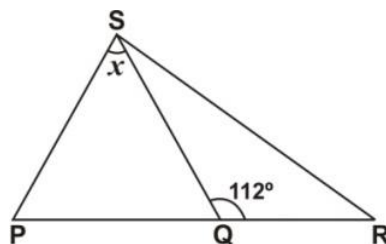
A) 3

B) 4

C) 5

D) 6

30.



In the diagram above, length of $PS =$ length of SQ and angle $SQR = 112^\circ$. Find the value of x .

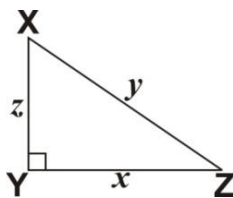
A) 68°

B) 56°

C) 46°

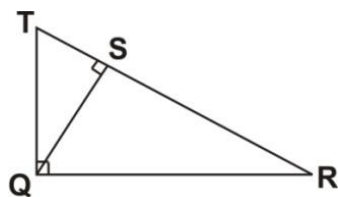
D) 44°

31. $\triangle XYZ$ is a right-angled triangle with length of sides as shown.



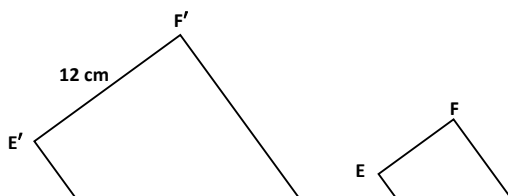
Which of the following equations gives the value of z^2 ?

- A) $z^2 = (x^2 + y^2)$
 B) $z^2 = (x - y)$
 C) $z^2 = (y^2 - x^2)$
 D) $z^2 = (x^2 - y^2)$
32. Express 7 min. 30 sec. as a percentage of 1 hour.
 A) 2.5% B) 7.5% C) 11.7% D) 12.5%
33. The point (4,5) is translated to the point (3,1). What is the translation vector?
 A. $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ B. $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$ C. $\begin{pmatrix} 1 \\ -4 \end{pmatrix}$ D. $\begin{pmatrix} -1 \\ -4 \end{pmatrix}$
34. In the diagram below, triangle QRT is the enlargement of QST.



Which side of triangle QRT corresponds to side QT of triangle QST?

- A) TS B) TR C) QR D) SR
- 35.



Not drawn to scale

In the diagrams above Fig. I is an enlargement of Fig. II.

Find the side EF of Fig. II

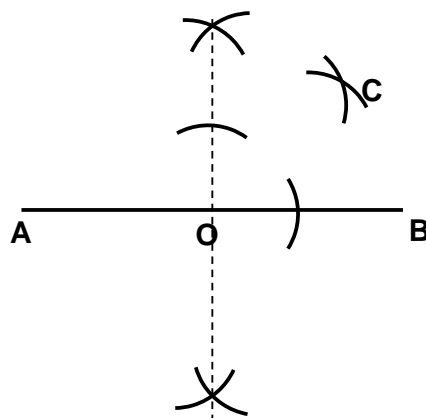
- A) 20 cm B) 5 cm C) 4 cm D) 3 cm

36. Express 4037 in standard form

- A) 4.037×10^{-4}
 B) 4.037×10^{-3}
 C) 4.037×10^3
 D) 4.037×10^4

37. Which of the following angles can be constructed by using the arcs at point C in the diagram below?

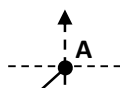
- A) 30° B) 45° C) 60° D) 75°



38. Given that vector $\mathbf{a} = \begin{pmatrix} -5 \\ 12 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 10x \\ 12 \end{pmatrix}$ find the value of x if $\mathbf{a} = \mathbf{b}$.

- A) -2 B) $-\frac{1}{2}$ C) $\frac{1}{2}$ D) 2

39.



Not drawn to scale

In the diagram above, the bearing of point **B** from **A** is

- A) 340° B) 220° C) 140° D) 50°

- 40.** Ama is 9 years older than Kwame. If Kwame is 18 years old, find the ratio of the age of Kwame to that of Ama.

- A) 3 : 2 B) 1 : 3 C) 2 : 3 D) 2 : 1

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MATHEMATICS 1

OBJECTIVE TEST

SOLUTIONS

1. D. {Seth, Mary, Jacob, Evelyn}
2. D) all the members of set B are in set A
3. D) 720
4. A) 8
5. C) 40, 41
6. A. $\{-10, -4, 0, 45, 100\}$
7. C) GH¢27.50
8. A) -3
9. C) $-5, 0, 0.5,$
10. D) 22
11. A) 198.6
12. C) 36
13. A) 24 minutes
14. A) 15.0%
15. D) 2.5%
16. A) $3x^3y^7$

17. B) 48
18. A) 126.0°
19. $\frac{11}{19}$ (NB: Not included in given options)
20. D) 16
21. D. $(x + 2)(y + 5)$
22. B. $\{2,3\}$
23. D) $x \leq 2$
24. C) $x \rightarrow 4x+3$
25. B) $16 \pi \text{ cm}$
26. C) Square
27. C) 2
28. B) 60
29. D) 6
30. D) 44°
31. C) $z^2 = (y^2 - x^2)$
32. D) 12.5%
33. D. $\begin{pmatrix} -1 \\ -4 \end{pmatrix}$
34. B) TR
35. D) 3 cm
36. C) 4.037×10^3
37. B) 45°
38. B) $-\frac{1}{2}$
39. B) 220°

40. C) 2:3

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MATHEMATICS 2

ESSAY

1 hour

[60 marks]

Answer **four** questions **only** from this section

All working must be clearly shown.

The use of calculators is **not** allowed

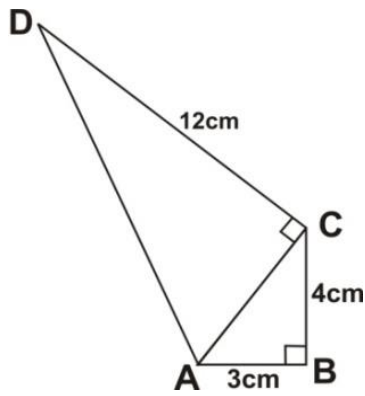
Marks will **not** be awarded for correct answers without corresponding working.

All questions carry equal marks

1. (a) Factorize: $(m + n)(2x - y) - x(m + n)$
- (b) A and B are subsets of a universal set
 $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18\}$
Such that $A = \{\text{even numbers}\}$ and $B = \{\text{multiples of 3}\}$
- (i) List the elements of the sets A, B, $(A \cap B)$, $(A \cup B)$ and $(A \cup B)'$
- (ii) Illustrate the information in (i) on a Venn diagram
- (c) Find the values of x and y in the vector equation

$$\begin{pmatrix} 5 \\ 3 \end{pmatrix} + 2 \begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 1 \\ -7 \end{pmatrix} = 0$$

2. (a) Find the sum of 2,483.65, 701.532 and 102.7, giving your answer to one decimal place.



- (b) In the quadrilateral ABCD above, $|AB| = 3$ cm, $|BC| = 4$ cm, $|CD| = 12$ cm and angle $ABC = 90^\circ$. Calculate:
- the perimeter of ABCD
 - the area of ABCD

3. (a) Evaluate: $\frac{2^7 \times 3^4 \times 5^3}{2^3 \times 3^2 \times 5^2}$, leaving your answer in standard form.

- (b) Kwame rode a bicycle for a distance of x km and walked for another $\frac{1}{2}$ hour at a rate of 6 km/hour. If Kwame covered a total distance of 10 km, find the distance x he covered by bicycle.

- (c) A rectangular tank of length 22 cm, width 9 cm and height 16 cm is filled with water. The water is poured into a cylindrical container of radius 6 cm.

Calculate the :

- volume of the rectangular tank
- depth of water in the cylindrical container.

[Take $\pi = \frac{22}{7}$]

4. (a) Simplify: $7\frac{2}{3} - 4\frac{5}{6} + 2\frac{3}{8}$

- (b) The area of a trapezium is 31.5 cm^2 . If the parallel sides are of lengths 7.3 cm and 5.3 cm, calculate the perpendicular distance between them.

- (c) The marks scored by four students in a Mathematics test are as follows:

| | | |
|------|---|----|
| Esi | - | 92 |
| Seth | - | 85 |
| Mary | - | 65 |

Efe - x

- (i) Write down an expression for the mean (average) of the marks.
- (ii) If the mean is less than 80, write a linear inequality for the information
- (iii) Find the possible marks Efe scored in the test. Represent your answer on the number line.

5. (a) Solve: $\frac{4x-3}{2} = \frac{8x-10}{8} + 2\frac{3}{4}$

- (b) Using a scale of 2 cm to 1 unit on both axes, draw two perpendicular lines OX and OY on a graph sheet for the x – axis from -5 to 5 and the y – axis from -6 to 6.

- (i) Plot the points A(2, 3) and B(-3, 4) and join them with a long straight line
- (ii) Plot on the same graph sheet, the points C(4, 2) and D(-2, -3) and join them with a long straight line to meet the line through AB
- (iii) Measure the angle between the lines through AB and CD.
- (iv) Find the coordinates of the point at which the lines through AB and CD meet.

6. The table below shows the frequency distribution of the number of letters in the surnames of some students in a school.

| No. of letters | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------------|---|---|---|---|---|---|----|
| No. of students | 7 | 3 | 2 | 8 | 5 | 3 | 1 |

- (a) From the distribution, determine
 - (i) the mode
 - (ii) the mean
- (b) If a student is selected at random, find the probability that his/ her name will contain more than 7 letters.
- (c) Draw a bar chart for the distribution

April 2010

MATHEMATICS 2

ESSAY

SOLUTIONS

1. (a) $(m + n)(2x - y) - x(m + n)$

Method 1

$$= (m + n) [2x - y - x]$$

Factorizing $(m + n)$ out

$$= (m + n) (2x - x - y)$$

$$= \underline{(m + n) (x - y)}$$

NB: $(m + n) (x - y) = (x - y)(m + n)$

Method 2

$$\begin{aligned} & (m + n)(2x - y) - x(m + n) \\ = & 2mx - my + 2nx - ny - mx - nx \\ = & 2mx - mx + 2nx - nx - my - ny \\ = & mx + nx - my - ny \\ = & x(m + n) - y(m + n) \\ = & \underline{(m + n) (x - y)} \end{aligned}$$

Expanding

Grouping like terms & simplifying

Factorizing

Factorizing $(m+n)$ out

1 (b) (i) $A = \{2, 4, 6, 8, 10, 12, 14, 16, 18\}$

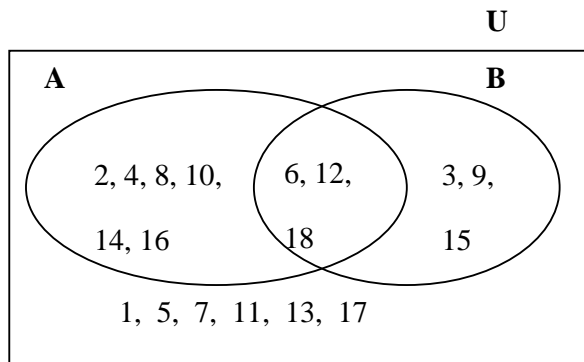
$$B = \{3, 6, 9, 12, 15, 18\}$$

$$A \cap B = \{6, 12, 18\}$$

$$A \cup B = \{2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18\}$$

$$(A \cup B)' = \{1, 5, 7, 11, 13, 17\}$$

1(b) (ii)



1 (c) $\begin{pmatrix} 5 \\ 3 \end{pmatrix} + 2\begin{pmatrix} x \\ y \end{pmatrix} - \begin{pmatrix} 1 \\ -7 \end{pmatrix} = 0$

Using the horizontal (x) component, we have

$$\begin{aligned} 5 + 2x - 1 &= 0 \\ \Rightarrow 2x &= 1 - 5 \\ \Rightarrow \frac{2x}{2} &= \frac{-4}{2} \\ \Rightarrow \underline{\underline{x = -2}} \end{aligned}$$

Solving for x

Using the vertical (y) component, we have

$$\begin{aligned} 3 + 2y - (-7) &= 0 \\ \Rightarrow 3 + 2y + 7 &= 0 \\ \Rightarrow 2y + 10 &= 0 \\ \Rightarrow 2y &= -10 \\ \Rightarrow y &= \frac{-10}{2} \\ \Rightarrow \underline{\underline{y = -5}} \end{aligned}$$

Solving for y

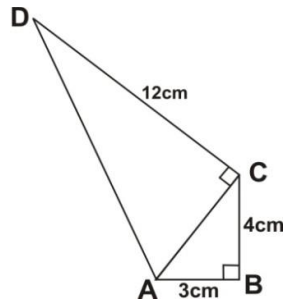
2. (a) $2,483.65 + 701.532 + 102.7$

$$\begin{array}{r} 2483.65 \\ 701.532 \\ + 102.7 \\ \hline 3287.882 \end{array}$$

Ensure that the places of the addends are in line

$\approx \underline{\underline{3287.9}}$ (one decimal place)

2 (b)



(i) Side **AC** is the hypotenuse of triangle ABC.

From the Pythagorean theorem,

$$|AC|^2 = |AB|^2 + |BC|^2$$

$$\Rightarrow |AC|^2 = (3cm)^2 + (4cm)^2$$

$$\Rightarrow |AC|^2 = 9cm^2 + 16cm^2$$

$$\Rightarrow |AC|^2 = 25cm^2$$

$$\Rightarrow |AC| = \sqrt{25cm^2}$$

$$\Rightarrow |AC| = 5cm$$

Now, side **AD** is the hypotenuse of triangle ACD

From the Pythagorean theorem,

$$|AD|^2 = |AC|^2 + |CD|^2$$

$$\Rightarrow |AD| = \sqrt{(5cm)^2 + (12cm)^2}$$

$$\Rightarrow |AD| = \sqrt{169cm^2}$$

$$\Rightarrow |AD| = 13cm$$

Hence the perimeter of ABCD

$$\begin{aligned} &= |AB| + |BC| + |CD| + |DA| \\ &= 3cm + 4cm + 12cm + 13cm \\ &= \underline{\underline{32cm}} \end{aligned}$$

The perimeter of ABCD is 32 cm

$$\begin{aligned} \text{2 (b) (ii) Area of (ABCD} &= \Delta ABC + \Delta ACD) \\ &= \frac{1}{2} (b_1 h_1) + \frac{1}{2} (b_2 h_2) \\ &= \frac{1}{2} (3cm)(4cm) + \frac{1}{2} (5cm)(12cm) \\ &= 6cm^2 + 30cm^2 \end{aligned}$$

$$= \underline{\underline{36\text{cm}^2}}$$

The area of ABCD is 36 cm^2

$$3. \quad (a) \quad \frac{2^7 \times 3^4 \times 5^3}{2^3 \times 3^2 \times 5^2}$$

$$= \frac{2^7}{2^3} \times \frac{3^4}{3^2} \times \frac{5^3}{5^2}$$

$$= 2^4 \times 3^2 \times 5$$

$$= 8 \times 9 \times 5$$

$$= 360$$

$$= \underline{\underline{3.6 \times 10^2}}$$

$$3 (b) \quad \text{Distance ridden} = x \text{ km}$$

$$\text{Distance walked} = \frac{1}{2} \text{ h} \times 6\text{km/h} = 3\text{km}$$

$$\text{Total distance} = 10 \text{ km}$$

$$\text{Dist. ridden} + \text{dist. walked} = \text{total dist.}$$

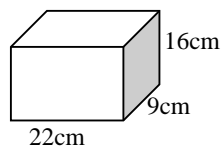
$$\Rightarrow x \text{ km} + 3 \text{ km} = 10 \text{ km}$$

$$\Rightarrow x \text{ km} = 10 \text{ km} - 3\text{km}$$

$$\Rightarrow x \text{ km} = 7 \text{ km}$$

The distance Kwame covered by bicycle is 7 km

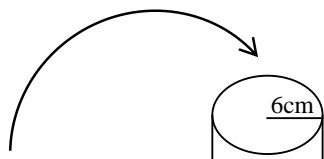
3 (c) (i)



$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

$$= 22\text{cm} \times 9\text{cm} \times 16\text{cm}$$

$$= \underline{\underline{3168\text{cm}^3}}$$



Let d = the depth of water in the cylinder

3 (c) (ii) Method 1 ([Using calculated volume of rectangular tank](#))

Vol. of water in rectangular tank = Vol. of water in cylinder

$$\Rightarrow 3168\text{cm}^3 = \pi r^2 \times d$$

$$\Rightarrow 3168\text{cm}^3 = \frac{22}{7} \times (6\text{cm})^2 \times d$$

Substituting

$$\Rightarrow 3168\text{cm}^3 = \frac{22}{7} \times 36\text{cm}^2 \times d$$

$$\Rightarrow \frac{3168\text{cm}^3}{\frac{22}{7} \times 36\text{cm}^2} = d$$

Dividing both sides by $\frac{22}{7} \times 36\text{cm}^2$

$$\Rightarrow \frac{3168}{\frac{792}{7}} \text{cm} = d$$

Simplifying

$$\Rightarrow 3168 \div \frac{792}{7} \text{cm} = d$$

$$\Rightarrow 3168 \times \frac{7}{792} \text{cm} = d$$

You may avoid the tedious simplification here by using Method 2 below

$$\Rightarrow 28 \text{ cm} = d$$

Hence the depth of water in the cylindrical container = 28cm

3(c)(ii) Method 2 ([Using the given dimensions of rectangular tank](#))

Vol. of water in cuboid = Vol. of water in cylinder

$$\Rightarrow l \times w \times h_{\text{cuboid}} = \pi r^2 \times d_{\text{cylinder}}$$

$$[22\text{cm} \times 9\text{cm}] \times 16\text{cm} = [\frac{22}{7} \times (6\text{cm})^2] \times d$$

Substituting and solving for d

$$\Rightarrow [22\text{cm} \times 9\text{cm}] \times 16\text{cm} = (\frac{22}{7} \times 6\text{cm} \times 6\text{cm}) \times d$$

$$\Rightarrow \frac{22\text{cm} \times 9\text{cm} \times 16\text{cm}}{\frac{22}{7} \times 6\text{cm} \times 6\text{cm}} = d$$

Simplifying

$$\Rightarrow \frac{22\text{cm} \times 9\text{cm} \times 16\text{cm} \times 7}{22 \times 6\text{cm} \times 6\text{cm}} = d \quad \text{Simplifying (by 'cancellation')}$$

$$\Rightarrow \underline{\underline{28\text{cm}}} = d$$

∴ The depth (d) of water in the cylindrical container = 28cm.

4. (a)

Method 1 [\(Evaluating whole number and fractions separately\)](#)

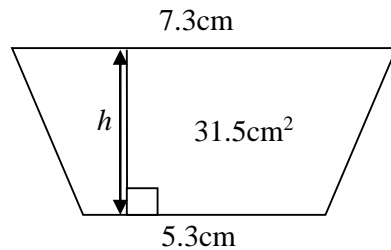
$$\begin{aligned} & 7\frac{2}{3} - 4\frac{5}{6} + 2\frac{3}{8} \\ \Rightarrow & 7 - 4 + 2 + \frac{2}{3} - \frac{5}{6} + \frac{3}{8} \\ \Rightarrow & 5 + \frac{16 - 20 + 9}{24} \\ \Rightarrow & 5 + \frac{5}{24} \\ = & \underline{\underline{5\frac{5}{24}}} \end{aligned}$$

4 (a)

Method 2 [\(Changing mixed fractions to improper fractions\)](#)

$$\begin{aligned} & 7\frac{2}{3} - 4\frac{5}{6} + 2\frac{3}{8} \\ \Rightarrow & \frac{23}{3} - \frac{29}{6} + \frac{19}{8} \\ \Rightarrow & \frac{184 - 116 + 57}{24} \\ \Rightarrow & \frac{125}{24} \\ = & \underline{\underline{5\frac{5}{24}}} \end{aligned}$$

4 (b)



Let h = perpendicular dist. between parallel sides

Method 1 [\(Substituting first\)](#)

$$\begin{aligned}
 \text{Area} &= \frac{1}{2} (\text{sum of parallel sides}) \times h \\
 \Rightarrow 31.5\text{cm}^2 &= \frac{1}{2} (7.3\text{cm} + 5.3\text{cm}) \times h \\
 \Rightarrow 2 \times 31.5\text{cm}^2 &= 2 \times \frac{1}{2} (7.3\text{cm} + 5.3\text{cm}) \times h \\
 \Rightarrow 63\text{cm}^2 &= 12.6\text{cm} \times h \\
 \Rightarrow \frac{63\text{cm}^2}{12.6\text{cm}} &= \frac{12.6\text{cm} \times h}{12.6\text{cm}} \\
 \frac{630\text{cm}^2}{126\text{cm}} &= h \\
 \Rightarrow \underline{\underline{5\text{cm}}} &= \underline{\underline{h}}
 \end{aligned}$$

Multiplying both sides by 2 to remove fraction

Dividing both sides by 12.6 cm to find 'h'

Multiplying both numerator and denominator by 10 and breaking down by cancellation

4 (b) Method 2 [\(Making \$h\$ the subject first\)](#)

Let A = Area of trapezium

$c + d$ = sum of parallel sides

h = perpendicular dist. between parallel sides

$$\begin{aligned}
 \Rightarrow A &= \frac{1}{2} (c + d) h \\
 \Rightarrow 2 \times A &= 2 \times \frac{1}{2} (c + d) h \\
 \Rightarrow 2A &= (c + d) h \\
 \Rightarrow \frac{2A}{c + d} &= h
 \end{aligned}$$

Multiplying both sides by 2 to remove fraction

Dividing both sides by 'c+d' to make 'h' the subject

$$\Rightarrow h = \frac{2A}{c + d}$$

Switching positions

$$\Rightarrow h = \frac{2 \times 31.5 \text{ cm}^2}{7.3 \text{ cm} + 5.3 \text{ cm}}$$

Substituting values to find 'h'

$$h = \frac{63 \text{ cm}^2}{12.6 \text{ cm}} = \underline{\underline{5 \text{ cm}}}$$

The perpendicular distance between the parallel sides is 5 cm.

4 (c)

(i) The mean mark = $\frac{92 + 85 + 65 + x}{4}$

(ii) If the mean is less than 80 then $\frac{92 + 85 + 65 + x}{4} < 80$, $\{x: x \geq 0\}$

(iii) $\frac{92 + 85 + 65 + x}{4} < 80$

$$\Rightarrow \frac{242 + x}{4} < 80$$

$$\Rightarrow 4 \times \left(\frac{242 + x}{4} \right) < 4 \times 80$$

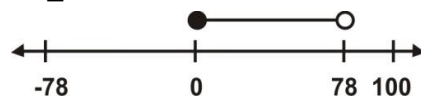
$$\Rightarrow 242 + x < 320$$

$$\Rightarrow x < 320 - 242$$

$$\Rightarrow x < 78 \quad \{x: x < 78, x \geq 0\}$$

The possible marks (x) that Efe scored in the test

$$= 0 \leq x < 78$$



5. (a)

Method 1 ([Clearing fractions first](#))

$$\begin{aligned}
& \frac{4x-3}{2} = \frac{8x-10}{8} + 2\frac{3}{4} \\
\Rightarrow & \frac{4x-3}{2} = \frac{8x-10}{8} + \frac{11}{4} \\
& 8 \times \left(\frac{4x-3}{2} \right) = 8 \times \left(\frac{8x-10}{8} \right) + 8 \times \frac{11}{4} \\
\Rightarrow & 4(4x-3) = 8x-10 + 2(11) \\
\Rightarrow & 16x-12 = 8x-10 + 22 \\
\Rightarrow & 16x-8x = 12-10 + 22 \\
\Rightarrow & 8x = 24 \\
\Rightarrow & x = \frac{24}{8} = \underline{\underline{3}}
\end{aligned}$$

Changing mixed fraction $2\frac{3}{4}$ to improper fraction

Multiplying through by 8 (to clear fractions):

Expanding and Simplifying

Grouping like terms on one side

Dividing both sides by 8 to find x

5 (a)

Method 2 (Grouping and simplifying terms containing the variable first)

$$\begin{aligned}
& \frac{4x-3}{2} = \frac{8x-10}{8} + 2\frac{3}{4} \\
\Rightarrow & \frac{4x-3}{2} - \frac{8x-10}{8} = 2\frac{3}{4} \\
\Rightarrow & \frac{4(4x-3) - (8x-10)}{8} = \frac{11}{4} \\
\Rightarrow & \frac{16x-12-8x+10}{8} = \frac{11}{4} \\
\Rightarrow & \frac{16x-8x-12+10}{8} = \frac{11}{4} \\
\Rightarrow & \frac{8x-2}{8} = \frac{11}{4}
\end{aligned}$$

Grouping the terms containing the variable

Simplifying

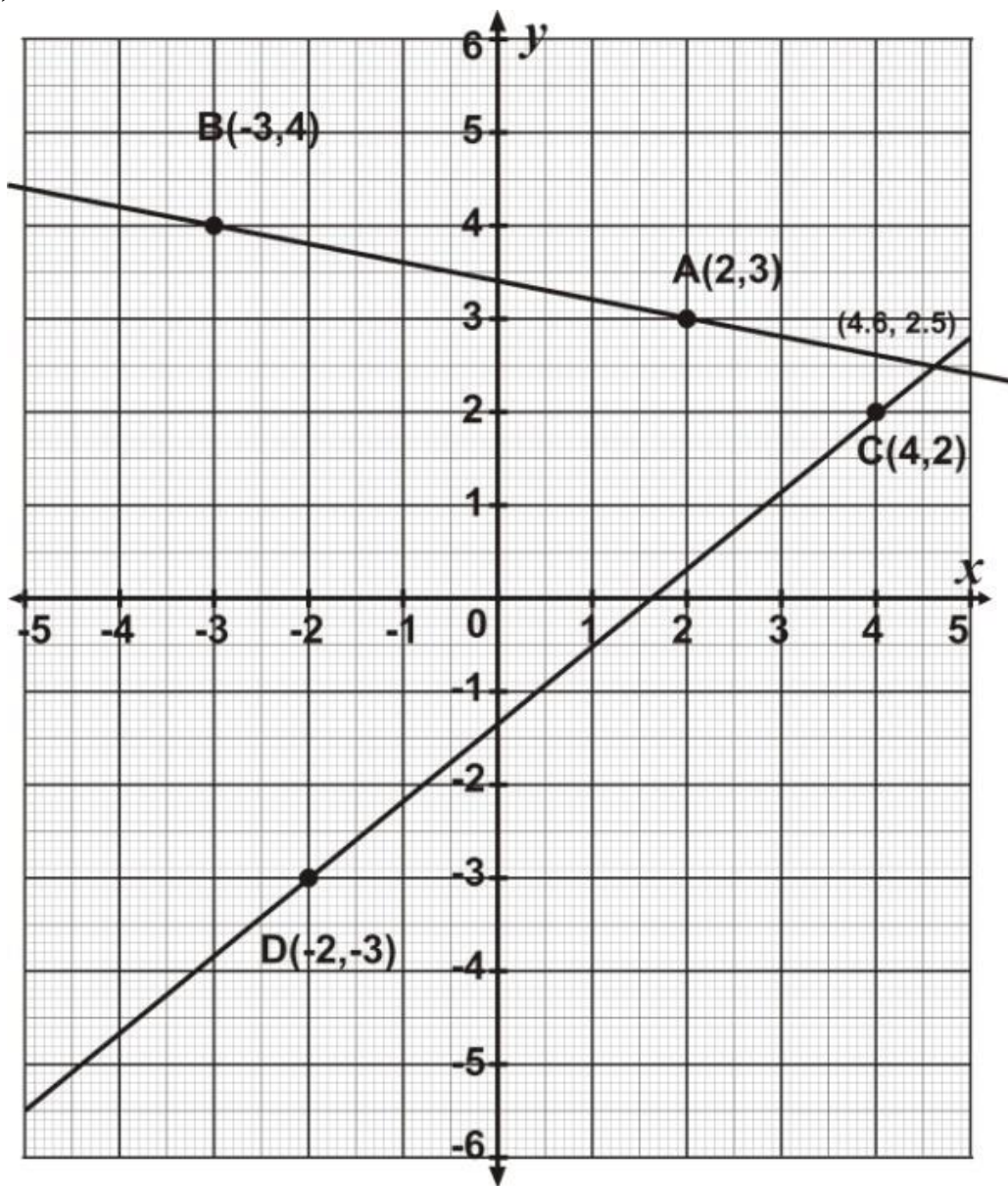
$$\begin{aligned}
\Rightarrow & 4(8x-2) = 8(11) \\
\Rightarrow & 32x-8 = 88 \\
\Rightarrow & 32x = 88+8 \\
\Rightarrow & \frac{32x}{32} = \frac{88+8}{32} = \frac{96}{32}
\end{aligned}$$

Cross multiplying

Simplifying and finding x

$$\Rightarrow \underline{\underline{x = 3}}$$

5 (b)



5 (b) (iii) The acute angle between lines AB and CD $\approx \underline{\underline{50^\circ}}$

5(b) (iv) The coordinates of the point at which the lines through AB and CD meet
 $\approx \underline{\underline{(4.6, 2.5)}}$

6.

(a) (i) The Mode = The most-occurring number of letters

(the number of letters with the highest frequency)

⇒ The mode = 7 letters

(ii)

| No. of letters (x) | No. of students (f) | fx |
|---------------------------|-------------------------|-------------------|
| 4 | 7 | 28 |
| 5 | 3 | 15 |
| 6 | 2 | 12 |
| 7 | 8 | 56 |
| 8 | 5 | 40 |
| 9 | 3 | 27 |
| 10 | 1 | 10 |
| $\Sigma f = 29$ | | $\Sigma fx = 188$ |

$$\begin{aligned}\text{The mean} &= \frac{\Sigma f x}{\Sigma f} = \frac{188}{29} \\ &= \underline{\underline{6\frac{14}{29}}} \approx \underline{\underline{6.483}}\end{aligned}$$

6 (b)

P(surname has more than 7 letters)

$$\begin{aligned}&= \frac{\text{Number of students with more than 7 letters in surname}}{\text{Total number of students}} \\ &= \frac{5 + 3 + 1}{7 + 3 + 2 + 8 + 5 + 3 + 1} \\ &= \frac{9}{29}\end{aligned}$$

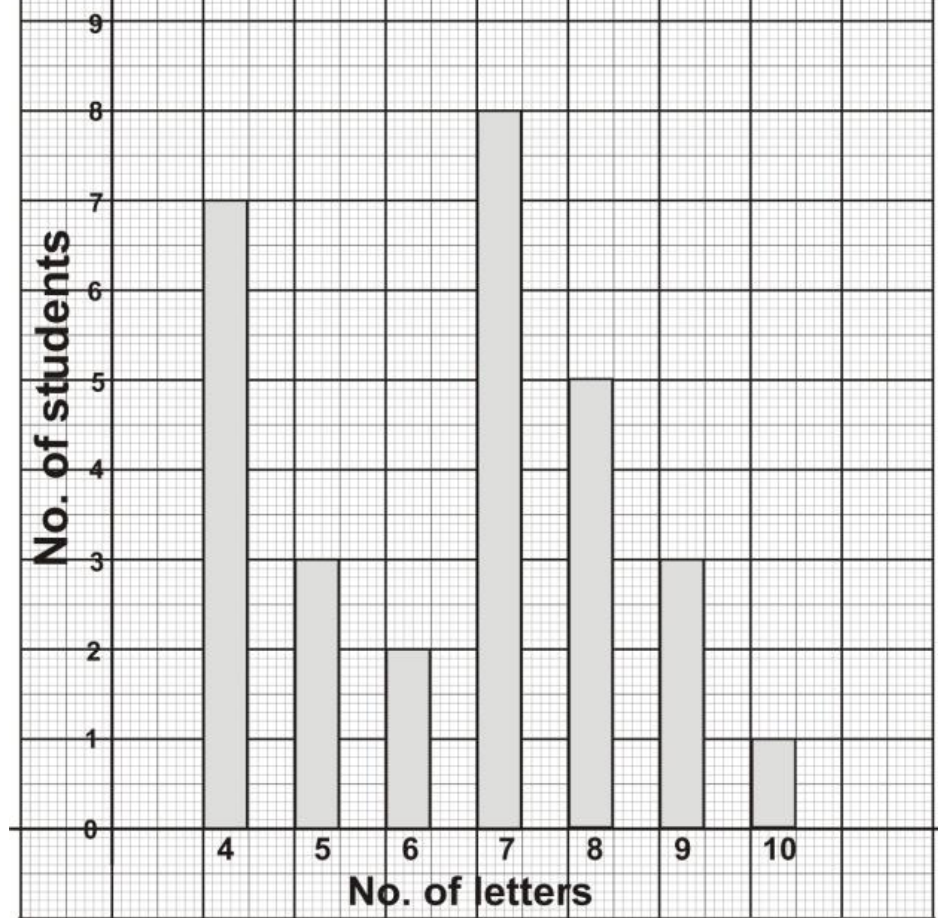
The probability that a student selected at random has a surname with more than 7 letters

$$= \underline{\underline{\frac{9}{29}}}$$

6 (c)

Vertical Axis Scale: 2cm to 1 student

The frequency distribution of the number of letters in the surnames of some of students in a school



April 2009

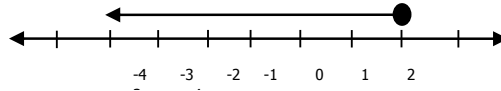
MATHEMATICS 1

OBJECTIVE TEST

1 hour

1. Given that $A = \{1,2,3,4,5,6\}$ and $B = \{3,6,9,12\}$, find $A \cup B$
A. $\{3,6\}$ B. $\{6,12\}$ C. $\{2,3,4,5,9,12\}$ D. $\{1,2,3,4,5,6,9,12\}$
2. Write 2340000 in standard form.
A) 2.34×10^{-6}
B) 2.34×10^{-5}
C) 2.34×10^6
D) 2.34×10^7
3. How many faces has a cuboid?
A) 12 B) 8 C) 6 D) 4
4. Subtract 125.47 from 203.90
A) 78.57 B) 78.43 C) -121.57 D) -122.38
5. Simplify $(5m+3n) - (2m-n)$
A) $5m-4n$ B) $3m+4n$ C) $3m-2n$ D) $7m+4n$
6. Which of the following sets is equal to $\{1,2,3,4\}$?
A. $\{2,4,1,5\}$ B. $\{2,1,4,3,\}$ C. $\{1,2,3,4,\dots\}$ D. $\{2,3,4,5,\dots\}$
7. In a town of 42,800 inhabitants, 48% are male. The rest are female. How many more females are there than males?
A) 22,256 B) 20,544 C) 1,712 D) 1,612

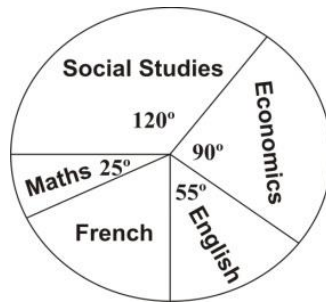
8. What set does the following graph represent?



- A. $\{x: x < 2\}$ B. $\{x: x \leq 2\}$ C. $\{x: x > 2\}$ D. $\{x: x \geq 2\}$

The pie chart below shows the performance of Kate in her final examination.

Use the diagram to answer Questions 9 and 10



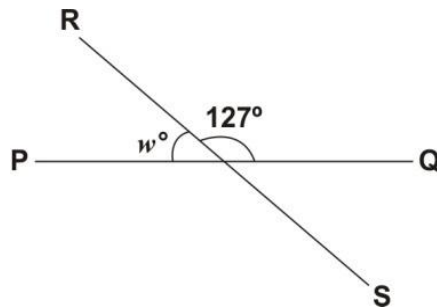
9. What is the angle for French?
- A) 120° B) 100° C) 70° D) 35°
10. If Kate scored 60% in Social Studies, what was her score in Economics?
- A) 45% B) 54% C) 72% D) 90%
11. A teacher is to be chosen at random from a group of 6 male and 2 female teachers for a patron of a Mathematics Club. What is the probability that a female teacher is chosen?
- A) $\frac{3}{4}$ B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) $\frac{1}{4}$
12. Solve the equation $2x - 3(x-1) = 6$
- A) 3 B) -3 C) -7 D) -9
13. If $m = 3$ and $n = -3$, evaluate $\frac{1}{2}(3m-n)$
- A) 6 B) 3 C) 0 D) -6
14. Which of the following sets of angles form the interior angles of a right angled triangle?
- A. $\{20^\circ, 50^\circ, 90^\circ\}$
- B. $\{80^\circ, 60^\circ, 90^\circ\}$

- C. $\{45^\circ, 45^\circ, 90^\circ\}$
 D. $\{65^\circ, 90^\circ, 35^\circ\}$

15. State the rule for the mapping

| | | | | | |
|--------------|--------------|---------------|---------------|---------------|--------------|
| x | 0 | 1 | 2 | 3 | 4 |
| \downarrow | \downarrow | \downarrow | \downarrow | \downarrow | \downarrow |
| y | 0 | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{3}{4}$ | 1 |

- A) $x \rightarrow \frac{x}{4}$ B) $x \rightarrow \frac{x}{2}$ C) $x \rightarrow \frac{3x}{4}$ D) $x \rightarrow \frac{1}{2x}$
16. A rectangle has an area of 36 cm^2 and a width of 3 cm. Find its perimeter.
 A) 12 cm B) 18 cm C) 24 cm D) 30 cm
17. Find the value of $4 + x^0$
 A) 3 B) 4 C) 5 D) 6
18. A van travels 154km in $1\frac{3}{4}$ hours. Find its speed in km/h.
 A) 77km/h B) 88km/h C) 100km/h D) 269.5km
19. In the figure below, PQ and RS are straight lines. Find the value of the angle marked w° .

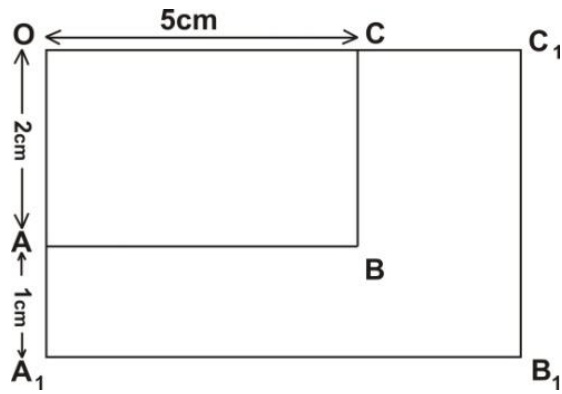


- A) 27° B) 53° C) 63° D) 127°
20. If $x + 5 = -7$, find the value of $\frac{x}{6}$
 A) -5 B) -2 C) $-\frac{1}{3}$ D) 2

In the diagram below, rectangle OABC is enlarged into rectangle $OA_1B_1C_1$ from centre O.

$|OC|=5\text{cm}$, $|OA|=2\text{cm}$ and $|AA_1|=1\text{cm}$

Use the diagram to answer Questions 21 and 22



21. Find the scale factor of the enlargement.
 A) 1 B) 1.5 C) 2 D) 2.5
22. Calculate OC_1
 A) 7.5cm B) 8cm C) 9cm D) 12cm
23. The height of a flag pole in a scale drawing is 5cm. If the scale is 1cm to 3m, what is the actual height of the pole?
 A) 10 m B) 15 m C) 8 m D) 5 m
24. Factorize: $ax + 3x + a + 3$
 A. $x(a+x)$ B. $(x-a)(x+3)$ C. $x(a-x)$ D. $(a+3)(x+1)$
25. If $y = \frac{x+8}{x-4}$, find the value of y when $x = 2$
 A) 5 B) -5 C) 4 D) -4
26. Find the greatest common factor (GCF) of 90, 126 and 72.
 A) 6 B) 9 C) 18 D) 24
27. Given that $1 : 3 = x : 21$, find the value of x .
 A) 4 B) 5 C) 7 D) 63
28. Find the difference between 432_{five} and 143_{five}
 A) 234_{five} B) 334_{five} C) 1130_{five} D) 1310_{five}
29. Simplify: $14\frac{1}{3} - 2\frac{3}{8} + 5\frac{7}{12}$

A) $6\frac{3}{8}$

B) $7\frac{5}{12}$

C) $17\frac{5}{12}$

D) $17\frac{13}{24}$

30. Nine bottles of equal capacity hold $4\frac{1}{2}$ litres of water. How much do x bottles hold?

A) $\frac{1}{2}x$ litres

B) $2x$ litres

C) $20\frac{1}{2}x$ litres

D) $40\frac{1}{2}x$ litres

31. A sales girl receives a 5% commission on all she sells. Find how much she has to sell to receive GH¢15.00

A) GH¢750.00

B) GH¢300.00

C) GH¢75.00

D) GH¢30.00

32. Arrange the following fractions in ascending order: $\frac{7}{12}$, $\frac{3}{5}$, $\frac{7}{15}$, $\frac{3}{4}$

A) $\frac{3}{5}$, $\frac{7}{15}$, $\frac{7}{12}$, $\frac{3}{4}$

B) $\frac{7}{12}$, $\frac{7}{15}$, $\frac{3}{5}$, $\frac{3}{4}$

C) $\frac{7}{15}$, $\frac{7}{12}$, $\frac{3}{5}$, $\frac{3}{4}$

D) $\frac{3}{5}$, $\frac{3}{4}$, $\frac{7}{12}$, $\frac{7}{15}$

33. Add 2.5 to the product of 4.2 and 0.2

A) 13.4

B) 10.9

C) 3.34

D) 1.34

34. What is the value of four in the number 7073.48?

A) four tenth

B) four

C) forty

D) four hundred

The table below shows the ages of children at a birthday party.

| Ages (yrs) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------------|---|---|---|---|---|---|---|---|---|----|
| No. of children | 3 | 4 | 2 | 5 | 4 | 4 | 6 | 4 | 2 | 1 |

Use this table to answer Questions 35, 36 and 37

35. What is the modal age?

A) 10

B) 7

C) 5

D) 4

36. A child is selected at random. What is the probability that he or she is 4 years old?

A) $\frac{4}{35}$

B) $\frac{1}{7}$

C) $\frac{2}{5}$

D) $\frac{4}{5}$

37. How many children are 7 or more years old?

A) 28

B) 22

C) 13

D) 6

38. Write the vector $\begin{pmatrix} 6\text{cm } W \\ 4\text{cm } S \end{pmatrix}$ using Cartesian components.

A. $\begin{pmatrix} -6 \\ -4 \end{pmatrix}$

B. $\begin{pmatrix} -4 \\ -6 \end{pmatrix}$

C. $\begin{pmatrix} -6 \\ 4 \end{pmatrix}$

D. $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$

39. Simplify: $5 - 7 + 2(3 - 8)$

A) -12

B) -8

C) -5

D) -4

40. If $\mathbf{r} = \begin{pmatrix} -10 \\ -3 \end{pmatrix}$ and $\mathbf{n} = \begin{pmatrix} 8 \\ -6 \end{pmatrix}$, find $\mathbf{n} + \mathbf{r}$

A. $\begin{pmatrix} -2 \\ -9 \end{pmatrix}$

B. $\begin{pmatrix} 2 \\ -9 \end{pmatrix}$

C. $\begin{pmatrix} 18 \\ 9 \end{pmatrix}$

D. $\begin{pmatrix} -2 \\ -3 \end{pmatrix}$

April 2009

MATHEMATICS 1

OBJECTIVE TEST

SOLUTIONS

1. D. $\{1,2,3,4,5,6,9,12\}$
2. C) 2.34×10^6
3. C) 6
4. B) 78.43
5. B) $3m+4n$
6. B. $\{2,1,4,3,\}$
7. C) 1,712
8. B. $\{x: x \leq 2\}$
9. C) 70°
10. A) 45%
11. D) $\frac{1}{4}$
12. B) -3
13. A) 6
14. C. $\{45^\circ, 45^\circ, 90^\circ\}$
15. A) $x \rightarrow \frac{x}{4}$
16. D) 30 cm
17. C) 5

18. B) 88km/h
19. B) 53°
20. B) -2
21. B) 1.5
22. A) 7.5cm
23. B) 15 m
24. D. $(a+3)(x+1)$
25. B) -5
26. C) 18
27. C) 7
28. A) 234_{five}
29. D) $17 \frac{13}{24}$
30. A) $\frac{1}{2} x$ litres
31. B) GH¢300.00
32. C) $\frac{7}{15}, \frac{7}{12}, \frac{3}{5}, \frac{3}{4}$
33. C)3.34
34. A) four tenth
35. B) 7
36. B) $\frac{1}{7}$
37. C) 13
38. A. $\begin{pmatrix} -6 \\ -4 \end{pmatrix}$
39. A) -12
40. A. $\begin{pmatrix} -2 \\ -9 \end{pmatrix}$

April 2009

MATHEMATICS 2

ESSAY

1 hour

[60 marks]

Answer **four** questions **only** from this section

All working must be clearly shown.

The use of calculators is **not** allowed

Marks will **not** be awarded for correct answers without corresponding working.

All questions carry equal marks

1. (a) Simplify: $\frac{1200 \times 1260}{800}$ and write your answer in standard form
- (b) A plot of land measures 25m by 12m. A portion of this plot measuring 8m by 8m is used for the cultivation of vegetables. Find the area of the plot **not** cultivated
- (c) The table below shows the performance of Aisha in her final examination.

| Subject | Score |
|------------------|-------|
| English Language | 54% |
| Mathematics | 36% |
| Ga | 68% |
| Science | 50% |
| Social Studies | 32% |

Draw a pie chart to represent this information

2. The table below shows the scores of some students in an examination.

| | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|---|---|----|
| Scores | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Frequency | 3 | 5 | 3 | 2 | 7 | 6 | 5 | 4 | 2 | 2 | 1 |

From the table find

- (a) how many students wrote the examination
- (b) the modal score
- (c) the number of students that scored 7 or more
- (d) the mean score correct to one decimal place

3. (a) (i) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes OX and OY on a graph sheet.
- (ii) Mark on the same graph sheet the x-axis from -5 to 5 and y-axis from -6 to 6
- (iii) Plot the points A(2,5), B(2,2) and C(4,2). Join the points A, B and C to form a triangle ABC
- (iv) Using the y-axis as mirror line, draw the image triangle $A_1B_1C_1$ of the triangle ABC such that $A \rightarrow A_1$, $B \rightarrow B_1$ and $C \rightarrow C_1$. Write down the coordinates of A_1 , B_1 and C_1
- (v) Draw the image triangle $A_2B_2C_2$ of triangle ABC under anticlockwise rotation of 180° about the origin where $A \rightarrow A_2$, $B \rightarrow B_2$ and $C \rightarrow C_2$. Write down the coordinates of A_2 , B_2 and C_2

(b) Given that $a = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, $b = \begin{pmatrix} -5 \\ -7 \end{pmatrix}$ and $c = \begin{pmatrix} -4 \\ -1 \end{pmatrix}$

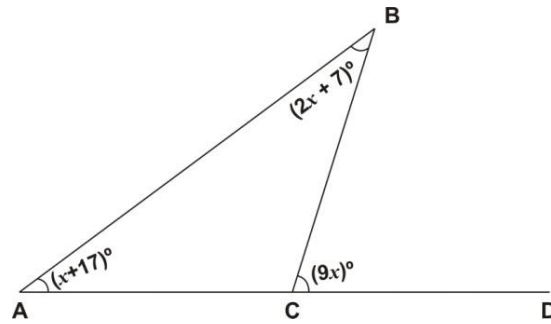
Evaluate $2a - 3c + b$

4. (a) The ratio of sheep to goats on a farm is 4:7. If there are 1,428 sheep, find how many goats are on the farm.
- (b) Using a ruler and a pair of compasses only, construct a triangle ABC with $|AB| = 6\text{cm}$, $|AC| = 8\text{cm}$ and angle $BAC = 30^\circ$.
Construct the bisector of angle ACB to meet line AB at D.
- (i) Measure $|AD|$ and $|BD|$
 - (ii) Write down the ratio $|AD| : |BD|$.

5. (a) The diagram is a triangle ABC with the side AC produced to D.

Find:

- (i) The value of x
- (ii) angle ACB



- (b) The simple interest formula $I = \frac{PTR}{100}$ gives the interest, I on a principal, P invested at a rate, R per annum for time, T years.
- (i) Find the simple interest on GH¢3,600.00 at 15% per annum for 2 years.
 - (ii) Make R the subject of the simple interest formula.
 - (iii) At what rate per annum will GH¢6,000.00 earn GH¢2,400.00 simple interest in 2 years?

6. (a) Given that $\text{¢}10,000.00 = \text{GH¢}1.00$.

Complete the following table relating cedis (x) to Ghana cedis (y)

| | | | | | | |
|----------------|--------|--------|---------|---------|---------|---------|
| $\text{¢} (x)$ | 10,000 | 50,000 | 150,000 | 250,000 | 350,000 | 450,000 |
| GH¢(y) | 1 | | | | | 45 |

- (b) (i) On a graph sheet draw two perpendicular axes OX and OY .
- (ii) Using a scale of 2cm to $\text{¢}50,000.00$ on the Ox axis and 2cm to GH¢5.00 on the Oy axis. Mark the Ox axis from 0 to $\text{¢}450,000$ and OY axis from 0 to GH¢50.00
- (c) Plot the points and join them with a straight line
- (d) From your graph find the value of
- (i) GH¢8.00 in cedis (¢)
 - (ii) GH¢35.00 in cedis (¢)
 - (iii) $\text{¢}260,000.00$ in Ghana Cedis (GH¢)

April 2009

MATHEMATICS 2

ESSAY

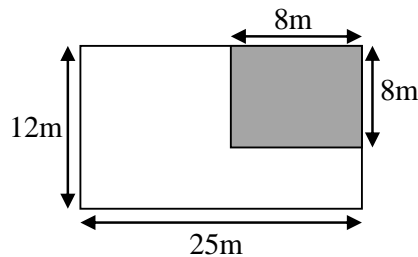
SOLUTIONS

1 (a)

$$\begin{aligned}\frac{1200 \times 1260}{800} &= \frac{12 \times 1260}{8} \\ &= 1890 \\ &= \underline{1.89 \times 10^3}\end{aligned}$$

Simplifying by 'cancellation'

1 (b)



$$\text{Total area of land} = 25 \text{ m} \times 12 \text{ m} = 300 \text{ m}^2$$

$$\text{Area cultivated} = 8 \text{ m} \times 8 \text{ m} = 64 \text{ m}^2$$

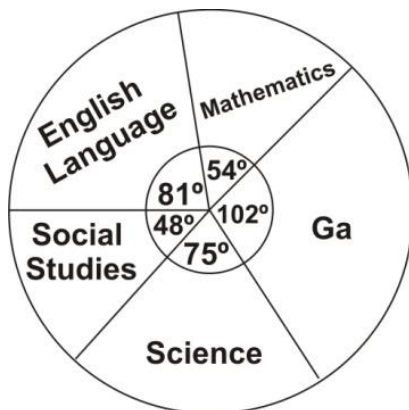
$$\begin{aligned}\text{Area not cultivated} &= \text{Total area} - \text{Area cultivated} \\ &= 300 \text{ m}^2 - 64 \text{ m}^2 \\ &= \underline{236 \text{ m}^2}\end{aligned}$$

1 (c)

| Subject | Score | Angle of sector |
|------------------|-------|--|
| English Language | 54% | $\frac{54}{240} \times 360^\circ = 81^\circ$ |
| Mathematics | 36% | $\frac{36}{240} \times 360^\circ = 54^\circ$ |

| | | |
|----------------|------------|---|
| Ga | 68% | $\frac{68}{240} \times 360^\circ = 102^\circ$ |
| Science | 50% | $\frac{50}{240} \times 360^\circ = 75^\circ$ |
| Social Studies | 32% | $\frac{32}{240} \times 360^\circ = 48^\circ$ |
| TOTAL | 240 | 360° |

Pie chart showing the performance of Aisha in her final examination



2 (a) $3 + 5 + 3 + 2 + 7 + 6 + 5 + 4 + 2 + 2 + 1 = 40$
 \Rightarrow 40 students wrote the examination

2(b) The modal score is the score that occurs most
 (i.e., has the highest frequency)
 \Rightarrow Modal score = 4

2(c) $4 + 2 + 2 + 1 = 9$
 \Rightarrow 9 students scored 7 or more.

2(d) **Method 1**

The Mean = $\frac{\text{The sum of scores}}{\text{The total number of students}}$

$$= \frac{(0 \times 3) + (1 \times 5) + (2 \times 3) + (3 \times 2) + (4 \times 7) + (5 \times 6) + (6 \times 5) + (7 \times 4) + (8 \times 2) + (9 \times 2) + (10 \times 1)}{3 + 5 + 3 + 2 + 7 + 6 + 5 + 4 + 2 + 2 + 1}$$

$$= \frac{0+5+6+6+28+30+30+28+16+18+10}{40}$$

$$= \frac{177}{40} = 4\frac{17}{40} \quad \text{or} \quad \underline{\underline{4.425}}$$

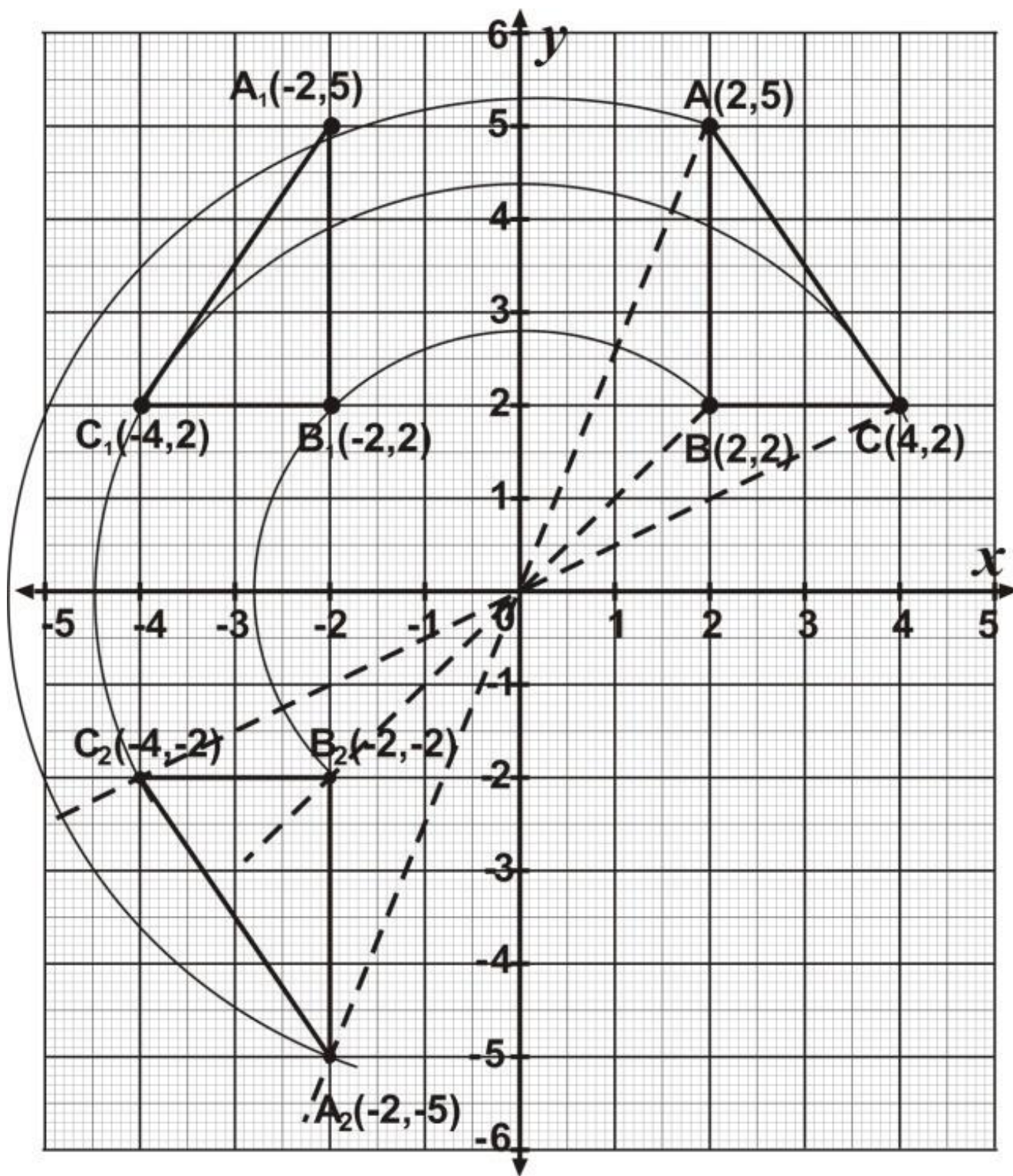
2(d) Method 2

| Scores (x) | Frequency (f) | f x |
|---------------|------------------|-----------------|
| 0 | 3 | 0 |
| 1 | 5 | 5 |
| 2 | 3 | 6 |
| 3 | 2 | 6 |
| 4 | 7 | 28 |
| 5 | 6 | 30 |
| 6 | 5 | 30 |
| 7 | 4 | 28 |
| 8 | 2 | 16 |
| 9 | 2 | 18 |
| 10 | 1 | 10 |
| $\Sigma f=40$ | | $\Sigma fx=177$ |

$$\text{The mean} = \frac{\Sigma f x}{\Sigma f} = \frac{177}{40} = \underline{\underline{4\frac{17}{40}}} \quad \text{or} \quad \underline{\underline{4.425}}$$

3(a)

Approach 1 ([By Inspection / Construction](#))



3(a)

Approach 2 [\(The rule / formula\)](#)

3 (a) (iv) Reflecting (x, y) in the y-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$\Rightarrow OA \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} -2 \\ 5 \end{pmatrix}, \quad \therefore A_1(-2, 5)$$

$$\Rightarrow OB \begin{pmatrix} 2 \\ 2 \end{pmatrix} \rightarrow OB_1 \begin{pmatrix} -2 \\ 2 \end{pmatrix}, \quad \therefore B_1(-2, 2)$$

$$\Rightarrow OC \begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OC_1 \begin{pmatrix} -4 \\ 2 \end{pmatrix}, \quad \therefore C_1(-4, 2)$$

\therefore Plot and join $A_1(-2, 5)$, $B_1(-2, 2)$ and $C_1(-4, 2)$ as the image of triangle ABC under a reflection in the y axis as shown above.

3 (a) (v) Rotating (x, y) through 180° about the origin

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ -y \end{pmatrix}$$

$$OA \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OA_2 \begin{pmatrix} -2 \\ -5 \end{pmatrix}, \quad \therefore A_2(-2, -5)$$

$$OB \begin{pmatrix} 2 \\ 2 \end{pmatrix} \rightarrow OB_2 \begin{pmatrix} -2 \\ -2 \end{pmatrix}, \quad \therefore B_2(-2, -2)$$

$$OC \begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OC_2 \begin{pmatrix} -4 \\ -2 \end{pmatrix}, \quad \therefore C_2(-4, -2)$$

\therefore Plot and join $A_2(-2, -5)$, $B_2(-2, -2)$ and $C_2(-4, -2)$ as the image of triangle ABC under a rotation through 180° about the origin as shown above.

3 (b)

$$2\mathbf{a} - 3\mathbf{c} + \mathbf{b}$$

$$\Rightarrow 2 \begin{pmatrix} -3 \\ 2 \end{pmatrix} - 3 \begin{pmatrix} -4 \\ -1 \end{pmatrix} + \begin{pmatrix} -5 \\ -7 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 2 \times (-3) \\ 2 \times 2 \end{pmatrix} - \begin{pmatrix} 3 \times (-4) \\ 3 \times (-1) \end{pmatrix} + \begin{pmatrix} -5 \\ -7 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} -6 \\ 4 \end{pmatrix} - \begin{pmatrix} -12 \\ -3 \end{pmatrix} + \begin{pmatrix} -5 \\ -7 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} -6 - (-12) + (-5) \\ 4 - (-3) + (-7) \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} -6+12-5 \\ 4+3-7 \end{pmatrix}$$

$$\Rightarrow \underline{\underline{\begin{pmatrix} 1 \\ 0 \end{pmatrix}}}$$

4 (a) Method 1 ([Unitary Approach – the value of one item](#))

If the sheep ratio, 4, corresponds to 1428,

then ratio, 1, corresponds to $\frac{1428}{4} = 357$

hence, goat ratio, 7, corresponds to $7 \times 357 = \underline{\underline{2499 \text{ goats}}}$

4 (a) Method 2 ([Equivalent Fractions](#))

| | Ratio | Actual no. |
|-------|-------|------------|
| Sheep | 4 | 1428 |
| Goats | 7 | g |

From the table above, $\frac{4}{7} = \frac{1428}{g}$

$$\Rightarrow 4 \times g = 1428 \times 7$$

$$\Rightarrow \frac{4g}{4} = \frac{1428 \times 7}{4}$$

$$\Rightarrow g = 357 \times 7$$

$$\Rightarrow = \underline{\underline{2499 \text{ goats}}}$$

Cross-multiplying

Dividing both side by 4 to find g

4 (a) Method 3 ([The rule: If more, less divides ...](#))

If 4 \rightarrow 1428

Then 7 \rightarrow ? (more)

If more, less (i.e., 4) divides; \therefore we have

$$\frac{7}{4} \times 1428 \Rightarrow 7 \times 357 = \underline{\underline{2499 \text{ goats}}}$$

4 (a) Method 4 ([Equivalent ratios](#))

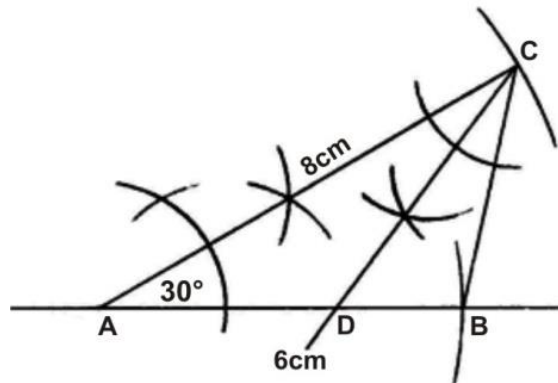
$$4 : 7 = 1428 : g$$

$$\Rightarrow \frac{4g}{4} = \frac{7 \times 1428}{4}$$

$$\Rightarrow g = 2499$$

$$\Rightarrow \underline{\underline{2499 \text{ goats}}}$$

4(b)



$$(i) \quad |AD| \approx 4 \text{ cm}, \quad |BD| \approx 2 \text{ cm}$$

$$(ii) \quad \begin{aligned} |AD| : |BD| &= 4\text{cm} : 2\text{cm} \\ &= \underline{\underline{2 : 1}} \end{aligned}$$

5 (a)(i) **Method 1** (Exterior angle = two opposite interior angles)

From the diagram,

$$\Rightarrow (x+17)^\circ + (2x+7)^\circ = (9x)^\circ$$

$$\Rightarrow x^\circ + 17^\circ + (2x)^\circ + 7^\circ = (9x)^\circ$$

$$\Rightarrow 17^\circ + 7^\circ = (9x)^\circ - x^\circ - (2x)^\circ$$

$$\Rightarrow 24^\circ = (6x)^\circ$$

$$\Rightarrow \frac{24}{6} = \frac{6x}{6}$$

$$\Rightarrow 4 = x$$

$$\Rightarrow \underline{\underline{x = 4}}$$

Exterior angle $(9x)^\circ$ = two
opposite interior angles
 $(x+17)^\circ$ and $(2x+7)^\circ$

Solving for x

5 (a)(i) Method 2 (Sum of interior angles of triangle = 180°)

From the diagram, $\angle ACB + (9x)^\circ = 180^\circ$

$$\angle ACB = 180^\circ - (9x)^\circ$$

$$\Rightarrow 180^\circ - (9x)^\circ + (x+17)^\circ + (2x+7)^\circ = 180^\circ$$

$$\Rightarrow 180^\circ - 180^\circ + (x+17)^\circ + (2x+7)^\circ = (9x)^\circ$$

$$\Rightarrow x^\circ + 17^\circ + (2x)^\circ + 7^\circ = (9x)^\circ$$

$$\Rightarrow 17^\circ + 7^\circ = (9x)^\circ - x^\circ - (2x)^\circ$$

$$\Rightarrow 24^\circ = (6x)^\circ$$

$$\Rightarrow \frac{24}{6} = \frac{6x}{6}$$

$$\Rightarrow 4 = x$$

$$\Rightarrow \underline{\underline{x = 4}}$$

Sum of angles at a point
on a straight line = 180°

Sum of interior angles
of triangle = 180°

$$\mathbf{5 (a)(ii)} \quad \angle ACB + (9x)^\circ = 180^\circ$$

$$\angle ACB + (9 \times 4)^\circ = 180^\circ$$

$$\angle ACB + 36^\circ = 180^\circ$$

$$\angle ACB = 180^\circ - 36^\circ$$

$$\underline{\underline{\text{Angle ACB} = 144^\circ}}$$

Sum of angles at a point
on a straight line = 180°

$$\begin{aligned} \mathbf{5 (b) (i)} \quad I &= \frac{PTR}{100} = \frac{3,600 \times 2 \times 15}{100} \\ &= 36 \times 2 \times 15 = 1080 \end{aligned}$$

$$\text{Simple interest} = \underline{\underline{\text{GH}\text{\textcent}1,080.00}}$$

5 (b) (ii) Method 1

$$I = \frac{PTR}{100}$$

$$100 \times I = \frac{PTR}{100} \times 100$$

Multiplying both sides by 100
to clear fraction

$$\Rightarrow 100 \times I = PTR$$

$$\frac{100 \times I}{PT} = \frac{PTR}{PT}$$

$$\Rightarrow \frac{100 \times I}{PT} = R$$

$$\Rightarrow R = \frac{100 \times I}{PT}$$

$$\Rightarrow \underline{\underline{R = \frac{100 I}{PT}}}$$

Dividing both sides by PT to make R the subject

Switching positions

5 (b) (ii) Method 2

$$I = \frac{PTR}{100}$$

$$100 \times I = PTR$$

$$\Rightarrow \frac{100 \times I}{PT} = \frac{PTR}{PT}$$

$$\Rightarrow \frac{100 \times I}{PT} = R$$

$$\Rightarrow R = \frac{100 \times I}{PT}$$

$$\Rightarrow \underline{\underline{R = \frac{100 I}{PT}}}$$

Cross-multiplying

Dividing both sides by PT

Switching positions

5 (b) (ii) Method 3

$$I = \frac{PTR}{100}$$

$$\frac{100}{PT} \times I = \frac{100}{PT} \times \frac{PTR}{100}$$

$$\Rightarrow \frac{100 \times I}{PT} = R$$

$$\Rightarrow R = \frac{100 \times I}{PT}$$

$$\Rightarrow \underline{\underline{R = \frac{100 I}{PT}}}$$

Multiplying both sides by $\frac{100}{PT}$
to remove $\frac{PT}{100}$

Switching positions

5 (b) (iii) Approach 1 (Substitute values in the expression for R)

Using the result obtained in (ii) above

$$R = \frac{100 I}{PT}$$

Substituting and
simplifying to find R

$$\Rightarrow R = \frac{100 \times 2,400}{6,000 \times 2}$$

$$\Rightarrow R = \frac{100 \times 2,400}{6,000 \times 2} = 20$$

$$\Rightarrow \text{The rate} = \underline{\underline{20\%}}$$

Approach 2 (Substitute values in the given expression for Simple Interest)

Substituting in $I = \frac{PTR}{100}$, we have

$$2,400 = \frac{6,000 \times 2 \times R}{100}$$

Substituting and
solving for R

$$\Rightarrow \frac{2,400 \times 100}{6,000 \times 2} = R$$

Simplifying to find R

$$\Rightarrow R = 20$$

$$\Rightarrow \text{The rate} = \underline{\underline{20\%}}$$

NB:

In actual fact, the simple interest, I, on a principal, P, at a rate, R, over a time, T, is given by $I = PTR$, (not $\frac{PTR}{100}$)

[the $\frac{PTR}{100}$ is on account of the rate being usually expressed as a percentage]

Hence, if for instance, $P = \text{GH¢}6000$, $T = 3$ years and $R = 15\%$

$$\begin{aligned} \text{Then Simple interest} &= P \times T \times R \\ &= 6000 \times 3 \times 15\% \\ &= 6000 \times 3 \times \frac{15}{100} \\ &= \underline{\underline{\text{GH¢ } 2700}} \end{aligned}$$

Not

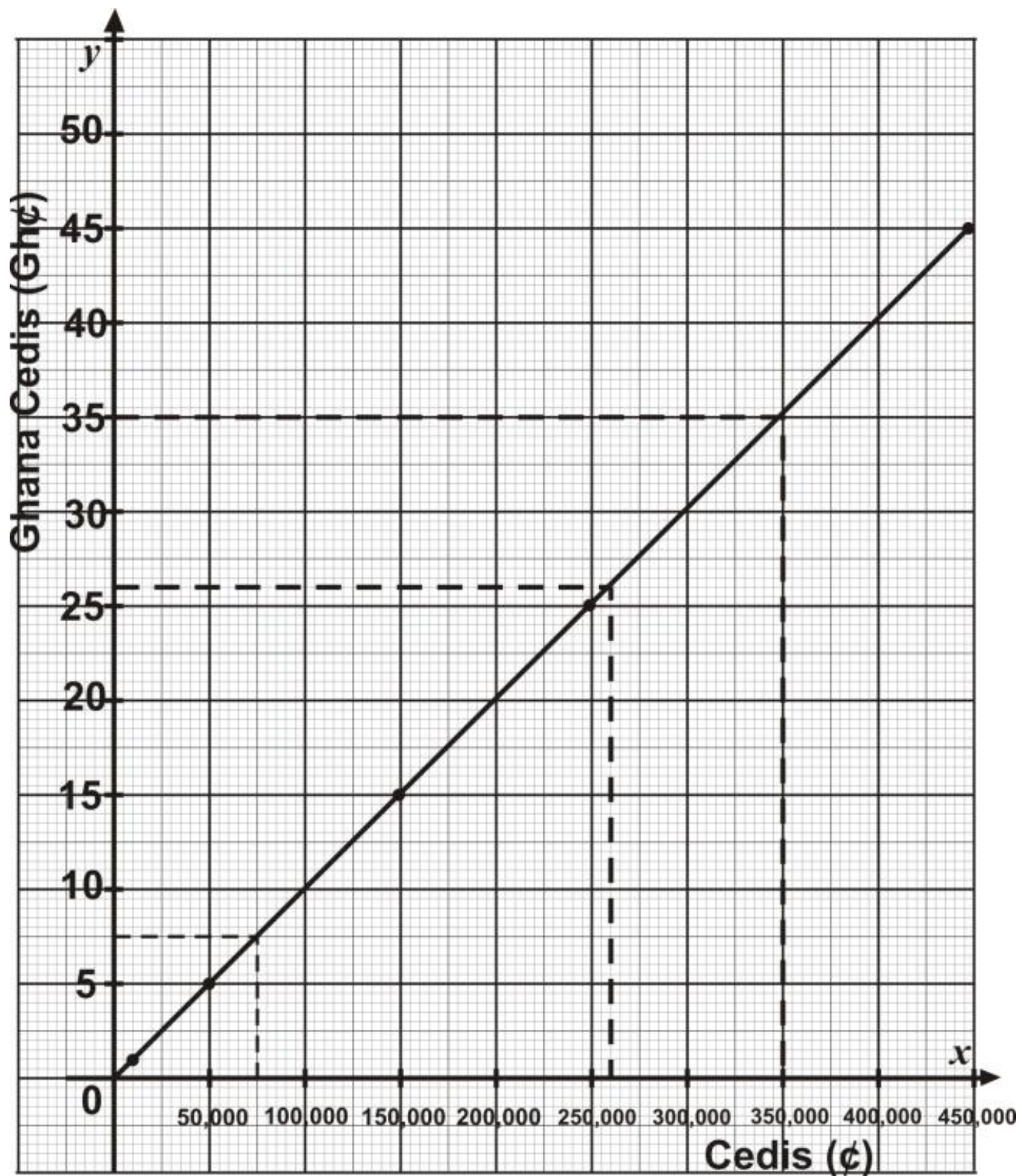
$$\begin{aligned} &\frac{P \times T \times R}{100}, \\ \Rightarrow &\frac{6000 \times 3 \times 15\%}{100} \\ &= \frac{6000 \times 3 \times 15}{100 \times 100}, \text{ which is clearly } \underline{\underline{\text{incorrect}}}. \end{aligned}$$

However, for ease of instruction, one may still accept $I = \frac{PTR}{100}$, though I would rather we do not.

6(a) Using the idea of simple proportion, the table is completed as shown below:

| | | | | | | |
|--------------|--------|--------|---------|---------|---------|---------|
| $\phi(x)$ | 10,000 | 50,000 | 150,000 | 250,000 | 350,000 | 450,000 |
| GH $\phi(y)$ | 1 | 5 | 15 | 25 | 35 | 45 |

6 (b), (c) The straight line graph is shown below



6 (d) From the graph, the value of

(i) GH¢8.00 = ¢ 80,000.00

(ii) GH¢35.00 = ¢350,000.00

(iii) ₺260,000.00 = GH₺26,000.00

April 2008

MATHEMATICS 1

OBJECTIVE TEST

1 hour

1. $M = \{1, 2, 3, 4, 5, \dots, 20\}$, $Q = \{3, 4, 5, 6, 7, 8\}$ and $R = \{2, 3, 5, 7\}$
If Q and R are subsets of M, find $Q \cap R$.
A. $\{3, 5\}$ B. $\{5, 7\}$ C. $\{3, 5, 7\}$ D. $\{2, 3, 5, 7\}$
2. List the members of the set $\{2 \leq x \leq 5\}$
A. $\{2, 5\}$ B. $\{2, 3, 4\}$ C. $\{2, 3, 5\}$ D. $\{2, 3, 4, 5\}$
3. Round 8921465 to the nearest hundred
A) 8921000 B) 8921400 C) 8921460 D) 8921500
4. Write 98 as a product of its prime factors
A) 2×7 B) $2^2 \times 7$ C) 2×7^2 D) $2^2 \times 7^2$
5. Evaluate $4(8-2) + 5(3-8)$
A) -31 B) -1 C) 37 D) 49
6. Arrange the following in descending order of magnitude: 0.32 , $\frac{2}{5}$, 27% , $\frac{1}{3}$
A) $0.32, \frac{2}{5}, 27\%, \frac{1}{3}$
B) $0.32, \frac{1}{3}, \frac{2}{5}, 27\%$
C) $27\%, 0.32, \frac{1}{3}, \frac{2}{5}$
D) $\frac{2}{5}, \frac{1}{3}, 0.32, 27\%$
7. The ratio 8:12 is equivalent to y:9. What is the value of y?
A) 4 B) 5 C) 6 D) 7
8. Write 0.55 as a fraction in its lowest term

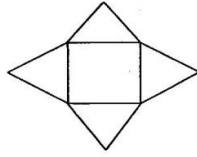
A) $11/200$

B) $11/20$

C) $11/2$

D) $11/5$

9. Which solid figure can be made from the net below?



- A) Triangular prism
B) Square pyramid
C) Triangular pyramid
D) Cuboid
10. Simplify $5w + 7p^2 - 4w + 3p^2$
A) $9w + 10p^2$ B) $w + 10p^2$ C) $w + 4p^2$ D) $9w + 4p^2$
11. Osei bought a hat for GH¢5.00. He sold it to Yaovi at a profit of 20%. How much did Yaovi pay for the hat?
A) GH¢4.80 B) GH¢5.50 C) GH¢6.00 D) GH¢7.00
12. Simplify $2^9 \div 2^3$
A) 2^3 B) 2^6 C) 2^{12} D) 2^{27}
13. Find the image of -3 under the mapping $x \rightarrow 2(x+3)$
A) 0 B) 2 C) 6 D) 12
14. A football field is 120 m long and 75 m wide. What is the perimeter of the field?
A) 195 m B) 390 m C) 780 m D) 900 m
15. A tank holds 240 litres of water. How much water is in the tank when it is $\frac{4}{5}$ full?
A) 60 litres B) 132 litres C) 192 litres D) 240 litres
16. A man has $6x$ sheep and $5y$ goats. He sells $3x$ sheep and $2y$ goats. How many animals are left after the sales?

A) $3x-3y$

B) $3x+3y$

C) $9x-5y$

D) $9x+5y$

The table below shows the average rainfall in a town from March 2003 to August 2003.

| Month | Mar | Apr | May | Jun | Jul | Aug |
|---------------|-----|-----|-----|-----|-----|-----|
| Rainfall (mm) | 96 | 147 | 281 | 452 | 265 | 139 |

17. What was the total amount of rainfall in May, June and July?

A) 696mm B) 930mm C) 998mm D) 1020mm

18. What was the mean rainfall in the town over the six months?

A) 230mm B) 281mm C) 366mm D) 452mm

19. A trader buys a dozen pens at GH¢4.80 and sells them at 48Gp each. Find her percentage profit.

A) 5% B) 10% C) 15% D) 20%

20. Find the angle through which the minute hand of a clock moves from 5:15pm to 5:25pm

A) 30° B) 45° C) 60° D) 120°

21. If $E = \{\text{prime numbers between 10 and 20}\}$ and $F = \{\text{odd numbers between 0 and 16}\}$, find $E \cap F$.

A. $\{11\}$ B. $\{11,13\}$ C. $\{3,11,13\}$ D. $\{3,11,13,15\}$

22. Write 17_{ten} as a base two numeral.

A) 1001 B) 10001 C) 11001 D) 11011

23. What fraction of a revolution is 72°

A) $\frac{1}{6}$ B) $\frac{1}{5}$ C) $\frac{2}{5}$ D) $\frac{5}{8}$

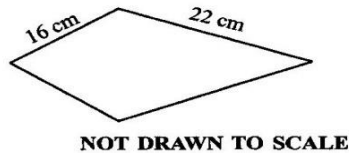
24. Express 6 days is to 3 weeks as a ratio in its simplest form

A) 1:2 B) 2:1 C) 2:7 D) 7:2

25. The letters in the word HIPPOPOTAMUS are placed in a box. What is the probability of taking out a letter that is a vowel?

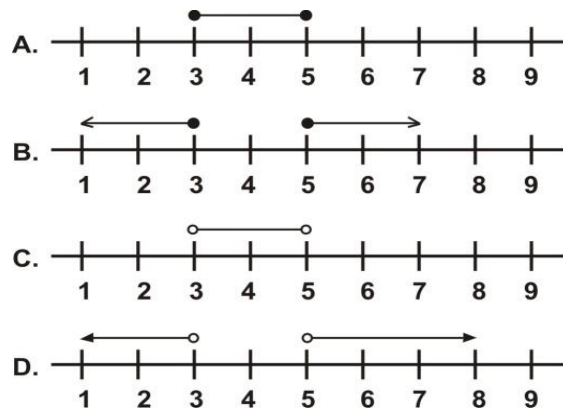
A) $\frac{1}{12}$ B) $\frac{3}{12}$ C) $\frac{5}{12}$ D) $\frac{7}{12}$

26. Find the perimeter of the kite below.



A) 38cm B) 64cm C) 76cm D) 88cm

27. Illustrate $3 < x < 5$ on the number line, where $x \in \{\text{rational numbers}\}$



28. How many lines of symmetry has an equilateral triangle?

A) 1 B) 2 C) 3 D) 4

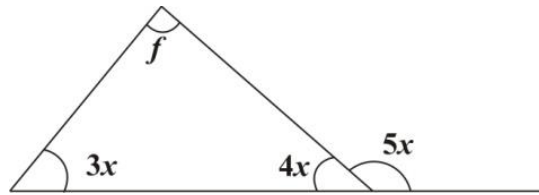
29. If $\mathbf{p} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$, find $4\mathbf{p} - 2\mathbf{q}$.

A. $\begin{pmatrix} 12 \\ -2 \end{pmatrix}$ B. $\begin{pmatrix} 12 \\ 2 \end{pmatrix}$ C. $\begin{pmatrix} 20 \\ -2 \end{pmatrix}$ D. $\begin{pmatrix} 20 \\ 2 \end{pmatrix}$

30. Which of the following is not a quadrilateral?

A) Hexagon
B) kite
C) Rectangle
D) Trapezium

Use the figure below to answer Questions 31 and 32



31. Find the value of x
- A) 20° B) 30° C) 40° D) 50°
32. What is the value of f ?
- A) 10° B) 20° C) 40° D) 80°
33. Solve $\frac{4k}{9} = 12$
- A) 23 B) 25 C) 27 D) 29
34. Expand $(a + 4)(a + 6)$
- A) $2a+24$ B) $a^2+6a+10$ C) $a^2+10a+10$ D) $a^2+10a+24$
35. Find $12\frac{1}{2}\%$ of GH¢80.00
- A) GH¢8.00 B) GH¢10.00 C) GH¢12.00 D) GH¢12.50
36. Write the number 34.1 in standard form
- A) 3.41×10^{-2}
B) 3.41×10^{-1}
C) 3.41×10^0
D) 3.41×10
37. Simplify $\frac{30}{5(-2)}$
- A) -10 B) -6 C) -3 D) 3

38. Find the highest common factor of 15 and 21.

- A) 1 B) 3 C) 5 D) 7

39. The difference between two numbers is 168. If the smaller number is 113, find the other number

- A) 223 B) 271 C) 281 D) 291

40. If $\mathbf{r} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$ and $\mathbf{t} = \begin{pmatrix} -2 \\ -3 \end{pmatrix}$, evaluate $\mathbf{r} + \mathbf{t}$.

- A. $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$ B. $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ C. $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ D. $\begin{pmatrix} 4 \\ 8 \end{pmatrix}$

April 2008

MATHEMATICS 1

OBJECTIVE TEST

SOLUTIONS

1. C. {3,5,7}
2. D. {2,3,4,5}
3. D) 8921500
4. C) 2×7^2
5. B) -1
6. D) $\frac{2}{5}$, $\frac{1}{3}$, 0.32, 27%
7. C) 6
8. B) $\frac{11}{20}$
9. B) Square pyramid
10. B) $w+10p^2$
11. C) GH¢6.00
12. B) 2^6
13. A) 0
14. B) 390 m
15. C) 192 litres
16. B) $3x+3y$
17. C) 998mm

18. A) 230mm

19. D) 20%

20. C) 60°

21. B. $\{11,13\}$

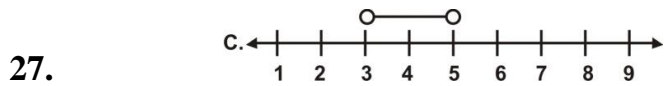
22. B) 10001

23. B) $1/5$

24. C) 2:7

25. C) $5/12$

26. C) 76 cm



28. C) 3

29. C. $\begin{pmatrix} 20 \\ -2 \end{pmatrix}$

30. A) Hexagon

31. A) 20°

32. C) 40°

33. C) 27

34. D) $a^2+10a+24$

35. B) GH¢10.00

36. D) 3.41×10

37. C) -3

38. B) 3

39. C) 281

40. B. $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$

April 2008

MATHEMATICS 2

ESSAY

1 hour

[60 marks]

*Answer **four** questions **only** from this section*

All working must be clearly shown.

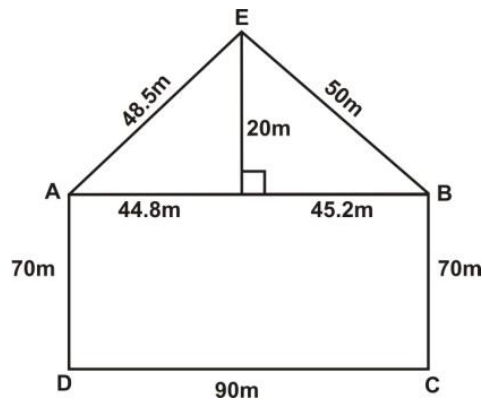
*The use of calculators is **not** allowed*

*Marks will **not** be awarded for correct answers without corresponding working.*

All questions carry equal marks

1. (a) E and F are subsets of the universal set U such that
 $U = \{\text{natural numbers less than } 15\}$,
 $E = \{\text{even numbers between } 1 \text{ and } 15\}$ and
 $F = \{\text{multiples of } 4 \text{ between } 9 \text{ and } 15\}$.
- (i) List the elements of U, E and F
- (ii) Draw a Venn diagram to show the sets U, E and F
- (b) In a school, $\frac{7}{10}$ of the pupils like Mathematics. Half of those pupils who like Mathematics are girls. If there are 240 pupils altogether in the school, how many girls like Mathematics?
- (c) A typist charges 28Gp for the first five sheets and 8Gp for each additional sheet she types. How much will she earn, if she types 36 sheets?

2.



The diagram AEB CD shows the shape of Mr. Awuah's garden, which is made up of a rectangular portion ABCD and a triangular portion AEB.

$|AB| = |DC| = 90\text{m}$, $|AD| = |BC| = 70\text{m}$, $|AE| = 48.5\text{m}$ and $|EB| = 50\text{m}$. The height of the triangle is 20m .

- (a) Find the
- Area of ABCD
 - Area of AEB
 - Total area of the garden
 - Perimeter of the garden.

- (b) Find the value of x if $\frac{3x-2}{5}$ is greater than $\frac{1-4x}{10}$ by 5.

3. (a) A traffic survey gave the results shown in the table below.

| Vehicle | Car | Lorry | Bus | Bicycle |
|-----------|-----|-------|-----|---------|
| Frequency | 15 | 12 | 8 | 25 |

- Represent the information on a pie chart.
 - What percentage of the vehicles were lorries?
- (b) Akosua was granted a loan of GH¢96.00. The interest rate was 24% per annum. Calculate the
- Interest at the end of the year
 - Total amount she had to pay at the end of the year.
 - Amount she still owes, if Akosua was able to pay only GH¢60.00 at the end of the year

4. (a) Copy and complete the table of values for the relations

$$y_1 = 2x+5 \quad \text{and} \quad y_2 = 3-2x \quad \text{for } x \text{ from } -4 \text{ to } 3$$

| | | | | | | | | |
|------------|----|----|----|----|---|---|---|----|
| x | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| $y_1=2x+5$ | -3 | | | 3 | | 7 | | 11 |
| $y_2=3-2x$ | 11 | 9 | | 5 | | | | -3 |

(b) (i) Using a scale of 2cm to 1 unit on the x - axis and 2cm to 2 units on the y -axis, draw two perpendicular axes OX and OY on a graph sheet.

(ii) On the same graph sheet draw the graphs of the relations
 $y_1 = 2x+5$ and $y_2 = 3-2x$

(c) Find the coordinates of the point where y_1 and y_2 meet.

(d) The vectors $p = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$, $q = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$ and $r = \frac{1}{2}(q + p)$. Find the vector r

5. (a) Using a ruler and a pair of compasses only,

- construct triangle ABC with sides $|AB|=7\text{cm}$, $|BC|=8\text{cm}$ and $|AC|=9\text{cm}$;
- draw the perpendicular bisectors of the three sides;
- locate the point of the intersection, O, of the perpendicular bisectors;
- With centre O and radius OA, draw a circle to pass through the vertices of the triangle.

(b) Measure and write down the radius of the circle you have drawn in a) (iv)

(c) Find the product of $(2x - 3)$ and $(x - 1)$

6. (a) The marks obtained by 20 pupils in a test were as follows:

| | | | |
|---|---|---|---|
| 4 | 8 | 7 | 6 |
| 2 | 1 | 7 | 4 |
| 3 | 7 | 6 | 4 |
| 7 | 5 | 2 | 7 |
| 5 | 4 | 8 | 3 |

- Construct a frequency distribution table for this data
- What is the mode of the distribution?
- Calculate the mean mark

(iv) What percentage of the pupils passed, if the pass mark is 6?

(v) What is the probability that a pupil selected at random scored **not** more than 5 marks?

(b) Simplify $7\frac{2}{3} - 4\frac{5}{6} + 2\frac{3}{8}$

April 2008

MATHEMATICS 2

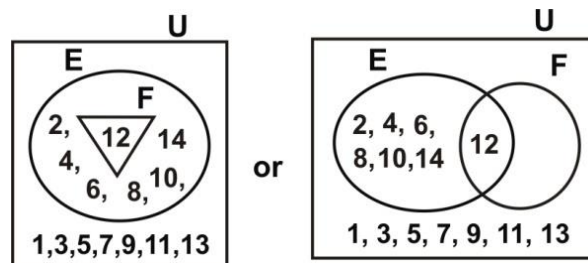
ESSAY

SOLUTIONS

1 (a) (i)

$$\begin{aligned}U &= \{1, 2, 3, 4, \dots, 14\} \\E &= \{2, 4, 6, 8, 10, 12, 14\} \\F &= \{12\}\end{aligned}$$

(ii)



1 (b) Method 1

$$\begin{aligned}& \frac{7}{10} \text{ of } 240 \text{ pupils like Mathematics} \\ \Rightarrow & \frac{7}{10} \times 240 \text{ pupils like Mathematics} \\ = & 7 \times 24 = 168 \\ \Rightarrow & 168 \text{ pupils like Mathematics}\end{aligned}$$

But half of 168 pupils who like Mathematics are girls

$$\begin{aligned}\Rightarrow & \frac{1}{2} \text{ of } 168 \text{ pupils are girls who like Mathematics} \\ \Rightarrow & \frac{1}{2} \times 168 \text{ pupils} \\ \Rightarrow & \underline{84 \text{ girls like Mathematics}}\end{aligned}$$

1 (b) Method 2

Half of pupils who like Mathematics are girls

$$\Rightarrow \frac{1}{2} \text{ of } \frac{7}{10} \text{ of } 240 \text{ pupils}$$

$$\Rightarrow \frac{1}{2} \times \frac{7}{10} \times 240$$

$$\Rightarrow \frac{7}{20} \times 240$$

$$\Rightarrow 84$$

$$\Rightarrow \underline{84 \text{ girls}} \text{ like Mathematics}$$

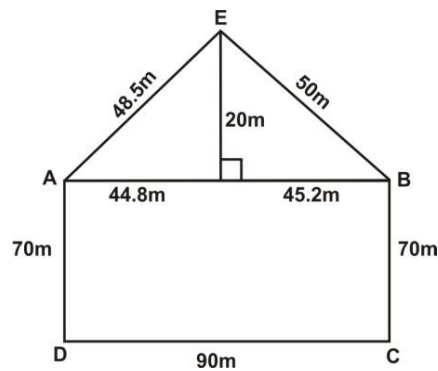
1 (c) Charge for: First 5 sheets = 28 Gp

$$\text{remaining 31 sheets} = 31 \times 8 \text{ Gp} = 248 \text{ Gp}$$

$$\text{Charge for typing 36 sheets} = \text{first 5 sheets} + \text{remaining 31 sheets}$$

$$= 28\text{Gp} + 248\text{Gp}$$

$$= \underline{276 \text{ Gp}} \quad \text{or } \underline{\text{GH}\text{\textcent}2.76}$$



2 (a) (i) Area of ABCD (rectangle)

$$= \text{Length} \times \text{width}$$

$$= 90\text{m} \times 70\text{m}$$

$$= \underline{6300 \text{ m}^2}$$

(ii) Area of AEB (triangle)

$$= \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 90\text{m} \times 20\text{m}$$

$$= \underline{900 \text{ m}^2}$$

(iii) Total area of the garden

$$= \text{ABCD area} + \text{AEB area}$$

$$= 6300 \text{ m}^2 + 900 \text{ m}^2$$

$$= \underline{7200 \text{ m}^2}$$

(iv) Perimeter of garden (Distance around garden)

From the base in the anticlockwise direction,

$$\text{Perimeter} = 90\text{m} + 70\text{m} + 50\text{m} + 48.5\text{m} + 70\text{m}$$

$$= \underline{328.5 \text{ m}}$$

2 (b) If $\frac{3x-2}{5}$ is greater than $\frac{1-4x}{10}$ by 5, then

$$\Rightarrow \frac{3x-2}{5} - \frac{1-4x}{10} = 5$$

Approach 1 [\(Simplifying the LHS first\)](#)

$$\frac{2(3x-2) - (1-4x)}{10} = 5$$

$$\Rightarrow \frac{6x - 4 - 1 + 4x}{10} = 5$$

$$\Rightarrow \frac{6x + 4x - 4 - 1}{10} = 5$$

$$\Rightarrow \frac{10x - 5}{10} = 5$$

$$\Rightarrow 10x - 5 = 5 \times 10$$

$$\Rightarrow 10x = 50 + 5$$

$$\Rightarrow \frac{10x}{10} = \frac{55}{10}$$

$$\Rightarrow \underline{\underline{x = 5.5}} \quad \text{or} \quad \underline{\underline{5\frac{1}{2}}}$$

2 (b) Approach 2 [\(Multiplying by 10 to clear fractions first\)](#)

$$10 \times \left(\frac{3x-2}{5} \right) - 10 \times \left(\frac{1-4x}{10} \right) = 10 \times 5$$

$$\Rightarrow 2 \times (3x - 2) - (1 - 4x) = 50$$

$$\Rightarrow 6x - 4 - 1 + 4x = 50$$

$$\Rightarrow 6x + 4x - 1 - 4 = 50$$

$$\Rightarrow 10x - 5 = 50$$

$$\Rightarrow 10x = 50 + 5$$

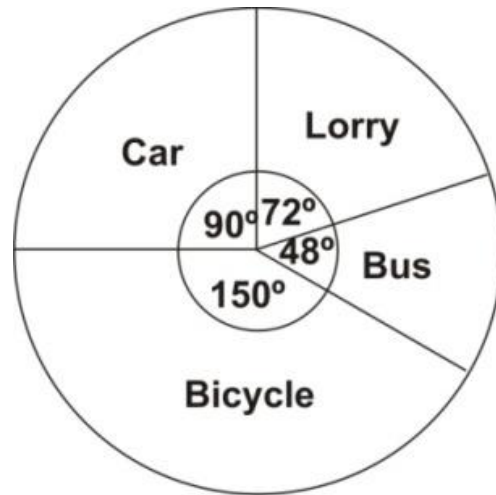
$$\Rightarrow \frac{10x}{10} = \frac{55}{10}$$

$$\Rightarrow \underline{\underline{x = 5.5}} \quad \text{or} \quad \underline{\underline{5\frac{1}{2}}}$$

3 (a) (i)

| Vehicle | Frequency | Angle of sector |
|----------------|-----------|--|
| Car | 15 | $\frac{15}{60} \times 360^\circ = 90^\circ$ |
| Lorry | 12 | $\frac{12}{60} \times 360^\circ = 72^\circ$ |
| Bus | 8 | $\frac{8}{60} \times 360^\circ = 48^\circ$ |
| Bicycle | 25 | $\frac{25}{60} \times 360^\circ = 150^\circ$ |
| TOTAL | 60 | 360° |

Pie chart showing results of a traffic survey



$$\begin{aligned}
 \text{3 (a) (ii)} \quad \text{Percentage of lorries} &= \frac{\text{No. of lorries}}{\text{Total no. of vehicles}} \times 100\% \\
 &= \frac{12}{60} \times 100\% \\
 &= \underline{20\%} \\
 &\Rightarrow \underline{20\% \text{ of the vehicles were lorries}}
 \end{aligned}$$

$$\begin{aligned}
 \text{3 (b) (i)} \quad \text{Simple interest} &= \text{Principal} \times \text{Rate} \times \text{Time} \\
 &= 96 \times 24\% \times 1 \\
 &= 96 \times \frac{24}{100} \times 1 = \frac{96 \times 24}{100} \\
 &= \frac{2304}{100} = \underline{23.04}
 \end{aligned}$$

The simple interest is GH¢23.04

$$\begin{aligned}
 \text{(ii)} \quad \text{Total amount to pay} &= \text{Principal} + \text{S. Interest} \\
 &= \text{GH¢96.00} + \text{GH¢23.04} \\
 &= \underline{\text{GH¢ 119.04}}
 \end{aligned}$$

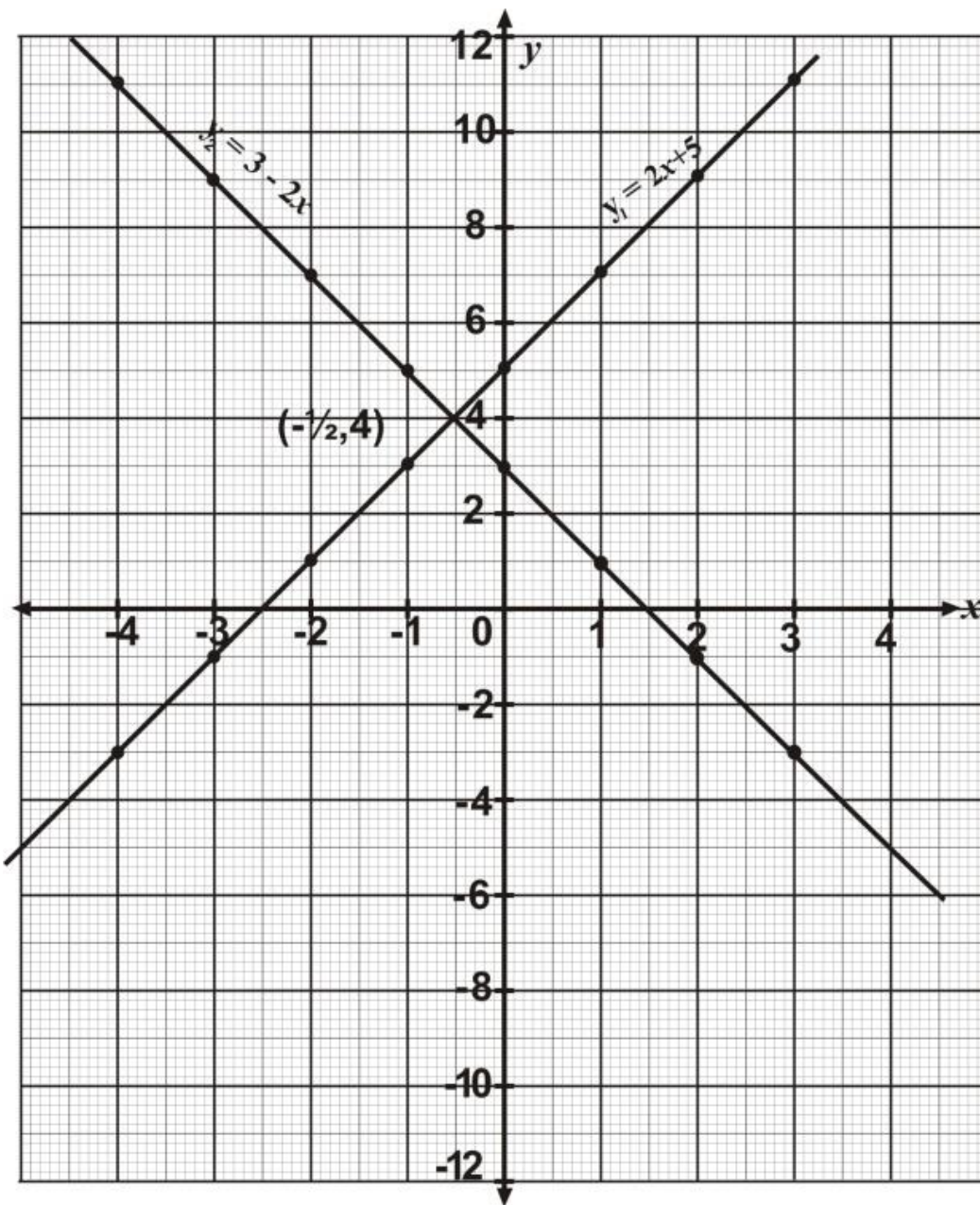
$$\begin{aligned}
 \text{(iii)} \quad \text{Amount still owed} &= \text{Total amount} - \text{amount paid} \\
 &= \text{GH¢ } 119.04 - \text{GH¢ } 60.00 \\
 &= \underline{\underline{\text{GH¢ } 59.04}}
 \end{aligned}$$

4 (a) (i) By substitution of the x values in the given relations, the table is completed as shown

below:

| | | | | | | | | |
|----------------|----|----|----|----|---|---|----|----|
| x | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| $y_1 = 2x + 5$ | -3 | -1 | 1 | 3 | 5 | 7 | 9 | 11 |
| $y_2 = 3 - 2x$ | 11 | 9 | 7 | 5 | 3 | 1 | -1 | -3 |

4 (b) The straight line graph is shown below



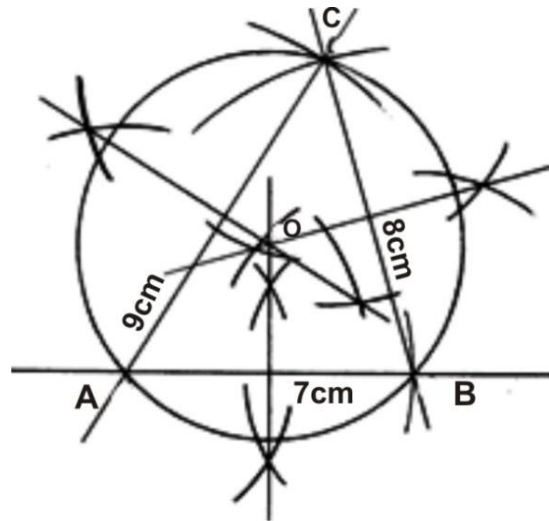
4 (c) y_1 and y_2 meet at $(-0.5, 4)$

4 (d) $\mathbf{r} = \frac{1}{2}(\mathbf{q} + \mathbf{p})$

$$= \frac{1}{2} \left[\begin{pmatrix} 2 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix} \right] = \frac{1}{2} \begin{pmatrix} 2+2 \\ 5+3 \end{pmatrix}$$

$$= \frac{1}{2} \begin{pmatrix} 4 \\ 8 \end{pmatrix} = \begin{pmatrix} \frac{1}{2} \times 4 \\ \frac{1}{2} \times 8 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 2 \\ 4 \end{pmatrix}}}$$

5 (a)



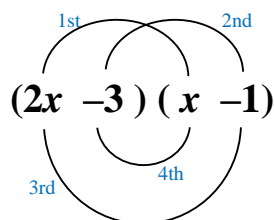
5 (b) Radius of circle \approx 4.7 cm

5 (c) The product of $(2x-3)$ and $(x-1)$

Approach 1 (Distributive property)

$$\begin{aligned} & \overbrace{(2x - 3)}^{(2x - 3)} \overbrace{(x - 1)}^{(x - 1)} \\ & \quad \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ & 2x(x - 1) - 3(x - 1) \\ = & 2x^2 - 2x - 3x + 3 \\ = & \underline{2x^2 - 5x + 3} \end{aligned}$$

Approach 2 (Smiley face)



1st: $2x \times x = 2x^2$

2nd: $-3 \times -1 = +3$

3rd: $2x \times -1 = -2x$

4th: $-3 \times x = -3x$

$$\Rightarrow 2x^2 + 3 - 2x - 3x$$

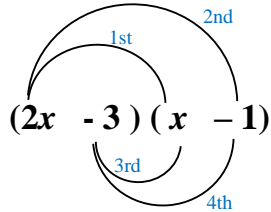
$$\Rightarrow 2x^2 - 2x - 3x + 3$$

$$\Rightarrow \underline{\underline{2x^2 - 5x + 3}}$$

Grouping like terms

$$-2x - 3x = -5x$$

Approach 3 (Moon shape)



$$\text{1st: } 2x \times x = 2x^2$$

$$\text{2nd: } 2x \times -1 = -2x$$

$$\text{3rd: } -3 \times x = -3x$$

$$2x^2 - 2x - 3x + 3$$

$$\Rightarrow \underline{\underline{2x^2 - 5x + 3}}$$

6 (a) (i)

| Mark | Tally | Frequency |
|------|-------|-----------|
| 1 | / | 1 |
| 2 | // | 2 |
| 3 | // | 2 |
| 4 | //// | 4 |
| 5 | // | 2 |
| 6 | // | 2 |
| 7 | ### | 5 |
| 8 | // | 2 |

6 (a) (ii)

Mode = The most occurring quantity

$$\Rightarrow \underline{\underline{\text{Mode} = 7 \text{ marks}}}$$

6 (a) (iii)

Method 1 (Using the raw data)

$$\text{The mean mark} = \frac{\text{The sum of marks}}{\text{The total number of pupils}}$$

$$\begin{aligned}
 &= \frac{(1 \times 1) + (2 \times 2) + (3 \times 2) + (4 \times 4) + (5 \times 2) + (6 \times 2) + (7 \times 5) + (8 \times 2)}{1 + 2 + 2 + 4 + 2 + 2 + 5 + 2} \\
 &= \frac{1 + 4 + 6 + 16 + 10 + 12 + 35 + 16}{20} \\
 &= \frac{100}{20} = \underline{\underline{5}}
 \end{aligned}$$

6 (a) (iii) **Method 2** [\(Using the frequency table\)](#)

| Mark (x) | Tally | Frequency (f) | fx |
|-------------|-------|-----------------------------------|-------------------------------------|
| 1 | / | 1 | 1 |
| 2 | // | 2 | 4 |
| 3 | // | 2 | 6 |
| 4 | //// | 4 | 16 |
| 5 | // | 2 | 10 |
| 6 | // | 2 | 12 |
| 7 | ### | 5 | 35 |
| 8 | // | 2 | 16 |
| | | $\Sigma f = 20$ | $\Sigma fx = 100$ |

$$\text{The mean} = \frac{\Sigma f x}{\Sigma f} = \frac{100}{20} = \underline{\underline{5}}$$

6 (a) (iv) Percentage of pupils who passed

$$\begin{aligned}
 &= \frac{\text{No. of pupils who passed (obtained 6 or more)}}{\text{Total no. of pupils}} \times 100\% \\
 &= \frac{2+5+2}{20} \times 100\% \\
 &= \frac{9}{20} \times 100\% \\
 &= \underline{\underline{45\%}} \\
 &\Rightarrow \underline{\underline{45\% \text{ of the pupils passed}}}
 \end{aligned}$$

6 (a) (v) Not more than 5 marks \Rightarrow 5 or less

Therefore, P (not more than 5 marks)

$$= \frac{\text{Number of pupils that obtained 5 or less marks}}{\text{Total number of pupils}}$$

$$= \frac{1 + 2 + 2 + 4 + 2}{1 + 2 + 2 + 4 + 2 + 2 + 5 + 2}$$

$$= \frac{11}{20}$$

6 (b)

Method 1 ([Evaluating whole number and fractions separately](#))

$$\begin{aligned} & 7\frac{2}{3} - 4\frac{5}{6} + 2\frac{3}{8} \\ \Rightarrow & 7 - 4 + 2 + \frac{2}{3} - \frac{5}{6} + \frac{3}{8} \\ \Rightarrow & 5 + \frac{16 - 20 + 9}{24} \\ \Rightarrow & 5 + \frac{5}{24} \\ = & \underline{\underline{5\frac{5}{24}}} \end{aligned}$$

6 (b)

Method 2 ([Changing mixed fractions to improper fractions](#))

$$\begin{aligned} & 7\frac{2}{3} - 4\frac{5}{6} + 2\frac{3}{8} \\ \Rightarrow & \frac{23}{3} - \frac{29}{6} + \frac{19}{8} \\ \Rightarrow & \frac{184 - 116 + 57}{24} \\ \Rightarrow & \frac{125}{24} \\ = & \underline{\underline{5\frac{5}{24}}} \end{aligned}$$

April 2007

MATHEMATICS 1

OBJECTIVE TEST

1 hour

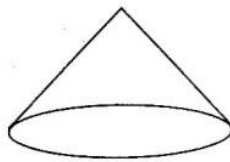
1. List the members of the set $P = \{\text{factors of 30 which are odd}\}$

- A) $P = \{2, 3, 5\}$
- B) $P = \{1, 2, 3, 5\}$
- C) $P = \{1, 3, 5, 15\}$
- D) $P = \{2, 6, 10, 30\}$

2. $M = \{g, o, q, s\}$ and $W = \{h, p, r, t\}$. Find $M \cup W$.

- A. $\{q, r, s, t\}$ B. $\{g, h, o, q, r\}$ C. $\{g, h, o, p, q, r, t\}$ D. $\{g, h, o, p, q, r, s, t\}$

3. Name the geometrical figure shown in the diagram below



- A) Cuboid
- B) cone
- C) pyramid
- D) sphere

4. Express $\frac{5}{16}$ as a decimal fraction

- A) 0.3333 B) 0.3125 C) 0.2667 D) 0.2500

5. If $y = -\frac{1}{2}x + 6$, find y when $x = 4$

- A) -2 B) 2 C) 4 D) 8

The marks obtained by 13 candidates in a test are 5, 7, 2, 9, 11, 10, 2, 12, 2, 9, 3, 18 and 2.

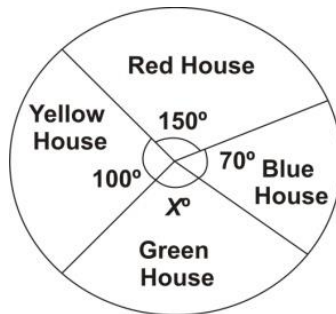
Use this information to answer Questions 6 and 7

6. What is the mode?

- A) 2 B) 5 C) 9 D) 18

7. Find the median

- A) 9 B) 7 C) 5 D) 2



The pie chart above shows the distribution of 360 pupils to various houses in a school.

Use this information to answer Question 8 and 9.

8. Find the value of the angle marked X°

- A) 30° B) 40° C) 100° D) 150°

9. How many more students are in Yellow house than in Blue house?

- A) 30 B) 40 C) 70 D) 100

10. Express 242 as a product of prime factors

- A) $2^2 \times 11^2$ B) 2×11^2 C) $2^2 \times 11$ D) 2×11

11. Change 110011_{two} to a number in base ten

- A) 51 B) 50 C) 48 D) 32

12. A boy throws a die once. What is the probability of getting the number 4?

- A) $\frac{1}{6}$ B) $\frac{1}{3}$ C) $\frac{1}{2}$ D) $\frac{5}{6}$

13. Arrange the following fractions from the highest to the lowest $\frac{5}{6}$, $\frac{4}{5}$ and $\frac{4}{7}$

- A) $\frac{4}{7}$, $\frac{4}{5}$, $\frac{5}{6}$
- B) $\frac{4}{5}$, $\frac{5}{6}$, $\frac{4}{7}$
- C) $\frac{5}{6}$, $\frac{4}{5}$, $\frac{4}{7}$
- D) $\frac{4}{7}$, $\frac{5}{6}$, $\frac{4}{5}$

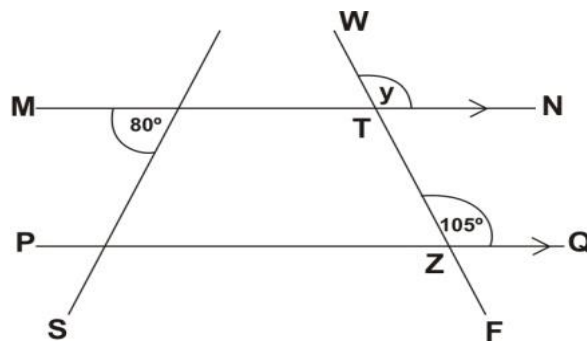
14. Solve the inequality $3x + 6 \leq 5x - 2$

- A) $x \leq 2$
- B) $x \geq 2$
- C) $x \leq 4$
- D) $x \geq 4$

15. If $8x - 3(2x - 4) = 4$, find the value of x

- A) -8
- B) -4
- C) 4
- D) 8

Use the diagram below to answer Questions 16 and 17



16. Find the size of angle y

- A) 75°
- B) 80°
- C) 100°
- D) 105°

17. Angles NTZ and QZT are ...

- A) alternate angles
- B) corresponding angles
- C) complementary angles
- D) supplementary angles

18. Factorize $\frac{1}{4}px^2 + \frac{1}{8}px$

- A) $\frac{1}{4}px(x + 2)$

B) $\frac{1}{4} px(x + \frac{1}{2})$

C) $\frac{1}{8} px(\frac{1}{2}x + 2)$

D) $\frac{1}{8} px(x + 2)$

19. Jojo and Fiifi shared an amount of money in the ratio 3:4 respectively. If Fiifi had ₵140,000 how much was shared?

A) ₵200,000.00

B) ₵220,000.00

C) ₵245,000.00

D) ₵280,000.00

20. Simplify $6(7a+4) - 3(8a+9)$

A) $18a-3$

B) $18a+51$

C) $42a-27$

D) $66a-3$

21. A man invested ₵500,000.00 at 15% simple interest per annum for 2 years. Calculate the amount at the end of the period

A) ₵350,000.00

B) ₵650,000.00

C) ₵750,000.00

D) ₵800,000.00

22. Make m the subject of $p = \frac{3m+1}{m}$

A) $m = 3p + 1$

B) $m = p - 3$

C) $m = \frac{1}{p-3}$

D) $m = \frac{3p+1}{p}$

23. Simplify $200 \times 0.01 \times 372$ leaving your answer in the standard form.

A) 74.4×10^1

B) 7.44×10^1

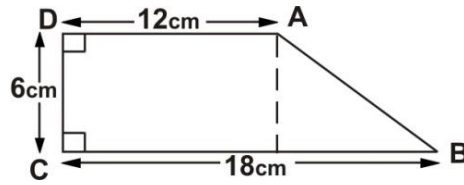
C) 7.44×10^2

D) 7.44×10^3

24. What percentage of 5 is 0.25?

- A) 4% B) 5% C) 20% D) 25%

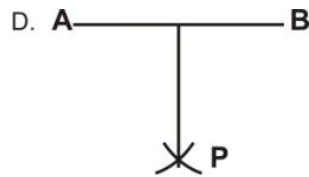
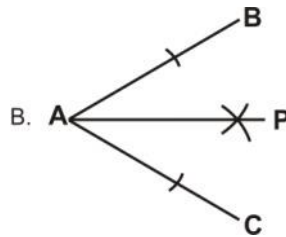
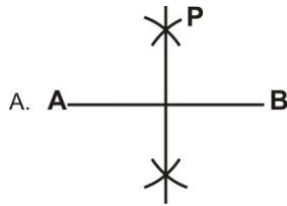
25.



Calculate the area of the figure ABCD above

- A) 72cm^2 B) 90cm^2 C) 108cm^2 D) 126cm^2

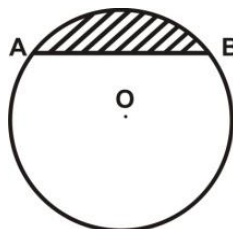
26. In which of the following constructions is P equidistant from the points A and B?



27. If $a:27 = 6:18$, find a

- A) 4 B) 9 C) 51 D) 81

28. The diagram below shows a circle with centre O. If A and B are points on the circle, what name is given to the shaded region?



- A) Chord B) Segment C) Sector D) arc

29. An amount of ₦5,400.00 is shared among three sisters in the ratio of their ages. Their ages are 10 years, 6 years and 2 years. Find the share of the youngest sister.

- A) ₦300.00 B) ₦600.00 C) ₦1,200.00 D) ₦1,800.00

30. Find the Least Common Multiple (LCM) of 4, 5 and 6.

- A) 20 B) 24 C) 30 D) 60

31. Expand $(a+2b)(a-2b)$

- A) $a^2 - 4ab - 4b^2$ B) $a^2 + 4ab - 4b^2$ C) $a^2 - 4b^2$ D) $a^2 + 4b^2$

32. If a woman was paid ₦180,000.00 for working for $4\frac{1}{2}$ days, how much would she be paid for one day?

- A) ₦40,000.00
B) ₦45,000.00
C) ₦54,000.00
D) ₦81,000.00

33. Express 0.68 as a fraction in its lowest term

- A) $\frac{7}{25}$ B) $\frac{17}{25}$ C) $\frac{3}{5}$ D) $\frac{7}{15}$

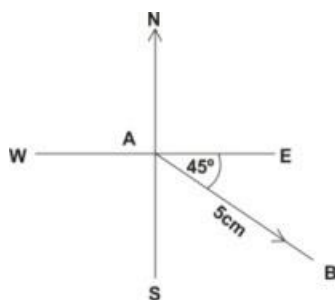
34. Write down all the integers within the interval $21 < y \leq 27$

- A. {21,22,23,24,25,26,27}
B. {22,23,24,25,26,27}
C. {21,22,23,24,25,26}
D. {22,23,24,25,26}

35. Simplify $(2^6 \times 3^4) \div (2^4 \times 3^2)$

- A) $2^2 \times 3^2$ B) $2^2 \times 3^6$ C) $2^{10} \times 3^2$ D) $2^{10} \times 3^6$

36.



Which of the following is represented by vector \overrightarrow{AB} in the diagram above?

- A. (5cm, 045°) B. (5cm, 135°) C. (5cm, 180°) D. (5cm, 225°)

37. Solve for y , if $3 + 3y = 1 - 13y$

- A) $-\frac{1}{8}$ B) $-\frac{1}{4}$ C) $\frac{1}{8}$ D) $\frac{1}{4}$

38. Convert 37_{ten} to a base two numeral

- A) 100101 B) 100111 C) 101101 D) 110101

39. The length of a rectangular playing field is 5 metres longer than its width. If the perimeter of the field is 150 metres, find its width.

- A) 30 m B) 35 m C) 40 m D) 45 m

40. If the vector $\mathbf{m} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{n} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$, find $\mathbf{m} - 2\mathbf{n}$

- A. $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ B. $\begin{pmatrix} 1 \\ -4 \end{pmatrix}$ C. $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$ D. $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$

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MATHEMATICS 1

OBJECTIVE TEST

SOLUTIONS

1. C) $P = \{1, 3, 5, 15\}$
2. D) $\{g, h, o, p, q, r, s, t\}$
3. B) cone
4. B) 0.3125
5. C) 4
6. A) 2
7. B) 7
8. B) 40°
9. A) 30
10. B) 2×11^2
11. A) 51
12. A) $\frac{1}{6}$
13. C) $\frac{5}{6}, \frac{4}{5}, \frac{4}{7}$
14. D) $x \geq 4$
15. B) -4
16. D) 105°
17. D) supplementary angles

18. B) $\frac{1}{4} px(x + \frac{1}{2})$

19. C) $\phi 245,000.00$

20. A) $18a-3$

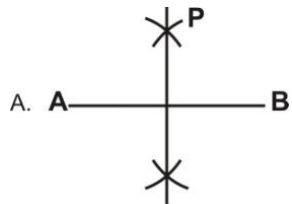
21. B) $\phi 650,000.00$

22. C) $m = \frac{1}{p-3}$

23. C) 7.44×10^2

24. B) 5%

25. B) 90 cm^2



26.

27. B) 9

28. B) Segment

29. B) $\phi 600.00$

30. D) 60

31. C) $a^2 - 4b^2$

32. A) $\phi 40,000.00$

33. B) $\frac{17}{25}$

34. B. $\{22,23,24,25,26,27\}$

35. A) $2^2 \times 3^2$

36. B. $(5\text{cm}, 135^\circ)$

37. A) $-\frac{1}{8}$

38. A) 100101

39.

B) 35 m

40.

D. $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$

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MATHEMATICS 2

ESSAY

1 hour

[60 marks]

Answer **four** questions **only** from this section

All working must be clearly shown.

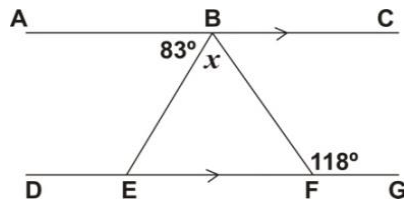
The use of calculators is **not** allowed

Marks will **not** be awarded for correct answers without corresponding working.

All questions carry equal marks

1. (a) In a class of 39 students, 19 offer French and 25 offer Ga. 5 students do not offer any of the two languages. How many students offer **only** French?

(b)



In the diagram above, AC is parallel to DG, angle BFG = 118° and angle ABE = 83° . Find the value of

- (i) Angle CBF
 - (ii) x
- (c) A fair die is thrown once,
- (i) Write down the set of all the possible outcomes
 - (ii) Find the probability of obtaining a multiple of 2
 - (iii) What is the probability of obtaining a prime number?

2. (a) A water tank in the form of a cuboid of height 22cm and a rectangular base of length 7cm and width 5cm is filled with water. The water is then poured into a cylindrical container of diameter 14cm. Calculate the height of the water in the cylindrical container.

(Take $\pi = \frac{22}{7}$)

- (b) A trader is given 15% discount on goods bought from a factory. If the original price of an item in the factory is ₦45,000,000, calculate
- the discount on the item
 - the amount the trader paid for the item
- (c) Find the truth set of $\frac{x-3}{3} \leq \frac{1}{2} + x$ and illustrate your answer on the number line.

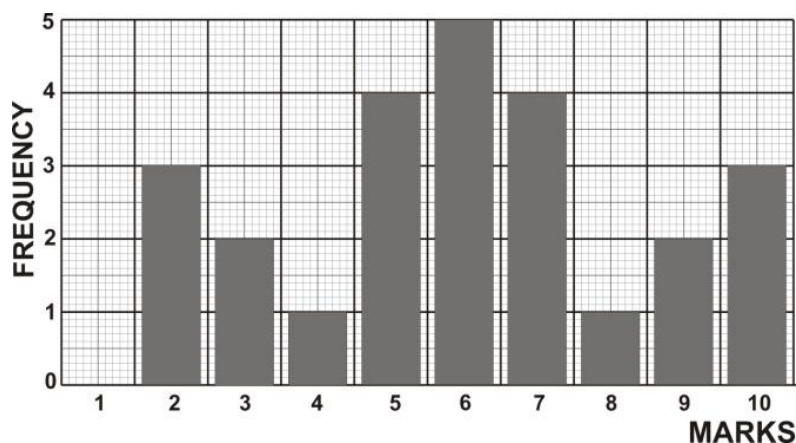
3. Using a ruler and a pair of compasses only,

- (a) Construct triangle PQR such that the length of PQ = 10cm, angle QPR = 90° and angle PQR = 30°

Measure the length of PR.

- (b) Bisect the angle QRP to meet PQ at M.
- (c) With M as centre, and radius MP draw a circle.
- (d) Measure the radius of the circle

4.



The Bar Chart above is for the distribution of marks in a class test

- (a) i) Write down the frequency table for the distribution
- ii) Use the table to find the mean mark
- (b) If the pass mark is 4, how many pupils **failed** the test?

5. (a) Mr. Jones used 173 units of electricity last month. If the charge for the first 110 units was ¢150 per unit and ¢200 per unit for the rest, calculate the total bill for Mr. Jones.
- (b) Express 4 hours in seconds leaving your answer in the standard form
- (c) Given the vectors $\mathbf{r} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$ and $\mathbf{p} = \begin{pmatrix} -7 \\ -9 \end{pmatrix}$, if $\mathbf{q} = 2\mathbf{p} - \mathbf{r}$, find \mathbf{q}
6. (a) Using a scale of 2cm to 2units on both axes, draw two perpendicular axes OX and OY on a graph sheet. On the same graph sheet, mark the x-axis from -10 to 10 and the y-axis from -10 to 10.
- (i) Plot A(2,2), B(6,2) and C(4,6). Join AB, BC and AC
- (ii) Draw the image triangle $A_1B_1C_1$ of triangle ABC under a clockwise rotation of 90° about the origin, where $A \rightarrow A_1$, $B \rightarrow B_1$ and $C \rightarrow C_1$.
- (iii) Draw the image triangle $A_2B_2C_2$ of triangle ABC under a reflection in the y-axis, where $A \rightarrow A_2$, $B \rightarrow B_2$ and $C \rightarrow C_2$
- (b) When 12 is added to a certain number and the sum is multiplied by 4, the result is 60. Find the number

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MATHEMATICS 2

ESSAY

SOLUTIONS

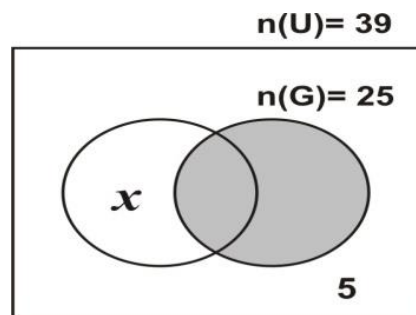
1 (a)

Method 1

Let $n(U)$ = No. of students in the class

$n(G)$ = No. of Ga students

x = No. of students that offer only French



From the Venn diagram above,

$$x + 25 + 5 = 39$$

$$x + 30 = 39$$

$$x = 39 - 30$$

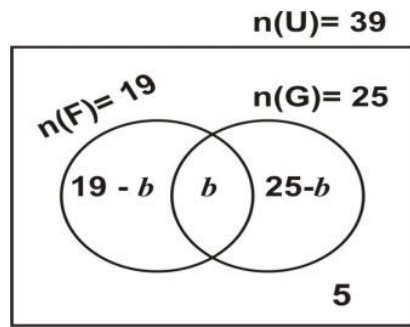
$$\underline{\underline{x = 9}}$$

Number of students that offer only French = 9

1 (a)

Method 2

Let b = No. of student that offer both French and Ga



From the above diagram,

$$19 - b + b + 25 - b + 5 = 39$$

$$\Rightarrow 19 + 0 + 25 - b + 5 = 39$$

$$\Rightarrow 19 + 25 + 5 - b = 39$$

$$\Rightarrow 49 - b = 39$$

$$\Rightarrow 49 - 39 = b$$

$$\Rightarrow b = 49 - 39$$

$$\Rightarrow b = 10$$

$$\begin{aligned} \text{But French only} &= n(F) - b \\ &= 19 - 10 = \underline{9} \end{aligned}$$

Therefore the number of students who offer only French 9

1 (b) (i) Method 1

Since $\angle CBF$ and $\angle BFG$ are Supplementary angles

$$\Rightarrow \angle CBF + \angle BFG = 180^\circ$$

$$\Rightarrow \angle CBF + 118^\circ = 180^\circ$$

$$\Rightarrow \angle CBF = 180^\circ - 118^\circ$$

$$\therefore \underline{\underline{\text{Angle CBF} = 62^\circ}}$$

1 (b) (i) Method 2

Since angles BFE and BFG lie on a straight line

$$\Rightarrow \angle BFE + \angle BFG = 180^\circ$$

$$\Rightarrow \angle BFE + 118^\circ = 180^\circ$$

$$\Rightarrow \angle BFE = 180^\circ - 118^\circ$$

$$\Rightarrow \angle BFE = 62^\circ$$

$$\text{But } \angle CBF = \angle BFE \quad (\text{Alternate angles})$$

$$\therefore \underline{\underline{\angle CBF = 62^\circ}}$$

1 (b) (ii) Since $\angle ABE$, x and $\angle CBF$ lie on a straight line,

$$\Rightarrow \angle ABE + x + \angle CBF = 180^\circ$$

$$\Rightarrow 83^\circ + x + 62^\circ = 180^\circ$$

$$\Rightarrow x = 180^\circ - 83^\circ - 62^\circ$$

$$\Rightarrow \underline{\underline{x = 35^\circ}}$$

NB: Triangle BEF could also be used to find the value of x

1 (c) (i) The set of all possible outcomes

$$= \{1, 2, 3, 4, 5, 6\}$$

1 (c) (ii) Multiples of 2 within the set = 2, 4, 6

$$\Rightarrow P(\text{multiple of 2}) = \frac{\text{Number of multiples of 2}}{\text{Total number of possible outcomes}}$$

$$= \frac{3}{6} = \frac{1}{2}$$

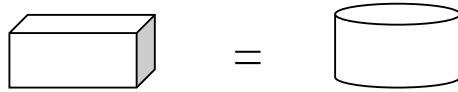
$$\text{The probability of obtaining a multiple of 2} = \frac{1}{2}$$

1 (c) (iii) Prime numbers within the set = 2, 3, 5

$$\Rightarrow P(\text{prime number}) = \frac{\text{Number of prime numbers}}{\text{Total number of possible outcomes}}$$

$$= \underline{\underline{\frac{3}{6} = \frac{1}{2}}}$$

2 (a) Volume of water in cuboid = Volume of water in cylinder



Let h_{cyl} = the height of water in the cylindrical container

and h_{cub} = the height of water in the cuboid

Method 1 **(Substituting values and solving for h_{cyl})**

Volume of water in cuboid = Volume of water in cylinder

Area of base cuboid \times height cuboid = Area of base cylinder \times height cylinder

$$\Rightarrow l \times w \times h_{cuboid} = \pi r^2 \times h_{cylinder}$$

$$\Rightarrow [7cm \times 5cm] \times 22cm = \left[\frac{22}{7} \times (7cm)^2\right] \times h_{cyl}$$

$$\Rightarrow 7cm \times 5cm \times 22cm = \frac{22}{7} \times 7cm \times 7cm \times h_{cyl}$$

$$\Rightarrow \frac{7cm \times 5cm \times 22cm \times 7}{22 \times 7cm \times 7cm} = h_{cyl}$$

$$\Rightarrow \underline{5cm} = h_{cyl}$$

\therefore The height of the water in the cylindrical container = 5cm

2 (a) **Method 2** **(Making h_{cyl} the subject first, then substituting and evaluating)**

Volume of water in cuboid = Volume of water in cylinder

$$l \times w \times h_{cub} = (\pi r^2) \times h_{cyl}$$

$$\Rightarrow \frac{l \times w \times h_{cub}}{\pi r^2} = h_{cyl}$$

$$\Rightarrow \frac{7cm \times 5cm \times 22cm}{\frac{22}{7} \times (7cm)^2} = h_{cyl}$$

$$\Rightarrow \frac{7\text{ cm} \times 5\text{ cm} \times 22\text{ cm} \times 7}{22 \times 7\text{ cm} \times 7\text{ cm}} = h_{cyl}$$

$$\Rightarrow \underline{5\text{ cm}} = h_{cyl}$$

\therefore The height of the water in the cylindrical container = 5cm

2 (a) **Method 3** (Finding the volume of water in cuboid first, then equating)

$$\begin{aligned} \text{Volume of water in cuboid} &= l \times w \times h_{\text{cuboid}} \\ &= 7\text{ cm} \times 5\text{ cm} \times 22\text{ cm} \\ &= 770\text{ cm}^3 \end{aligned}$$

But Volume of water in cuboid = Volume of water in cylinder

$$\Rightarrow 770\text{ cm}^3 = 154\text{ cm}^2 \times h_{cyl}$$

$$\Rightarrow \frac{770\text{ cm}^3}{154\text{ cm}^2} = h_{cyl}$$

$$\Rightarrow 5\text{ cm} = h_{cyl}$$

\therefore The height of the water in the cylindrical container = 5cm

2 (b) (i) The discount = Discount rate \times Original price

$$= 15\% \times \text{¢}45,000,000$$

$$= \frac{15}{100} \times \text{¢}45,000,000$$

$$= 15 \times \text{¢}450,000$$

$$= \underline{\underline{\text{¢}6,750,000}}$$

(ii) Amount paid = Original amount – discount

$$= \text{¢}45,000,000 - \text{¢}6,750,000$$

$$= \underline{\underline{\text{¢}38,250,000}}$$

2 (c)

$$\frac{x-3}{3} \leq \frac{1}{2} + x$$

Approach 1

$$\Rightarrow \frac{x-3}{3} \leq \frac{1}{2} + \frac{x}{1}$$

$$\Rightarrow \frac{x-3}{3} \leq \frac{1+2x}{2}$$

$$\Rightarrow 6\left(\frac{x-3}{3}\right) \leq 6\left(\frac{1+2x}{2}\right)$$

$$\Rightarrow 2(x-3) \leq 3(1+2x)$$

$$\Rightarrow 2x - 6 \leq 3 + 6x$$

$$\Rightarrow 2x - 6x \leq 3 + 6$$

$$\Rightarrow -4x \leq 9$$

$$\Rightarrow \frac{-4x}{-4} \geq \frac{9}{-4}$$

$$\Rightarrow \underline{\underline{x \geq -2\frac{1}{4}}}$$

2 (c)

Approach 2

$$\Rightarrow 6\left(\frac{x-3}{3}\right) \leq 6\left(\frac{1}{2} + x\right)$$

$$\Rightarrow 2(x-3) \leq 6\left(\frac{1}{2}\right) + 6x$$

$$\Rightarrow 2x - 6 \leq 3 + 6x$$

$$\Rightarrow -3 - 6 \leq 6x - 2x$$

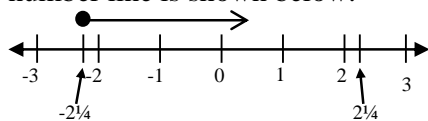
$$\Rightarrow -9 \leq 4x$$

$$\Rightarrow \quad \frac{-9}{4} \leq \frac{4x}{4}$$

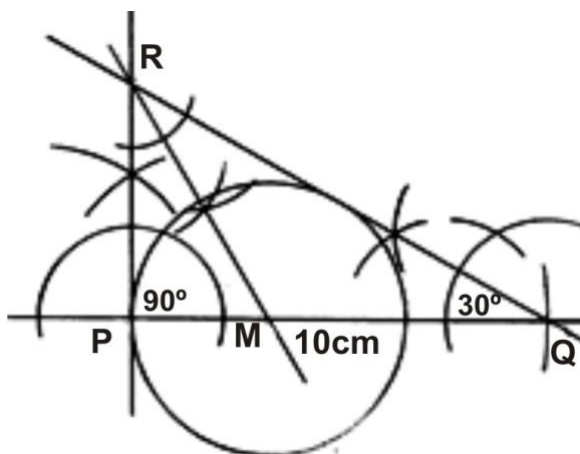
$$\Rightarrow \quad -2\frac{1}{4} \leq x$$

$$\Rightarrow \quad \underline{\underline{x \geq -2\frac{1}{4}}}$$

The number line is shown below:



3(a),(b),(c)



3(a) $|PR| \approx \underline{\underline{5.8 \text{ cm}}}$

3(d) Radius of circle $\approx \underline{\underline{3.3 \text{ cm}}}$

4(a) (i) The frequency table is shown below

| Mark | Tally | Frequency |
|------|-------|-----------|
| 2 | /// | 3 |
| 3 | // | 2 |
| 4 | / | 1 |
| 5 | //// | 4 |
| 6 | ### | 5 |
| 7 | //// | 4 |
| 8 | / | 1 |

| | | |
|----|-----|---|
| 9 | // | 2 |
| 10 | /// | 3 |

4(a) (ii)

| Mark (x) | Tally | Frequency (f) | f x |
|-------------|-------|------------------|-------------------|
| 2 | /// | 3 | 6 |
| 3 | // | 2 | 6 |
| 4 | / | 1 | 4 |
| 5 | //// | 4 | 20 |
| 6 | ### | 5 | 30 |
| 7 | //// | 4 | 28 |
| 8 | / | 1 | 8 |
| 9 | // | 2 | 18 |
| 10 | /// | 3 | 30 |
| | | $\Sigma f = 25$ | $\Sigma fx = 150$ |

$$\text{The mean mark} = \frac{\Sigma f x}{\Sigma f} = \frac{150}{25} = \underline{6}$$

4(b) If the pass mark is 4, \Rightarrow pupils who scored 2 or 3 failed

$$\begin{aligned} \Rightarrow & \text{Frequency of 2} + \text{Frequency of 3} \\ &= 3 \text{ pupils} + 2 \text{ pupils} \\ &= \underline{5 \text{ pupils}} \end{aligned}$$

Therefore 5 pupils failed the test

5(a) Charge for:

$$\begin{aligned} \text{First 110 units} &= \text{¢}150 \times 110 = \text{¢}16,500 \\ \text{Remaining } (173 - 110 = 63) \text{ units} &= \text{¢}200 \times 63 = \text{¢}12,600 \\ \therefore \text{Total charge} &= \text{¢}12,600 + \text{¢}16,500 \\ &= \underline{\underline{\text{¢}29,100.00}} \end{aligned}$$

5(b)

Method 1

$$\begin{aligned} 4 \text{ hours} &= 4 \times 60 \text{ minutes} \\ &= 240 \text{ minutes} \\ \text{Now, } 240 \text{ min} &= 240 \times 60 \text{ seconds} \\ &= 14400 \text{ seconds} \\ &= \underline{1.44 \times 10^4 \text{ seconds}} \end{aligned}$$

5(b)

Method 2

$$\begin{aligned} \text{Since } 1 \text{ hour} &= 60 \text{ minutes and} \\ 1 \text{ minute} &= 60 \text{ seconds} \\ \Rightarrow 1 \text{ hour} &= 60 \times 60 \text{ seconds} = 3600 \text{ seconds} \end{aligned}$$

$$\begin{aligned} \text{Now, if } 1 \text{ hour} &= 3600 \text{ seconds} \\ \text{then } 4 \text{ hours} &= ? \text{ (more)} \end{aligned}$$

If more, less divides

$$\begin{aligned} \Rightarrow \frac{4 \text{ hours}}{1 \text{ hour}} \times 3600 \text{ s} \\ \Rightarrow 4 \times 3600 \text{ s} &= 14400 \text{ s} \\ &= \underline{1.44 \times 10^4 \text{ seconds}} \end{aligned}$$

5(b)

Method 3

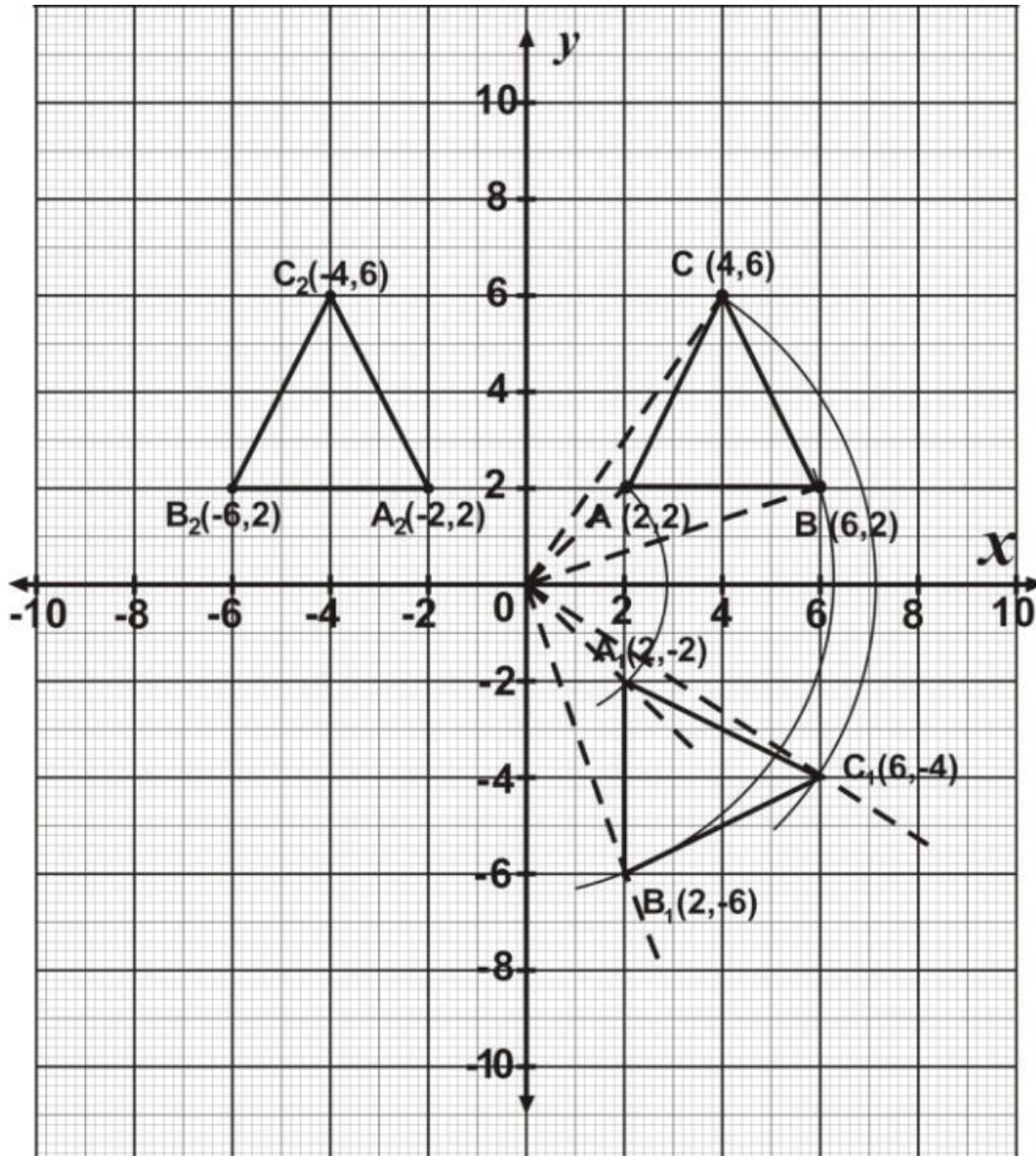
$$\begin{aligned} \text{If } 1 \text{ hour} &= 3600 \text{ seconds} \\ \text{then } 4 \text{ hours} &= x \\ \Rightarrow \frac{1}{4} &= \frac{3600}{x} \\ \Rightarrow x &= 3600 \times 4 \\ \Rightarrow x &= 14400 \\ \Rightarrow 4 \text{ hours} &= 14400 \text{ seconds} \\ &= \underline{1.44 \times 10^4 \text{ seconds}} \end{aligned}$$

5(c)

$$\mathbf{q} = 2\mathbf{p} - \mathbf{r}$$

$$\begin{aligned}
 &= 2 \begin{pmatrix} -7 \\ -9 \end{pmatrix} - \begin{pmatrix} 3 \\ -5 \end{pmatrix} \\
 &= \begin{pmatrix} -14 \\ -18 \end{pmatrix} - \begin{pmatrix} 3 \\ -5 \end{pmatrix} \\
 &= \begin{pmatrix} -14 - 3 \\ -18 - (-5) \end{pmatrix} \\
 \mathbf{q} &= \begin{pmatrix} -14 - 3 \\ -18 + 5 \end{pmatrix} = \underline{\underline{\begin{pmatrix} -17 \\ -13 \end{pmatrix}}}
 \end{aligned}$$

6 (a) Approach 1 ([By Inspection / Construction](#))



Approach 2 [\(Using the rule / formula\)](#)

6 (a) (ii) Rotating (x, y) through 90° clockwise about the origin

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} y \\ -x \end{pmatrix}$$

$$\Rightarrow OA \begin{pmatrix} 2 \\ 2 \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} 2 \\ -2 \end{pmatrix}, \quad \therefore A_1(2, -2)$$

$$\Rightarrow OB \begin{pmatrix} 6 \\ 2 \end{pmatrix} \rightarrow OB_1 \begin{pmatrix} 2 \\ -6 \end{pmatrix}, \quad \therefore B_1(2, -6)$$

$$\Rightarrow OC \begin{pmatrix} 4 \\ 6 \end{pmatrix} \rightarrow OC_1 \begin{pmatrix} 6 \\ -4 \end{pmatrix}, \quad \therefore C_1(6, -4)$$

\therefore Plot and join $A_1(2, -2)$, $B_1(2, -6)$ and $C_1(6, -4)$ as the image of triangle ABC under a rotation through 90° clockwise about the origin as shown above.

6 (a) (iii) Reflecting (x, y) in the y-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$\Rightarrow OA \begin{pmatrix} 2 \\ 2 \end{pmatrix} \rightarrow OA_2 \begin{pmatrix} -2 \\ 2 \end{pmatrix}, \quad \therefore A_2(-2, 2)$$

$$\Rightarrow OB \begin{pmatrix} 6 \\ 2 \end{pmatrix} \rightarrow OB_2 \begin{pmatrix} -6 \\ 2 \end{pmatrix}, \quad \therefore B_2(-6, 2)$$

$$\Rightarrow OC \begin{pmatrix} 4 \\ 6 \end{pmatrix} \rightarrow OC_2 \begin{pmatrix} -4 \\ 6 \end{pmatrix}, \quad \therefore C_2(-4, 6)$$

\therefore Plot and join $A_2(-2, 2)$, $B_2(-6, 2)$ and $C_2(-4, 6)$ as the image of triangle ABC under a reflection in the y axis as shown above

6 (b) Let n = the number, then $\Rightarrow (12 + n) \times 4 = 60$

Approach 1 [\(Expanding first\)](#)

$$4(12 + n) = 60$$

$$\Rightarrow 48 + 4n = 60$$

$$\Rightarrow 4n = 60 - 48$$

$$\Rightarrow 4n = 12$$

$$\Rightarrow n = 12 \div 4$$

$$\Rightarrow \quad \underline{\underline{n = 3}}$$

6 (b) **Approach 2** [\(Dividing through by 4 first\)](#)

$$4 (12 + n) = 60$$

$$\Rightarrow \quad \frac{4(12 + n)}{4} = \frac{60}{4}$$

$$\Rightarrow \quad 12 + n = 15$$

$$\Rightarrow \quad n = 15 - 12$$

$$\Rightarrow \quad \underline{\underline{n = 3}}$$

Therefore the number is 3

April 2006

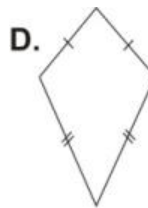
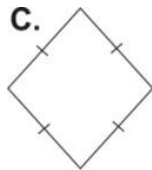
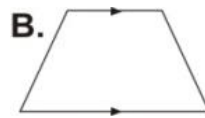
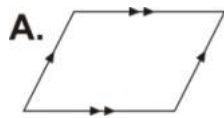
MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. If $Q = \{1, 3, 5, 7, 9, 11, 13, 15\}$ and $R = \{1, 2, 3, 5, 6, 7, 10, 11, 12\}$, find $Q \cap R$.
- A. $\{1, 3, 5, 7, 11\}$
B. $\{1, 3, 5, 7, 9, 11\}$
C. $\{2, 4, 8, 9, 13, 14\}$
D. $\{1, 2, 3, 5, 6, 7, 9, 10, 11, 12\}$
2. If x is an integer, list the members of the set, $\{2 \leq x < 10\}$
- A. $\{3, 4, 5, 6, 7, 8, 9\}$
B. $\{2, 3, 4, 5, 6, 7, 8, 9\}$
C. $\{3, 4, 5, 6, 7, 8, 9, 10\}$
D. $\{2, 3, 4, 5, 6, 7, 8, 9, 10\}$
3. Simplify: $\frac{4}{3}x - \frac{2}{9}x$
- A) $\frac{2}{9}x$ B) $\frac{2}{3}x$ C) $\frac{10}{9}x$ D) $\frac{14}{9}x$
4. The number of boys in a school is 120. If the ratio of boys to girls is 5:7, find the total number of students in the school.
- A) 240 B) 288 C) 600 D) 840
5. Find the circumference of a circle with radius 3.5 cm. (Take $\pi = \frac{22}{7}$)
- A) 11 cm B) 22 cm C) 35 cm D) 38.5 cm

6. Which of the following are the prime factors of 12?
 A. {1, 3} B. {2, 3} C. {2, 4, 6, 12} D. {2, 3, 4, 6}
7. The base of an isosceles triangle is 7cm long. Each of the other two sides is x cm long. What will be the expression for its perimeter?
 A) $x+7$ B) $x+14$ C) $2x-7$ D) $2x+7$
8. Correct 0.003858 to three significant figures
 A) 0.00385 B) 0.00386 C) 0.0039 D) 386
9. Find the value of $a - 3ab$ when $a = -2$ and $b = 3$
 A) -20 B) -16 C) 16 D) 20
10. A boy sold some oranges at three for ¢500.00. If his total sales was ¢100,000.00, how many oranges did he sell?
 A) 300 B) 400 C) 500 D) 600
11. A train travels at a speed of 80km per hour. How long will it take to travel a distance of 320km?
 A) 2 hours B) 3 hours C) 4 hours D) 5 hours

12. Which of the following figures is a rhombus?



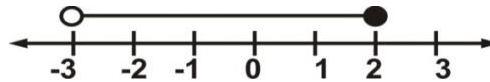
13. Three children share an amount of ¢910,800.00 in the ratio 2:3:4. What will be the highest share?
 A) ¢202,400.00
 B) ¢303,600.00
 C) ¢404,800.00
 D) ¢455,400.00

14. The next term in the sequence 3, 6, 12, 24, ...
A) 27 B) 30 C) 36 D) 48

15. Express 350 as a product of prime factors
A) $2 \times 5 \times 7$ B) $2 \times 5^2 \times 7$ C) $2 \times 5 \times 7^2$ D) $2^2 \times 5 \times 7$

16. Express 962 in standard form.
A) 96.2×10
B) 9.62×10^2
C) 0.962×10^3
D) 0.0962×10^4

17.



Which of the following inequalities is shown on the number line above, where $p \in \{\text{real numbers}\}$

- A) $-2 < p < 3$ B) $-2 \geq p > 3$ C) $-3 < p \leq 2$ D) $-3 > p \geq 2$
18. Solve the equation $\frac{x+2}{3} + 2x = 10$.
A) 3 B) 4 C) 5 D) 6
19. Arrange the fractions $\frac{3}{4}$, $\frac{2}{3}$, $\frac{4}{5}$ in ascending order of magnitude.
A) $\frac{3}{4}$, $\frac{2}{3}$, $\frac{4}{5}$
B) $\frac{4}{5}$, $\frac{2}{3}$, $\frac{3}{4}$
C) $\frac{4}{5}$, $\frac{3}{4}$, $\frac{2}{3}$
D) $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$
20. Express 87_{ten} as a base five numeral.
A) 302_{five} B) 322_{five} C) 3022_{five} D) 3202_{five}
21. A bag contains 6 blue and 5 black balls. What is the probability of picking a black ball at random?
A) $\frac{1}{11}$ B) $\frac{1}{5}$ C) $\frac{5}{11}$ D) $\frac{6}{11}$

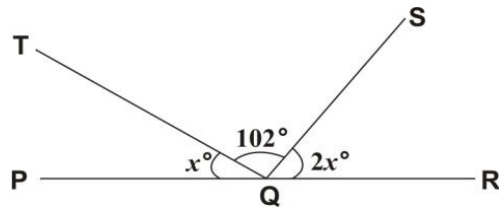
22. Evaluate $\frac{2^3 \times 3^4 \times 3^3}{2^2 \times 2 \times 3^5}$
- A) 6 B) 9 C) 12 D) 18

The table below gives the ages of members of a juvenile club.

Use it to answer Questions 23 and 24

| | | | | |
|--------------|---|----|----|----|
| Age in years | 8 | 9 | 10 | 11 |
| Frequency | 5 | 10 | 6 | 9 |

23. How many people are in the club?
- A) 15 B) 20 C) 30 D) 38
24. What is the modal age of the members of the club?
- A) 8 years B) 9 years C) 10 years D) 11 years
25. In an examination, 154 out of 175 candidates passed. What percentage failed?
- A) 6% B) 12% C) 13% D) 18%
26. Expand $(6 - x)(6 + y)$
- A) $36 - 6x + 6y - xy$
B) $36 - 6x - 6y + xy$
C) $36 - 6x - xy$
D) $36 + 6y - xy$
27. Find the highest common factor (HCF) of 20, 12 and 28.
- A) 2 B) 4 C) 8 D) 12
28. If $F = \frac{9}{5}C + 32$ find F when C = 40.
- A) 49 B) 78.4 C) 104 D) 129.6
29. Evaluate $\frac{2}{3}(27 - 12) - 6$.
- A) 4 B) 6 C) 14 D) 16
- 30.



In the figure, PQR is a straight line. Angle TQP = x° , angle TQS = 102° and angle SQR = $2x^\circ$. Find the value of x .

- A) 78 B) 39 C) 34 D) 26

31. Factorize $22ab - 11ac + 6rb - 3rc$.

- A. $(2b - c)(11a + 3r)$
 B. $(2b + c)(11a - 3r)$
 C. $(2b - c)(11a - 3r)$
 D. $(2b + c)(11a + 3r)$

32. Find the sum of 124.3, 0.275 and 74.06. (Correct your answer to one decimal place)

- A) 198.6 B) 198.7 C) 892.0 D) 892.4

33. Simplify $6p^3 \times p^2 \div 3p^4$

- A) $2p$ B) $3p$ C) $18p$ D) $2p^2$

34. Mr. Nkrumah saved ₵75,000.00 at a simple interest rate of 20% per annum for 3 years. Calculate the interest he earned on his savings

- A) ₵15,000.00 B) ₵30,000.00 C) ₵45,000.00 D) ₵60,000.00

35. Find the rule for the mapping:

| | | | | | | |
|----|----|----|----|----|-----|---|
| 1 | 2 | 3 | 4 | 5 | ... | n |
| ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ |
| 10 | 21 | 32 | 43 | 54 | ... | - |

- A) $n \rightarrow 10n$
 B) $n \rightarrow (10n + 1)$
 C) $n \rightarrow (11n - 1)$
 D) $n \rightarrow (7n + 3)$

36. What is the value of the digit 9 in the number 624.93 ?

A) 9 hundreds

B) 9 tens

C) 9 units

D) 9 tenths

37. The marks obtained by 5 girls in a test are: 10, 15, 8, 18, 12.

Find the median mark.

A) 10

B) 11

C) 12

D) 15

38. The point $P(3, 4)$ is translated by the vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ to a new position P' . Find the coordinates of the image P' .

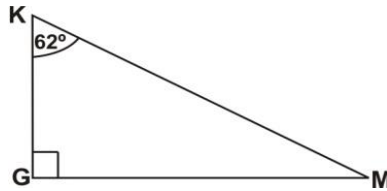
A. (0, 2)

B. (6, -2)

C. (6, 2)

D. (6, 6)

39.



In the diagram above, KGM is a right-angled triangle and angle $GKM = 62^\circ$. Find the angle of elevation of K from M.

A) 28° B) 62° C) 90° D) 118°

40. Given that vector $\mathbf{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and vector $\mathbf{b} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$, find $\mathbf{a} + 2\mathbf{b}$

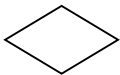
A. $\begin{pmatrix} 6 \\ 13 \end{pmatrix}$ B. $\begin{pmatrix} 2 \\ -13 \end{pmatrix}$ C. $\begin{pmatrix} -2 \\ 7 \end{pmatrix}$ D. $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. A. $\{1,3,5,7,11\}$
2. B. $\{2,3,4,5,6,7,8,9\}$
3. C) $\frac{10}{9}x$
4. B) 288
5. B) 22 cm
6. B. $\{2, 3\}$
7. D) $2x+7$
8. B) 0.00386
9. C) 16
10. D) 600
11. C) 4 hours
12. C. 
13. C) ₦404,800.00
14. D) 48
15. B) $2 \times 5^2 \times 7$
16. B) 9.62×10^2

17. C) $-3 < p \leq 2$
18. B) 4
19. D) $2/3, 3/4, 4/5$
20. B) 322_{five}
21. C) $5/11$
22. B) 9
23. C) 30
24. B) 9 years
25. B) 12%
26. A) $36 - 6x + 6y - xy$
27. B) 4
28. C) 104
29. A) 4
30. D) 26
31. A. $(2b - c)(11a + 3r)$
32. A) 198.6
33. A) $2p$
34. C) $\text{¢}45,000.00$
35. C) $n \rightarrow (11n - 1)$
36. D) 9 tenths
37. C) 12
38. C. $(6, 2)$
39. A) 28°
40. D $\cdot \begin{pmatrix} 2 \\ -7 \end{pmatrix}$

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) A trader sold 250 articles for ₦525,000.00 at a profit of 25%.
 - (i) Calculate the cost price of each article
 - (ii) If the trader had wanted 45% profit on the cost price, how much should he have sold each of the articles?
- (b) Find the simple interest on ₦880,000.00 for $2\frac{1}{2}$ years at $3\frac{1}{4}\%$ per annum

2. (a) The ratio of men to women in a village is 12:25. If there are 120 men,
 - (i) how many women are there?
 - (ii) what is the total number of men and women?
- (b) A bag contains 70 pencils out of which 15 are green and 30 blue.
 - (i) How many pencils of other colours are in the bag?
 - (ii) A pencil is selected from the bag at random. What is the probability that it is blue?
- (c) Solve $\frac{1}{3}(x-1) - \frac{1}{2}(x-3) \leq 1\frac{1}{4}$ and illustrate your answer on the number line.

3. (a) (i) Using a pair of compasses and ruler only, construct triangle XYZ with $XZ = 12\text{cm}$, $XY = 10\text{cm}$ and angle $XYZ = 90^\circ$.

(ii) Measure YZ.

(iii) Calculate the area of triangle XYZ

(iv) Measure angle ZXY.

- (b) An isosceles triangle has a perimeter of $(9y - 15)\text{ cm}$.

What is the length of each of the two equal sides, if its third side is $(3y - 7)\text{ cm}$?

4. The mapping below has the rule, $y = 2x + 3$.

| | | | | | |
|-----|---|---|---|---|---|
| x | 0 | 1 | 2 | 3 | 4 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | - | 5 | 7 | - | - |

- (a) (i) Copy the mapping and fill in the missing numbers
- (ii) Using a scale of 2cm to 1 unit on both axes on a graph sheet, choose the origin O and draw the perpendicular axes OX and OY.
- (iii) On the same graph sheet, mark the x-axis from 0 to 5 and the y-axis from 0 to 12.
- (iv) Plot on the graph sheet the ordered pairs (x, y) from the mapping and join all the points using a straight edge.
- (b) From your graph, find:
- (i) y when $x = 3.5$;
- (ii) x when $y = 8$;
- (iii) the gradient of the line $y = 2x + 3$.

5. (a) A man spent $\frac{1}{4}$ of his monthly salary on rent, $\frac{2}{5}$ on food and $\frac{1}{6}$ on books. If he still had ₦55,000 left, what was his monthly salary?

- (b) The average age of a family of eight is 30 years.

The average age of the six children in the family is 19 years.

If the mother is four years younger than the father, calculate the age of the father.

6. The following table shows the distribution of grades obtained by 120 students in an examination.

| Grade | A | B | C | D |
|-----------------|----|----|----|----|
| No. of students | 14 | 30 | 52 | 24 |

- (a) Draw a pie chart for the distribution.
- (b) (i) Evaluate: $5\frac{7}{15} - 2\frac{2}{3} + 1\frac{5}{12}$
- (ii) Factorize: $xy - xz + 5y - 5z$

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MATHEMATICS

SECTION B

ESSAY

SOLUTIONS

1 (a) (i) **METHOD 1** [Formula-(Finding CP of all 250 articles first, then CP of 1)]

$$\text{CP} = \frac{\text{Percentage of CP}}{\text{Percentage of SP}} \times \text{SP}$$

$$\begin{aligned}\text{CP of 250 articles} &= \frac{100\%}{100\% + 25\%} \times \text{¢}525,000 \\ &= \frac{100}{125} \times \text{¢}525,000 \\ &= \text{¢} 420,000\end{aligned}$$

$$\text{Therefore CP of 1 article} = \text{¢} 420,000 \div 250 = \text{¢} \underline{\underline{1,680}}$$

1 (a) (i) **METHOD 2** [Formula -(Finding SP of 1 article first, then CP of 1)]

$$\text{SP of 1 article} = \text{¢} 525,000 \div 250 = \text{¢} \underline{\underline{2100}}$$

$$\text{CP} = \frac{\text{Percentage of CP}}{\text{Percentage of SP}} \times \text{SP}$$

$$\begin{aligned}\text{Therefore, CP of 1 article} &= \frac{100}{100 + 25} \times \text{¢}2100 \\ &= \frac{100}{125} \times \text{¢}2100 \\ &= \text{¢} \underline{\underline{1,680}}\end{aligned}$$

1 (a) (i) **METHOD 3** [**S. Prop / E.Frac** (Finding CP of all 250 articles first, then CP of 1)]

| | Percentage | Amount (250 articles) |
|----|-----------------------------|--------------------------|
| SP | 100% + 25% = 125% | ¢ 525,000 |
| CP | 100% | x |

From the table above, $\frac{125}{100} = \frac{¢ 525,000}{x}$

Cross multiplying, we have $125x = ¢ 525,000 \times 100$

$$\Rightarrow x = \frac{¢ 525,000 \times 100}{125}$$

$$\Rightarrow x = ¢ 4200 \times 100$$

$$= ¢ \underline{420,000}$$

$$\therefore \text{CP of all 250 articles} = ¢ 420,000$$

$$\Rightarrow \text{CP of 1 article} = ¢ 420,000 \div 250 = ¢ \underline{1,680}$$

1 (a) (i) **METHOD 4** [**S. Prop / E. Frac** (Finding SP of 1 article first, then CP of 1)]

| | Percentage | Amount (1 article) |
|----|-----------------------------|---|
| SP | 100% + 25% = 125% | $¢ 525,000 \div 250$ = ¢ 2100 |
| CP | 100% | x |

From the table above,

$$\frac{125\%}{100\%} = \frac{¢ 2100}{x} \Rightarrow \frac{125}{100} = \frac{¢ 2100}{x}$$

Cross multiplying, we have

$$125x = ¢ 2100 \times 100$$

$$\Rightarrow x = \frac{¢ 2100 \times 100}{125} = ¢ \underline{1,680}$$

Simple Proportion (S. Prop) / 'If more, less divides...' (IM, LD,...)

1 (a) (i) METHOD 5 [S. Prop / IM, LD,... (Finding CP of all 250 articles first, then CP of 1)]

| | Percentage | Amount (250 articles) |
|----|-----------------------------|--------------------------|
| SP | 100% + 25% = 125% | ¢ 525,000 |
| CP | 100% | x |

If 125% → ¢ 525,000

Then 100% → ? (less)

If less, more (i.e., 125%) divides; therefore we have

$$\frac{100\%}{125\%} \times \text{¢}525,000 = \frac{100}{125} \times \text{¢}525,000$$
$$= \text{¢}\underline{420,000}$$

$$\therefore \text{CP of all 250 articles} = \text{¢ } 420,000$$

$$\Rightarrow \text{CP of 1 article} = \text{¢ } 420,000 \div 250 = \text{¢ } \underline{1,680}$$

1 (a) (i) METHOD 6 [S. Prop / IM, LD,... (Finding SP of 1 article first, then CP of 1)]

| | Percentage | Amount (1 article) |
|----|-----------------------------|--|
| SP | 100% + 25% = 125% | $\text{¢}525,000 \div 250$ = ¢2100 |
| CP | 100% | x |

If 125% → ¢ 2,100

Then 100% → ? (less)

If less, more (i.e., 125%) divides; therefore we have

$$\frac{100\%}{125\%} \times \text{¢}2100 = \frac{100}{125} \times \text{¢}2100$$
$$= \text{¢ } \underline{1,680}$$

1 (a) (ii) Selling price of each article to make 45% profit

METHOD 1 [\(Formula\)](#)

$$\begin{aligned}\text{SP of 1 article} &= \text{Percentage of SP} \times \text{CP of 1 article} \\ &= 145\% \times \text{CP of 1 article} \\ &= \frac{145}{100} \times \text{¢ } 1680 \\ &= \frac{\text{¢ } 243600}{100} = \text{¢ } \underline{\underline{2436}}\end{aligned}$$

1 (a) (ii) **METHOD 2** [\(Formula\)](#)

$$\begin{aligned}\text{SP of 1 article} &= \text{Profit on 1 article} + \text{CP of 1 article} \\ &= (45\% \times \text{CP of 1 article}) + \text{CP of 1 article} \\ &= \left(\frac{45}{100} \times \text{¢ } 1680 \right) + \text{¢ } 1680 \\ &= \text{¢ } 756 + \text{¢ } 1680 \\ &= \text{¢ } \underline{\underline{2436}}\end{aligned}$$

NB:.

Simple Proportion, using the ideas of equivalent fractions and the rule ‘If more, less divides; If less, more divides’, could also be used [as in Methods 3 – 6 in Solution to 1 (a) (i) above] to solve the problem.

1 (b) Simple interest = Principal \times Rate \times time

Approach 1 [\(common fractions\)](#)

$$\begin{aligned}&= 880,000 \times 3\frac{1}{4}\% \times 2\frac{1}{2} \\ &= 880,000 \times \frac{13}{4}\% \times \frac{5}{2} \\ &= \frac{880,000}{1} \times \frac{13}{4 \times 100} \times \frac{5}{2} \\ &= \frac{880,000 \times 13 \times 5}{4 \times 100 \times 2} \\ &= 1100 \times 13 \times 5\end{aligned}$$

$$= \underline{\text{¢ } 71,500}$$

1 (b) Approach 2a [\(decimal fractions\)](#)

$$\begin{aligned} &= 880,000 \times 3\frac{1}{4}\% \times 2\frac{1}{2} \\ &= 880,000 \times 3.25 \% \times 2.5 \\ &= 880,000 \times \frac{3.25}{100} \times 2.5 \\ &= 880,000 \times 0.0325 \times 2.5 \\ &= \underline{\text{¢ } 71,500} \end{aligned}$$

1 (b) Approach 2b [\(decimal fractions\)](#)

$$\begin{aligned} &= 880,000 \times 3\frac{1}{4}\% \times 2\frac{1}{2} \\ &= 880,000 \times 3.25 \% \times 2.5 \\ &= 880,000 \times \frac{3.25}{100} \times 2.5 \\ &= \frac{880,000}{1} \times \frac{325}{10000} \times \frac{25}{10} \\ &= \frac{88 \times 325 \times 25}{10} = \frac{715,000}{10} \\ &= 71,500 \end{aligned}$$

\therefore The simple interest = ¢ 71,500

2(a) (i) Method 1 [\(Unitary Approach – the value of one item\)](#)

Since the men ratio, 12, corresponds to 120 persons,

$$\Rightarrow \text{ratio 1 corresponds to } \frac{120}{12} = 10$$

\therefore women ratio, 25, corresponds to $25 \times 10 = \underline{\underline{250 \text{ women}}}$

2(a) (i) Method 2 [\(Equivalent Fractions\)](#)

| | Ratio | Actual no. |
|-------|-------|------------|
| Men | 12 | 120 |
| Women | 25 | w |

From the table above, $\frac{12}{25} = \frac{120}{w}$

Cross multiplying, we have

$$12 \times w = 120 \times 25$$

$$\Rightarrow \frac{12w}{12} = \frac{120 \times 25}{12}$$

$$\Rightarrow w = 10 \times 25$$

$$\Rightarrow w = \underline{\underline{250}}$$

NB:

Alternatively,
it can be deduced from the
table (by simple logic) that
 $w = 250$

2(a) (i) Method 3 (If more, less divides ...)

If 12 \rightarrow 120

Then 25 \rightarrow ? (more)

If more, less (i.e., 12) divides; \therefore we have

$$\frac{25}{12} \times 120 = 25 \times 10 = \underline{\underline{250 \text{ women}}}$$

2(a) (i) Method 4 (Equivalent ratios)

$$12 : 25 = 120 : w$$

$$\Rightarrow \frac{12w}{12} = \frac{25 \times 120}{12}$$

$$\Rightarrow \underline{\underline{w = 250}}$$

2(b) (i) Number of pencils of other colours

$$\begin{aligned} &= 70 - (15+30) &= 70 - 45 \\ & &= \underline{\underline{25}} \end{aligned}$$

$$\begin{aligned} \text{(ii) } P(\text{Blue pencil}) &= \frac{\text{Number of blue pencils}}{\text{Total number of pencils}} \\ &= \frac{30}{70} = \underline{\underline{\frac{3}{7}}} \end{aligned}$$

2(c) $\frac{1}{3}(x-1) - \frac{1}{2}(x-3) \leq 1\frac{1}{4}$

Method 1 (Simplifying expression on LHS first)

$$\frac{x-1}{3} - \frac{x-3}{2} \leq \frac{5}{4}$$

$$\frac{2(x-1) - 3(x-3)}{6} \leq \frac{5}{4}$$

$$\frac{2x-2-3x+9}{6} \leq \frac{5}{4}$$

$$\frac{-x+7}{6} \leq \frac{5}{4}$$

$$24\left(\frac{-x+7}{6}\right) \leq 24\left(\frac{5}{4}\right)$$

$$4(-x+7) \leq 6(5)$$

$$-4x+28 \leq 30$$

$$-4x \leq 30-28$$

$$\frac{-4x}{-4} \geq \frac{2}{-4}$$

$$\underline{\underline{x \geq -\frac{1}{2}}}$$

2(c) Method 2 (Eliminating fractions first, by multiplying through by 12)

$$12 \times \frac{1}{3}(x-1) - 12 \times \frac{1}{2}(x-3) \leq 12\left(\frac{5}{4}\right)$$

$$\Rightarrow 4(x-1) - 6(x-3) \leq 3(5)$$

$$\Rightarrow 4x-4-6x+18 \leq 15$$

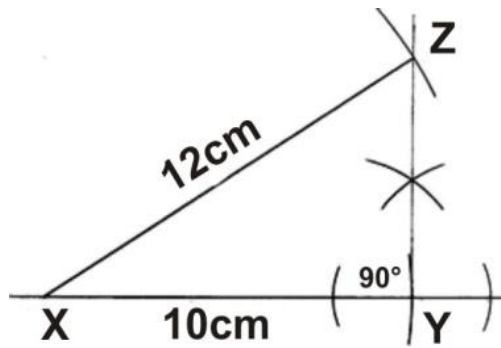
$$\Rightarrow 4x-6x \leq 15+4-18$$

$$\Rightarrow -2x \leq 1$$

$$\Rightarrow \frac{-2x}{-2} \geq \frac{1}{-2}$$

$$\Rightarrow \underline{\underline{x \geq -\frac{1}{2}}}$$

3(a)



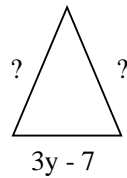
(ii) $|YZ| \approx \underline{6.6 \text{ cm}}$

(iii) Area of triangle XYZ

$$\begin{aligned}
 &= \frac{1}{2} bh \\
 &= \frac{1}{2} \times |XY| \times |YZ| \\
 &= \frac{1}{2} \times 10\text{cm} \times 6.6\text{cm} \\
 &= 10\text{cm} \times 3.3\text{cm} \\
 &= \underline{33\text{cm}^2}
 \end{aligned}$$

(iv) Angle ZXY $\approx \underline{34^\circ}$

3(b)



| |
|-----------------------|
| Perimeter = $9y - 15$ |
|-----------------------|

Method 1

Length of each of the two equal sides

$$= [(9y - 15) - (3y - 7)] \div 2$$

$$= \frac{(9y-15) - (3y-7)}{2}$$

$$= \frac{9y-15-3y+7}{2}$$

$$= \frac{9y-3y-15+7}{2}$$

$$= \frac{6y-8}{2}$$

$$= \frac{1}{2} (6y - 8)$$

$$= \underline{\underline{3y - 4}}$$

\Rightarrow The length of each of the two equal sides = $\underline{\underline{3y - 4}}$

3(b) Method 2

Let x = length of each of the other two sides

Then $x + x + 3y - 7$ = Perimeter

$$\Rightarrow x + x + 3y - 7 = 9y - 15$$

$$\Rightarrow 2x + 3y - 7 = 9y - 15$$

$$\Rightarrow 2x = 9y - 15 - 3y + 7$$

$$\Rightarrow 2x = 9y - 3y - 15 + 7$$

$$\Rightarrow 2x = 6y - 8$$

$$\Rightarrow x = \frac{6y - 8}{2}$$

$$\Rightarrow x = \frac{6y}{2} - \frac{8}{2}$$

$$\Rightarrow x = \underline{\underline{3y - 4}}$$

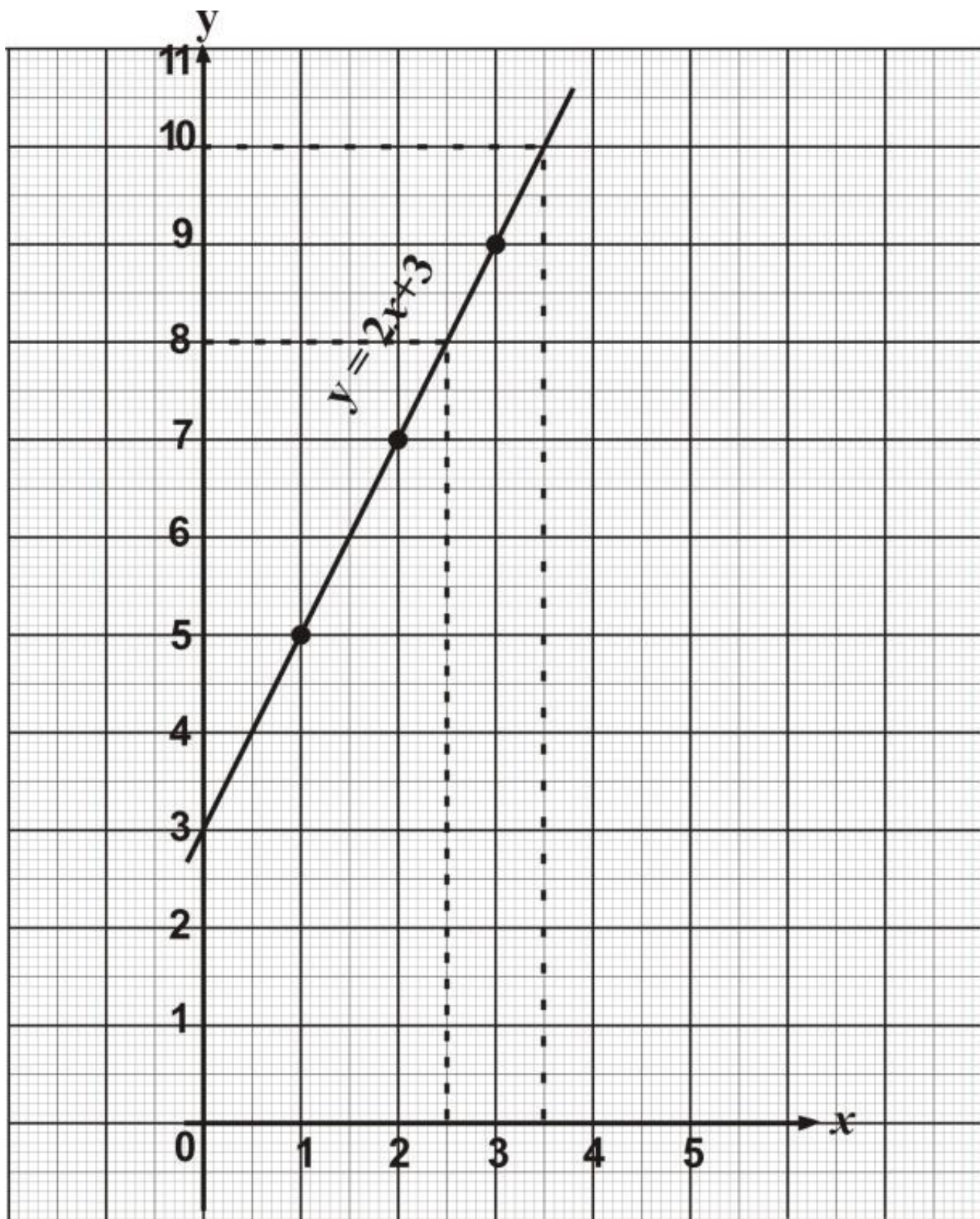
\Rightarrow The length of each of the two equal sides = $\underline{\underline{3y - 4}}$

4(a) (i)

By substitution of the x values in the given relation, the mapping is completed as shown below:

| | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|
| x | 0 | 1 | 2 | 3 | 4 |
| \downarrow | \downarrow | \downarrow | \downarrow | \downarrow | \downarrow |
| y | 3 | 5 | 7 | 9 | 11 |

(ii), (iii) The straight line graph is shown below



4(b) From the graph,

- (i) When $x = 3.5$, $y = 10$
- (ii) When $y = 8$, $x = 2.5$
- (iii) the gradient of the line:

$y = 2x + 3$ is in the form $y = mx + c$, where $m = 2$,

\therefore gradient = 2 (by inspection)

Or by the rule $\frac{y_2 - y_1}{x_2 - x_1}$, Using the points (2, 7) and (1, 5)

$$\text{Gradient} = \frac{7-5}{2-1} = \frac{2}{1} = \underline{2}$$

5(a) Total fraction spent = Fractions spent on *Rent + food + books*

$$= \frac{1}{4} + \frac{2}{5} + \frac{1}{6}$$

$$\text{Fraction spent} = \frac{15 + 24 + 10}{60} = \frac{49}{60}$$

$$\Rightarrow \text{Fraction left} = 1 - \frac{49}{60} = \frac{60}{60} - \frac{49}{60} = \frac{11}{60}$$

Method 1 [\(Formula\)](#)

$$\text{Total amount} = \frac{\text{Fraction of Total amount}}{\text{Fraction left}} \times \text{Amount left}$$

$$\begin{aligned} \text{Total amount (M. Salary)} &= \frac{\frac{60}{60}}{\frac{11}{60}} \times \text{¢}55,000 \\ &= \frac{60}{60} \div \frac{11}{60} \times \text{¢}55,000 \\ &= \frac{60}{60} \times \frac{60}{11} \times \text{¢}55,000 \\ &= \frac{60}{11} \times \text{¢}55,000 \\ &= 60 \times \text{¢}5,000 \\ &= \underline{\underline{\text{¢}300,000}} \end{aligned}$$

5(a) **Method 2** [\(Equivalent Fractions\)](#)

| | Fraction | Amount (¢) |
|-------|-----------------|------------|
| Spent | $\frac{49}{60}$ | ? |

| | | |
|----------------------|-----------------|---------------|
| Left | $\frac{11}{60}$ | 55,000 |
| Total (M. Salary) | $\frac{60}{60}$ | ? (x) |

From the above table, using the 'Left' and 'Total' rows,

$$\frac{\frac{11}{60}}{\frac{60}{60}} = \frac{55,000}{x} \Rightarrow \frac{11}{60} = \frac{55,000}{x}$$

Cross-multiplying, we have

$$\begin{aligned} 11x &= 55,000 \times 60 \\ \Rightarrow \frac{11x}{11} &= \frac{55,000 \times 60}{11} \\ &= 5,000 \times 60 \\ \Rightarrow x &= 300,000 \end{aligned}$$

\therefore The monthly salary is €300,000.00

5(a) Method 3 ('If more, less divides ...')

If $\frac{11}{60} \rightarrow 55,000$

Then $\frac{60}{60} \rightarrow ?$ (more)

If more, less ($\frac{11}{60}$) divides, hence we have

$$\begin{aligned} \frac{\frac{60}{60}}{\frac{11}{60}} \times 55,000 &= \frac{60}{60} \div \frac{11}{60} \times \text{€}55,000 \\ &= \frac{60}{60} \times \frac{60}{11} \times \text{€}55,000 \\ &= \frac{60}{11} \times \text{€}55,000 \\ &= 60 \times \text{€}5,000 \\ &= \underline{\underline{\text{€}300,000}} \end{aligned}$$

5(a) Method 4 (Equation)

If Monthly Salary = M, Fraction spent = $\frac{1}{4} + \frac{2}{5} + \frac{1}{6} = \frac{49}{60}$

$$\text{Fraction left} = \frac{60}{60} - \frac{49}{60} = \frac{11}{60}$$

Fraction left \times Total amount (M) = Amount left

$$\text{or } \frac{11}{60} \text{ of } M = \text{¢}55,000 \quad (\text{Left})$$

$$\Rightarrow \frac{11}{60} \times M = \text{¢}55,000$$

$$\Rightarrow M = \text{¢}55,000 \times \frac{60}{11}$$

$$\Rightarrow M = \underline{\underline{\text{¢}300,000}}$$

5(b) Method 1 [Expression in terms of the father (f)]

Let the age of the father = f ,

then the mother's age = $f - 4$

Sum of children's ages = $6 \times 19\text{yrs} = 114\text{ yrs}$

Now, since the average age of the family = 30 years

$$\text{Average age} = \frac{\text{Ages of (children + father + mother)}}{8 \text{ people}} = 30$$

$$\Rightarrow \frac{114 + f + f - 4}{8} = 30$$

$$\Rightarrow \frac{114 - 4 + f + f}{8} = 30$$

$$\Rightarrow \frac{110 + 2f}{8} = 30$$

$$\Rightarrow 110 + 2f = 30 \times 8$$

$$\Rightarrow 2f = 240 - 110$$

$$\Rightarrow 2f = 130$$

$$\Rightarrow f = 130 \div 2$$

$$\Rightarrow f = 65$$

Therefore the father is 65 years old

5(b) Method 2 [Expression in terms of the mother (m)]

Since average age of the 8 family members = 30yrs,

\Rightarrow Sum of ages of family members = $8 \times 30 \text{ years} = 240 \text{ years}$

\Rightarrow Ages of children + (father) + mother = 240 years

$$\Rightarrow (6 \times 19) + (4 + \text{mother}) + \text{mother} = 240$$

Let mother's age = m

$$\Rightarrow (6 \times 19) + (4 + m) + m = 240$$

$$\Rightarrow 114 + 4 + 2m = 240$$

$$\Rightarrow 118 + 2m = 240$$

$$\Rightarrow 2m = 240 - 118$$

$$\Rightarrow 2m = 122$$

$$\Rightarrow m = 122 \div 2$$

$$\Rightarrow m = 61$$

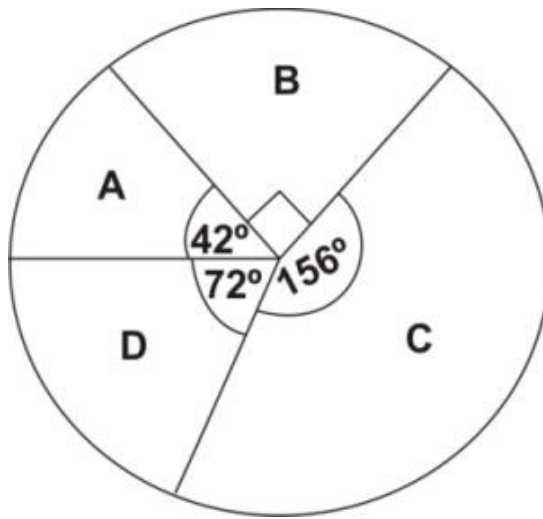
$$\Rightarrow \text{The mother's age} = 61 \text{ years}$$

$$\begin{aligned} \text{Therefore, the father's age} &= 61 \text{ years} + 4 \text{ years} \\ &= \underline{\underline{65 \text{ years}}} \end{aligned}$$

6 (a)

| Grade | Frequency | Angle of sector |
|--------------|------------|---|
| A | 14 | $\frac{14}{120} \times 360^\circ = 42^\circ$ |
| B | 30 | $\frac{30}{120} \times 360^\circ = 90^\circ$ |
| C | 52 | $\frac{52}{120} \times 360^\circ = 156^\circ$ |
| D | 24 | $\frac{24}{120} \times 360^\circ = 72^\circ$ |
| TOTAL | 120 | = 360° |

Pie chart showing the distribution of grades obtained by 120 students in an examination



6 (a) (i)

Method 1 (Evaluating whole numbers and fractions separately)

$$\begin{aligned}
 & 5\frac{7}{15} - 2\frac{2}{3} + 1\frac{5}{12} \\
 \Rightarrow & 5 - 2 + 1 + \frac{7}{15} - \frac{2}{3} + \frac{5}{12} \\
 \Rightarrow & 4 + \frac{28 - 40 + 25}{60} \\
 \Rightarrow & 4 + \frac{13}{60} \\
 \Rightarrow & \underline{\underline{4\frac{13}{60}}}
 \end{aligned}$$

6 (b) (i)

Method 2 (Changing mixed fractions to improper fractions)

$$\begin{aligned}
 & 5\frac{7}{15} - 2\frac{2}{3} + 1\frac{5}{12} \\
 \Rightarrow & \frac{82}{15} - \frac{8}{3} + \frac{17}{12} \\
 \Rightarrow & \frac{328 - 160 + 85}{60} \\
 \Rightarrow & \frac{253}{60} = \underline{\underline{4\frac{13}{60}}}
 \end{aligned}$$

6 (b) (ii)

$$xy - xz + 5y - 5z$$

$$= x(y - z) + 5(y - z)$$

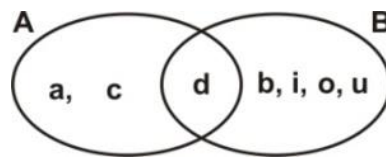
$$= \underline{\underline{(y - z)(x + 5)}}$$

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MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1.



In the diagram above, A and B are two intersecting sets. How many members are in the set B?

- A) 2 B) 3 C) 5 D) 7

2. Which of the following is not a factor of 18?

- A) 3 B) 4 C) 6 D) 9

3. Multiply 0.014 by 0.2

- A) 0.00028 B) 0.0028 C) 0.028 D) 0.28

4. Given that $A = \{b, c, i\}$ and $B = \{a, e, f, i\}$, find $A \cap B$.

- A. $\{a, b, c, e, f, i\}$ B. $\{f, i\}$ C. $\{a\}$ D. $\{i\}$

5. If $a = 64$ and $b = 2^2$, find a/b .

- A) 32 B) 16 C) $1/16$ D) $1/32$

6. Arrange the following numbers from the highest to the lowest: $2/3, -7, 0$.

- A) $-7, 0, 2/3$
B) $-7, 2/3, 0$
C) $0, 2/3, -7$
D) $2/3, 0, -7$

7. Simplify $2^2 \times 3^2 \times 2^3 \times 3^4$

- A) $2^2 \times 3^6$ B) $2^4 \times 3^7$ C) $2^5 \times 3^6$ D) $2^6 \times 3^8$

8. In an examination 40% of the students failed. The number of students that passed was 180. How many students failed?
A) 120 B) 270 C) 300 D) 450
9. Evaluate $\frac{1}{3} [(5 - 1) - (2 - 7)]$
A) -3 B) -1 C) 1 D) 3
10. If $6n + 4 = 16$, find the value of n .
A) 2 B) 3 C) 5 D) 6
11. What is the next term in the following set of numbers: $\{1, 3, 7, 15, 31, \dots\}$?
A) 35 B) 39 C) 47 D) 63
12. Find the mean of the following set of numbers 10, 12, 14 and 16.
A) 12 B) 13 C) 14 D) 15
13. Simplify $3a^2 \times 2ab \times 4bc$
A) $9a^3b^2c$ B) $12a^2b^2c$ C) $24a^2b^2c$ D) $24a^3b^2c$
14. Expand $3(2a + 3b)$
A) $2a + 9b$ B) $5a + 6b$ C) $6a + 3b$ D) $6a + 9b$
15. Find the area of a circle whose diameter is 28 cm.
(Take $\pi = \frac{22}{7}$)
A) 44 cm^2 B) 88 cm^2 C) 352 cm^2 D) 616 cm^2
16. In sharing 95 oranges with Dede, Fofo kept 45 of them and shared the rest equally with Dede. How many oranges did Dede get?
A) 20 B) 25 C) 40 D) 55
17. If $c = \frac{b^2 + 4r}{2ar}$, find c when $b = 3$, $r = 4$ and $a = 5$.
A) $\frac{19}{40}$ B) $\frac{11}{20}$ C) $\frac{3}{8}$ D) $\frac{5}{8}$

18. A woman bought a sewing machine for ₦800,000.00 and sold it for ₦920,000.00. Find the percentage profit

A) 12% B) 13% C) 15% D) 16.4%

19. What is the rule for the following mapping?

| | | | | | |
|---|---|---|----|----|----|
| x | 0 | 1 | 2 | 3 | 4 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 5 | 9 | 13 | 17 | 21 |

A) $y = x + 5$ B) $y = 4x + 5$ C) $y = 5x + 4$ D) $y = 6x + 1$

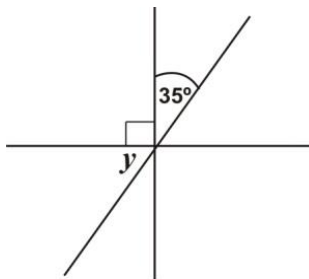
20. Find the volume of a cuboid of sides 15 m by 12 m by 3 m.

A) 36 m^3 B) 45 m^3 C) 180 m^3 D) 540 m^3

21. A bag contains 4 blue and 8 red balls. What is the probability of picking a blue ball at random from the bag?

A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) $\frac{2}{3}$ D) $\frac{3}{4}$

22.



Find the size of the angle marked y in the diagram.

A) 35° B) 45° C) 55° D) 90°

23. An equilateral triangle has side 16cm. A square has the same perimeter as the equilateral triangle. What is the area of the square?

A) 48 cm^2 B) 96 cm^2 C) 144 cm^2 D) 256 cm^2

24. Kofi deposited ₦500,000.00 with a bank for 2 years at a rate of 10% per annum. Find the simple interest

A) ₦10,000.00 B) ₦20,000.00 C) ₦50,000.00 D) ₦100,000.00

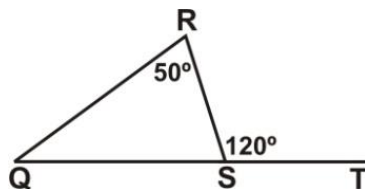
25. Make T the subject of the relation $l^2 = \frac{4\pi^2 T}{g}$
- A) $T = \frac{gl}{2\pi}$ B) $T = \frac{gl^2}{2\pi}$
- C) $T = \frac{l^2}{4g\pi^2}$ D) $T = \frac{gl^2}{4\pi^2}$
26. Evaluate $\frac{0.54 \times 0.7}{9}$
- A) 0.0042 B) 0.042 C) 0.42 D) 4.2
27. Eric and Ebo are to share an amount of ₦800,000.00 in the ratio 5:3 respectively. What will be Ebo's share?
- A. ₦30,000.00
- B) ₦50,000.00
- C) ₦300,000.00
- D) ₦500,000.00
28. How many faces has a rectangular pyramid?
- A) 4 B) 5 C) 6 D) 7
29. The perimeter of a rectangle is 24cm. If the breadth of the rectangle is 4 cm, find the area of the rectangle.
- A) 32 cm² B) 48 cm² C) 64 cm² D) 144 cm²
30. Factorize $4ab^2 - 20ba^2$.
- A. $4a(b^2 - 5b)$
- B. $4b(b - 5a)$
- C. $4ab(b-5a)$
- D. $4ab(a-5b)$

31. Solve the equation $\frac{2}{3}(x-3) = \frac{5}{6}(x+6)$
- A) -42 B) -12 C) 18 D) 42
32. Kofi had 100 mangoes and sold 80 of them. What is the percentage of mangoes left?
- A) 12.5% B) 18% C) 20% D) 25%
33. Find the median of the following marks: 2, 4, 10, 3, 6, 12.
- A) 4 B) 5 C) 6 D) 10

In a class of 20 pupils, 8 pupils read Mathematics, 13 read English and 3 read both Mathematics and English.

Use this information to answer Questions 34 and 35

34. How many pupils read English only?
- A) 2 B) 3 C) 5 D) 10
35. How many pupils do not read either Mathematics or English?
- A) 2 B) 3 C) 5 D) 7
36. Calculate $82.5 \div 0.25$, expressing the answer in the standard form
- A) 3.3×10^{-3} B) 3.3×10 C) 3.3×10^2 D) 3.3×10^3
37. The price of a gas cooker costing ₦450,000.00 was increased by 10%. Find its new price.
- A) ₦45,000.00 B) ₦49,000.00 C) ₦405,000.00 D) ₦495,000.00
38. What is the number of all possible outcomes of tossing a die?
- A) 2 B) 3 C) 4 D) 6
39. In the diagram, QRS is a triangle. Angle QRS = 50° and angle RST = 120° . Find angle RQS.



- A) 60° B) 65° C) 70° D) 80°

40.

If $r = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $s = \begin{pmatrix} -4 \\ -1 \end{pmatrix}$, find $r + 2s$

A. $\begin{pmatrix} -10 \\ 1 \end{pmatrix}$ B. $\begin{pmatrix} -10 \\ -1 \end{pmatrix}$ C. $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$ D. $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. C) 5
2. B) 4
3. B) 0.0028
4. D. $\{i\}$
5. B) 16
6. D) $\frac{2}{3}, 0, -7$
7. C) $2^5 \times 3^6$
8. A) 120
9. D) 3
10. A) 2
11. D) 63
12. B) 13
13. D) $24a^3b^2c$
14. D) $6a + 9b$
15. D) 616 cm^2
16. B) 25

17. D) $\frac{5}{8}$
18. C) 15%
19. B) $y = 4x + 5$
20. D) 540m^3
21. A) $\frac{1}{3}$
22. C) 55°
23. C) 144cm^2
24. D) ₱100,000.00
25. D) $T = \frac{gl^2}{4\pi^2}$
26. B) 0.042
27. C) ₱300,000.00
28. B) 5
29. A) 32 cm^2
30. C. $4ab(b - 5a)$
31. A) -42
32. C) 20%
33. B) 5
34. D) 10
35. A) 2
36. C) 3.3×10^2
37. D. ₱495,000.00
38. D) 6
39. C) 70°

40.

A) $\begin{pmatrix} -10 \\ 1 \end{pmatrix}$

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

Attempt **four** questions **only** from this section

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) A boy has enough money to buy 14 pencils at ¢450.00 each. How many erasers costing ¢300.00 each can he buy with the same amount of money?

- (b) A circle has a circumference of 44cm. Calculate its radius if $\pi = \frac{22}{7}$.

- (c) Simplify $\left(2\frac{1}{4} - 1\frac{5}{8}\right) \div 3\frac{7}{16}$

- (d) If $\frac{5(n+6)}{n} = 1$ find n.

2. (a) Copy and complete the table below for the relation; $x + y = 180$

| | | | | | | | |
|---|-----|----|----|----|-----|-----|-----|
| X | 0 | 30 | 60 | 90 | 120 | 150 | 180 |
| Y | 180 | | | 90 | | | |

- (b) (i) Using a scale of 2cm to 20 units on both axes, draw two perpendicular axes OX and OY.

- (ii) Mark both axes from 0 to 180.
- (iii) Plot all the seven points. Use a ruler to join all the points.

- (c) Using your graph, find
- (i) y when $x = 100$;
 - (ii) x when $y = 70$.

3. (a) There are 30 boys in a sporting club. 20 of them play hockey and 15 play volley-ball. Each boy plays at least one of the two games.
- (i) Illustrate the information on a Venn diagram
 - (ii) How many boys play volley-ball only?

- (b) Factorize $xy + 3x + 6y + 18$
- (c) Multiply $(3 + x)$ by $(5 - 2x)$

4. (a) A woman borrowed ₦2,000,000.00 from a bank at a rate of 15% per annum simple interest for 2 years.
- Find

- (i) the interest for the 2 years
- (ii) how much she paid in all to the bank after the 2 years.

- (b) A woman borrowed ₦2,000,000.00 from a bank. She used the ₦2,000,000.00 to purchase a fridge and sold it at a profit of 45%. Find the selling price of the fridge.

5. (a) Using a pair of compasses and ruler only, construct
- (i) triangle ABC with $|AB| = 10\text{cm}$, angle $ABC = 30^\circ$ and angle $CAB = 60^\circ$;
 - (ii) a perpendicular from the point C to meet the line AB at P.
- (b) (i) Extend line CP to the point D such that $|BC| = |BD|$.
- (ii) Join A to D and B to D.
- (iii) Measure $|AC|$ and $|AD|$.
- (c) What type of quadrilateral is ADBC?

6. The following marks were obtained by pupils in a test.

| | | | | |
|---|---|---|---|----|
| 6 | 4 | 8 | 2 | 8 |
| 6 | 8 | 8 | 8 | 10 |
| 8 | 9 | 8 | 6 | 10 |
| 2 | 2 | 6 | 6 | 6 |

- (a) Construct a frequency distribution table for the data.
- (b) What is the modal mark?
- (c) Calculate the mean mark.
- (d) How many pupils scored more than 6 marks?
- (e) What is the probability that a student chosen at random obtained 2 marks?

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1(a) Method 1 [\(Simple logic\)](#)

$$\text{Total amount} = 14 \times \text{₹}450.00 = \text{₹}6300.00$$

$$\text{Now, } \text{₹}6300 \div \text{₹}300 = 21$$

∴ He can buy 21 erasers with the same amount

1(a) Method 2 [\[Simple Proportion \(indirect\)\]](#)

If @ ₹450 each, he can buy 14 pencils

Then @ ₹300 each, he can buy ? (more) erasers

If more, less (i.e., ₹300) divides,

$$\Rightarrow \frac{\text{₹}450}{\text{₹}300} \times 14 = 21$$

∴ He can buy 21 erasers with the same amount

$$\text{Circumference (C)} = 2 \times \pi (\pi) \times \text{radius (r)}$$

1(b)

Method 1 [\(Substituting first\)](#)

$$\begin{aligned}C &= 2 \pi r \\ \Rightarrow 44 &= 2 \times \frac{22}{7} \times r \\ \Rightarrow 44 &= \frac{44}{7} \times r \\ \Rightarrow 44 \times \frac{7}{44} &= r \\ \Rightarrow 7 &= r \\ \Rightarrow \underline{\underline{\text{Radius} = 7 \text{ cm}}}\end{aligned}$$

1(b)

Method 2 [\(Making r the subject first\)](#)

$$\begin{aligned}C &= 2 \pi r \\ \Rightarrow \frac{C}{2 \pi} &= r \\ \Rightarrow \frac{44}{2 \times \frac{22}{7}} &= r \\ \Rightarrow \frac{44}{\frac{44}{7}} &= r \\ \Rightarrow 44 \div \frac{44}{7} &= r \\ \Rightarrow 44 \times \frac{7}{44} &= r \\ \Rightarrow 7 &= r \\ \Rightarrow \underline{\underline{\text{Radius} = 7 \text{ cm}}}\end{aligned}$$

1(c)

$$\begin{aligned}&\left(2\frac{1}{4} - 1\frac{5}{8}\right) \div 3\frac{7}{16} \\ \Rightarrow &\left(\frac{9}{4} - \frac{13}{8}\right) \div \frac{55}{16}\end{aligned}$$

$$\Rightarrow \left(\frac{18 - 13}{8} \right) \div \frac{55}{16}$$

$$\Rightarrow \frac{5}{8} \times \frac{16}{55}$$

$$\Rightarrow \underline{\underline{\frac{2}{11}}}$$

1(d)

$$\frac{5(n+6)}{n} = 1$$

Multiplying both sides by n

$$n \times \frac{5(n+6)}{n} = 1 \times n$$

$$\Rightarrow 5(n+6) = n$$

$$\Rightarrow 5n + 30 = n$$

$$\Rightarrow 5n - n = -30$$

$$\Rightarrow 4n = -30$$

$$\Rightarrow \frac{4n}{4} = \frac{-30}{4}$$

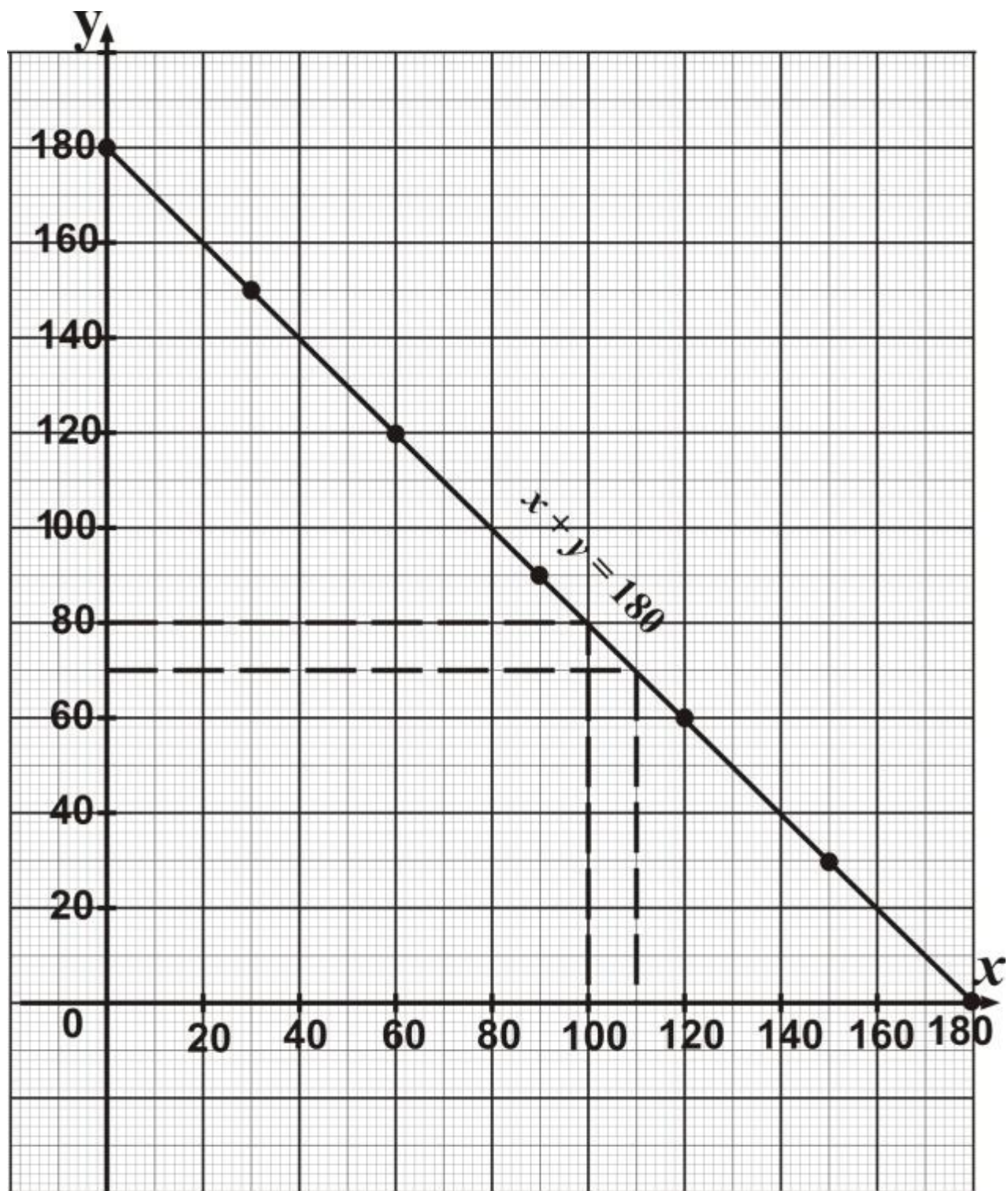
$$\Rightarrow n = \frac{-15}{2}$$

$$\Rightarrow n = \underline{\underline{-7\frac{1}{2}}}$$

2 (a) By substitution of the x values in the given relation, the table is completed as shown below:

| | | | | | | | |
|---|-----|-----|-----|----|-----|-----|-----|
| X | 0 | 30 | 60 | 90 | 120 | 150 | 180 |
| Y | 180 | 150 | 120 | 90 | 60 | 30 | 0 |

2(b) The straight line graph is shown below

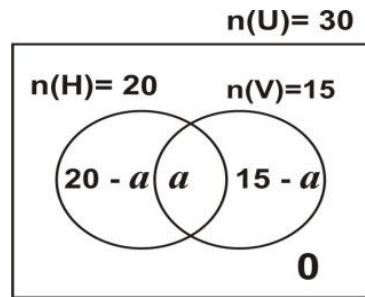


2(c) From the graph,

(i) When $x = 100$, $y = 80$

(ii) When $y = 70$, $x = 110$

- 3(a) (i)** Let $n(U)$ = No. of boys in the club
 $n(H)$ = No. of boys that play hockey
 $n(V)$ = No. of boys that play volleyball
 a = No. of boys that play both hockey and volleyball



- 3(a) (ii)** From the above diagram,

$$\begin{aligned}
 20 - a + a + 15 - a + 0 &= 30 \\
 \Rightarrow 20 + 0 + 15 - a + 0 &= 30 \\
 \Rightarrow 20 + 15 - a &= 30 \\
 \Rightarrow 35 - a &= 30 \\
 \Rightarrow \underline{\underline{a = 5}}
 \end{aligned}$$

No. that play volleyball only

$$\begin{aligned}
 &= n(V) - a \\
 &= 15 - 5 \\
 &= \underline{\underline{10}}
 \end{aligned}$$

10 boys play volleyball only

3(b) $xy + 3x + 6y + 18$

$$= x(y + 3) + 6(y + 3)$$

$$= \underline{\underline{(y + 3)(x + 6)}}$$

3(c) $(3 + x)(5 - 2x)$

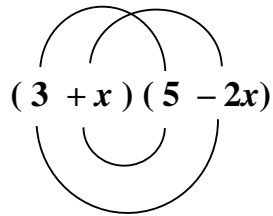
Approach 1 (Distributive property idea)

$$3(5 - 2x) + x(5 - 2x)$$

$$\Rightarrow 15 - 6x + 5x - 2x^2$$

$$\Rightarrow \underline{\underline{15 - x - 2x^2}}$$

3(c) Approach 2 (Smiley face)

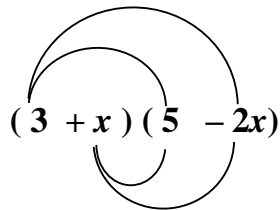


$$15 - 2x^2 + 5x - 6x$$

$$\Rightarrow 15 + 5x - 6x - 2x^2$$

$$\Rightarrow \underline{\underline{15 - x - 2x^2}}$$

3(c) Approach 3 (Moon shape)



$$(3 + x)(5 - 2x)$$

$$\Rightarrow 15 - 6x + 5x - 2x^2$$

$$\Rightarrow \underline{\underline{15 - x - 2x^2}}$$

4(a) (i) Simple interest = Principal \times Rate \times Time

$$= 2,000,000 \times 15\% \quad \times 2$$

$$= 2,000,000 \times \frac{15}{100} \quad \times 2$$

$$= 20,000 \quad \times 15 \quad \times 2$$

$$= \quad \quad \quad 600,000$$

The simple interest is €600,000.00

(ii) Amount paid to bank = Principal + S. interest

$$= \text{¢}2,000,000 + \text{¢}600,000$$

$$= \text{¢}2,600,000$$

She paid ¢2,600,000 to the bank after the 2 years

4(b) Method 1 [\(Formula 1\)](#)

$$\begin{aligned} \text{SP} &= \text{CP} + \text{Profit} \\ &= \text{¢}2,000,000 + (45\% \text{ of } \text{¢}2,000,000) \\ &= \text{¢}2,000,000 + \left(\frac{45}{100} \times \text{¢}2,000,000 \right) \\ &= \text{¢}2,000,000 + 45 \times \text{¢}20,000 \\ &= \text{¢}2,000,000 + \text{¢}900,000 \\ &= \underline{\text{¢}2,900,000} \end{aligned}$$

4(b) Method 2 [\(Formula 2\)](#)

$$\begin{aligned} \text{SP} &= \frac{\text{SP percentage}}{\text{CP percentage}} \times \text{CP} \\ &= \frac{145\%}{100\%} \times 2,000,000 \\ &= \frac{145}{100} \times 2,000,000 \\ &= 145 \times 20,000 \\ &= \underline{\text{¢}2,900,000} \end{aligned}$$

NB
The Percentage of the Original
(Cost) Price is always 100%

4(b) Method 3 [\(Equivalent Fractions\)](#)

| | Percentage | Amount |
|----|------------|-----------|
| CP | 100% | 2,000,000 |
| | 100% + 45% | |

| | | |
|----|---------------|-----|
| SP | = 145% | x |
|----|---------------|-----|

$$\frac{100\%}{145\%} = \frac{2,000,000}{x}$$

← From the above table

Cross multiplying,

$$100 \times x = 2,000,000 \times 145$$

Dividing both sides by 100

$$\Rightarrow x = \frac{2,000,000 \times 145}{100}$$

$$\Rightarrow x = 20,000 \times 145$$

$$\Rightarrow \underline{\underline{x = 2,900,000}}$$

4(b) Method 4 (If more, less divides ...)

If 100% → 2,000,000

Then 145% → ? (more)

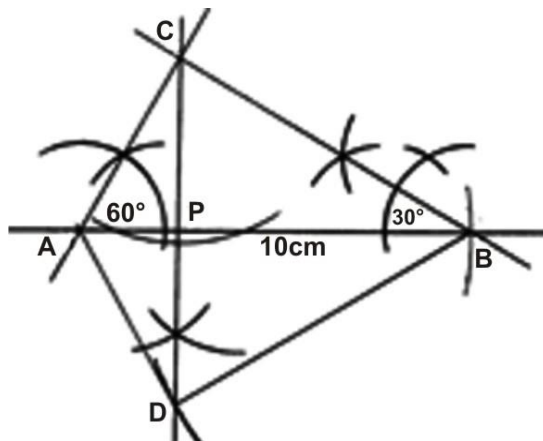
If more, less (i.e., 100) divides; therefore we have

$$\frac{145}{100} \times 2,000,000$$

$$= 145 \times 20,000$$

$$= \text{₹ } \underline{\underline{2,900,000}}$$

5 (a), (b)



(b) (iii) $|AC| \approx \underline{\underline{5 \text{ cm}}}$, $|AD| \approx \underline{\underline{5 \text{ cm}}}$

(c) ADBC is a kite.

6 (a) Frequency Table

| Mark | Tally | Frequency |
|------|--------|-----------|
| 2 | /// | 3 |
| 4 | / | 1 |
| 6 | ### / | 6 |
| 8 | ### // | 7 |
| 9 | / | 1 |
| 10 | // | 2 |

6(b) The modal mark is the most occurring mark

⇒ The modal mark = 8

6(c) Method 1 [\(Using raw data\)](#)

The mean mark = $\frac{\text{The sum of marks}}{\text{The total number of pupils}}$

$$= \frac{(2 \times 3) + (4 \times 1) + (6 \times 6) + (8 \times 7) + (9 \times 1) + (10 \times 2)}{3 + 1 + 6 + 7 + 1 + 2}$$

$$= \frac{6 + 4 + 36 + 56 + 9 + 20}{20}$$

$$= \frac{131}{20} = \underline{\underline{6 \frac{11}{20}}} \quad \text{or} \quad \underline{\underline{6.55}}$$

6(c) Method 2 [\(Using frequency table\)](#)

| Mark (x) | Tally | Frequency (f) | fx |
|-----------------|-------|----------------------|------|
| 2 | /// | 3 | 6 |
| 4 | / | 1 | 4 |

| | | | |
|----|--------|-----------------|-------------------|
| 6 | ### / | 6 | 36 |
| 8 | ### // | 7 | 56 |
| 9 | / | 1 | 9 |
| 10 | // | 2 | 20 |
| | | $\Sigma f = 20$ | $\Sigma fx = 131$ |

$$\begin{aligned}\text{The mean mark} &= \frac{\Sigma f x}{\Sigma f} = \frac{131}{20} \\ &= \underline{\underline{6\frac{11}{20}}} \quad \text{or } \underline{\underline{6.55}}\end{aligned}$$

6 (d) Sum of frequencies of 8, 9 and 10

$$\Rightarrow 7 + 1 + 2 \text{ pupils} = \underline{\underline{10 \text{ pupils}}}$$

6 (e) $P(2 \text{ marks}) = \frac{\text{Number of pupils that obtained 2 marks}}{\text{Total number of pupils}}$

$$= \underline{\underline{\frac{3}{20}}}$$

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MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. If the set $A = \{1, 2, 3, 4, 5\}$ and the set $B = \{2, 4, 6\}$, find the number of members in the set $A \cup B$.
A) 8 B) 6 C) 5 D) 2
2. How many faces has a cuboid ?
A) 3 B) 4 C) 5 D) 6
3. Evaluate $\frac{0.036}{0.02}$
A) 0.018 B) 0.18 C) 1.8 D) 18.0
4. The angle formed by one complete revolution is equivalent to
A) one right angle
B) two right angles
C) three right angles
D) four right angles
5. If the set $P = \{1, 2, 3, 4, 5\}$ which of the following statements best describes P?
A) Set of whole numbers up to 6.
B) Set of counting numbers less than 6
C) Set of counting numbers greater than 6
D) Set of integers less than 6.
6. Which of the following numbers is the next prime number greater than 23 ?
A) 17 B) 24 C) 25 D) 29
7. Simplify $-35 - (-15) + (-30)$
A) -10 B) -20 C) -50 D) -80

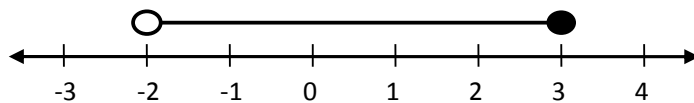
8. Write 78910 correct to the **nearest** thousand

- A) 70,000 B) 78,000 C) 79,000 D) 80,000

9. Simplify $\frac{2^{10} \times 3^2}{3^6 \times 2^8}$

- A) $\frac{2^2}{3^4}$ B) $\frac{3^4}{2^2}$ C) $\frac{3^2}{2^4}$ D) $\frac{2^4}{3^4}$

10. Which of the following inequalities is represented on the number line below?



- A. $-2 < x < 3$
B. $-2 \leq x < 3$
C. $-2 \leq x \leq 3$
D. $-2 < x \leq 3$

11. Factorize completely the expression $4xy - 16x + 10y - 40$.

- A.. $(y + 4)(4x - 10)$
B. $(y - 4)(4x + 10)$
C. $(4 - y)(10 - 4x)$
D. $(y + 4)(4x + 10)$

12. What is the image of 2 in the mapping $x \rightarrow 2x + 5$?

- A) 7 B) 9 C) 12 D) 20

13. Simplify $3a^2b^3 \times 4a^3b$

- A) $12a^5b^4$ B) $12a^4b^5$ C) $7a^5b^4$ D) $7a^4b^5$

14. Find the solution set of $2x + 1 < 5$ in the domain $\{-1, 0, 1, 2, 3\}$.

- A. $\{-1, 1, 3\}$ B. $\{-1, 0, 1\}$ C. $\{-1, 1, 2\}$ D. $\{0, 1, 2\}$

15. Find the highest common factor (HCF) of 48, 60 and 96.

- A) 12 B) 24 C) 36 D) 48

16. $P = \{\text{odd numbers between 20 and 30}\}$ and $Q = \{23, 29\}$. Which of the following is true?

- A) $P \subset Q$ B) $Q \subset P$ C) $P = Q$ D) $P \cap Q = \Phi$

17. Find the rule for the following mapping

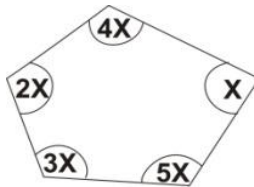
| | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|
| x | 0 | 1 | 2 | 3 | 4 |
| \downarrow | \downarrow | \downarrow | \downarrow | \downarrow | \downarrow |
| y | -1 | 1 | 3 | 5 | 7 |

- A) $y = 2x + 1$ B) $y = 2x - 1$ C) $y = x^2 - 1$ D) $y = x^2 + 1$

18. If $\mathbf{a} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ find $2\mathbf{a} - \mathbf{b}$.

- A. $\begin{pmatrix} 1 \\ 6 \end{pmatrix}$ B. $\begin{pmatrix} 7 \\ 6 \end{pmatrix}$ C. $\begin{pmatrix} 1 \\ 10 \end{pmatrix}$ D. $\begin{pmatrix} 7 \\ 10 \end{pmatrix}$

19. Find the value of x in the polygon below.



- A) 12° B) 36° C) 60° D) 72°

20. An article costs ₦60,000.00. The price was increased by 10%. Find the new price.

- A) ₦54,000.00 B) ₦61,000.00 C) ₦66,000.00 D) ₦70,000.00

21. Solve for x in the equation $15 - 2x = 6$

- A) -10.5 B) -4.5 C) 4.5 D) 10.5

22. The population of Ghana was 5,000,000 in 1957. The population in 1998 was estimated to be 17,000,000. Find the percentage increase in population from 1957 to 1998.

- A) 2.4% B) 24% C) 240% D) 2400%

23. The angles of a triangle are in the ratio 3:2:1. Find the value of the smallest angle.

- A) 30° B) 45° C) 60° D) 90°

24. Find the least common multiple (LCM) of 4, 6 and 10

- A) 10 B) 24 C) 30 D) 60

25. Convert 134_{five} to a base ten numeral

- A) 16 B) 40 C) 44 D) 220

26. A circle has radius 7cm; find its area.

(Take $\pi = \frac{22}{7}$)

- A) 22 cm^2 B) 44 cm^2 C) 145 cm^2 D) 154 cm^2

27. Simplify: $\frac{1}{2} - \frac{2}{3} + \frac{3}{4}$

- A) $\frac{11}{12}$ B) $\frac{7}{12}$ C) $\frac{2}{3}$ D) $\frac{5}{12}$

28. Solve for x, if $\frac{1}{2}x - 4x > 20$

- A) $x < -13\frac{1}{3}$ B) $x < -5\frac{5}{7}$ C) $x > 5\frac{5}{7}$ D) $x > 13\frac{1}{3}$

29. Which of the following is equivalent to $2^2 \times 6^3$?

- A) $2^6 \times 3^3$ B) $2^5 \times 3^3$ C) $2^4 \times 3$ D) $2^3 \times 3^3$

30. The volume of water in a rectangular tank is 30 cm^3 . The length of the tank is 5 cm and its breadth is 2 cm. Calculate the depth of water in the tank.

- A) 4.0 cm B) 3.0 cm C) 5.0 cm D) 6.0 cm

31. The following temperatures in $^\circ\text{C}$ were recorded in 10 cities in Europe;

-4, 5, 2, 0, -6, -4, 3, -6, -4, 7.

Find the modal temperature.

- A) -2°C B) -4°C C) 0°C D) -6°C

32. The ratio of the ages of two sisters is 4:3. The elder sister is 3 years older than the younger one. How old is the younger sister?

- A) 9 years B) 12 years C) 15 years D) 18 years

33. If $n^2 + 4 = 40$, find n

- A) 6 B) 18 C) 22 D) 44

34. An angle which is more than 90° but less than 180° is

- A) an acute angle
B) a right angle
C) an obtuse angle
D) a reflex angle

35. Arrange the following fractions in ascending order: $4\frac{1}{4}$, $4\frac{1}{2}$, $4\frac{1}{3}$

- A) $4\frac{1}{4}$, $4\frac{1}{3}$, $4\frac{1}{2}$
B) $4\frac{1}{3}$, $4\frac{1}{2}$, $4\frac{1}{4}$
C) $4\frac{1}{2}$, $4\frac{1}{4}$, $4\frac{1}{3}$
D) $4\frac{1}{2}$, $4\frac{1}{3}$, $4\frac{1}{4}$

36. Prices of items in a shop were reduced by 10% during a reduction sale. If a customer bought an electric fan for ₦81,000.00, what was its original price?

- A) ₦72,900.00
B) ₦73,900.00
C) ₦89,100.00
D) ₦90,000.00

37. The marks scored by 8 pupils in a science test are: 3, 7, 8, 8, 5, 4, 8, 4.

What is the median mark?

- A) 5 B) 6 C) 7 D) 8

38. The marks scored by 8 pupils in a science test are: 3, 7, 8, 8, 5, 4, 8, 4.

What is the probability that a pupil chosen at random scored 4 marks?

- A) $\frac{1}{2}$ B) $\frac{1}{4}$ C) $\frac{1}{8}$ D) $\frac{2}{47}$

39. If $y = k + ax^2$, find y when $k = \frac{14}{5}$, $a = \frac{4}{5}$ and $x = 2$

- A) 30 B) $7\frac{3}{5}$ C) 6 D) 4

40. Which of the following dimensions of a triangle form the sides of a right –angled triangle ?

- A) 3cm, 4cm, 6cm
- B) 3cm, 5cm, 7cm
- C) 5cm, 12cm, 13cm
- D) 5cm, 13cm, 17cm

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. B) 6
2. D) 6
3. C) 1.8
4. D) four right angles
5. B) Set of counting numbers less than 6
6. D) 29
7. C) -50
8. C) 79,000
9. A) $\frac{2^2}{3^4}$
10. D. $-2 < x \leq 3$
11. B. $(y - 4)(4x + 10)$
12. B) 9
13. A) $12a^5b^4$
14. B. $\{-1, 0, 1\}$
15. A) 12

16. B) $Q \subset P$
17. B) $y = 2x - 1$
18. B. $\begin{pmatrix} 7 \\ 6 \end{pmatrix}$
19. B) 36°
20. C) ₦66,000.00
21. C) 4.5
22. C) 240%
23. A) 30°
24. D) 60
25. C) 44
26. D) 154 cm^2
27. B) $\frac{7}{12}$
28. B) $x < -5\frac{5}{7}$
29. B) $2^5 \times 3^3$
30. B) 3.0cm
31. B) -4°C
32. A) 9 years
33. A) 6
34. C) an obtuse angle
35. A) $4\frac{1}{4}$, $4\frac{1}{3}$, $4\frac{1}{2}$
36. D) ₦90,000.00
37. B) 6
38. B) $\frac{1}{4}$
39. C) 6

40. C) 5cm, 12cm, 13cm

April 2004

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) (i) Factorize completely the expression $2xy - 8x + 3y - 12$
(ii) Evaluate the expression in (i) if $x = 5$ and $y = 7$
(b) Make q the subject of the equation $t = \frac{1}{p} + \frac{1}{q}$
(c) Given that $\mathbf{U} = \begin{pmatrix} -5 \\ 9 \end{pmatrix}$ and $\mathbf{V} = \begin{pmatrix} 8 \\ 12 \end{pmatrix}$, find $3(\mathbf{U} + \frac{1}{2} \mathbf{V})$

2. (a) Ama and Kofi shared the profit earned from their business in the ratio 3:4. The profit was ₵1,743,000.00
(i) Find how much of the profit each person received.
(ii) Kofi lent out his share of the profit at a rate of 20% per annum for 2 years. Find the interest on his share.
(iii) What will be Kofi's total amount at the end of the 2 years?
.
(b) Change 243_{five} to a base ten numeral.

3. (a) Using a ruler and a pair of compasses only, construct,
- triangle PQR such that $|PQ| = 8\text{cm}$, angle $QPR = 60^\circ$ and angle $PQR = 45^\circ$.
 - Measure $|QR|$.
- (b) A rectangular water tank has length 60cm, width 45cm and height 50cm.
Find
- the total surface area of the tank when closed
 - the volume of the tank
 - the height of the water in the tank, if the tank contains $81,000\text{cm}^3$ of water.
4. (a) A car runs on the average at 45 km to 5litres of fuel. Calculate how many litres of fuel are required for a journey of 117km.
- (b) (i) Solve for x in the inequality $\frac{2}{3}(2x + 5) \leq 8\frac{2}{3}$
- (ii) Illustrate the solution on the number line
- (c) A factory increased its production by $22\frac{1}{2}\%$ and produced 49,000 tonnes. How many tonnes was it producing before?
5. (a) (i) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes OX and OY on a graph sheet.
- (ii) On the same graph sheet, mark the x-axis from -5 to 5 and the y-axis from -6 to 6 .
- (b) Plot the points,
- P (1, -2) and Q (4, 5)
 - P' the image of P under a translation by the vector $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$ and Q', the image of Q by the same vector.
- (NB: The original given vector $\begin{pmatrix} 5 \\ 0 \end{pmatrix}$, which was an error, is corrected to $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$)
- (c) (i) Join PQQ'P'.
- (ii) Measure angles PQQ' and PP'Q'.
- (d) (i) Find the vectors \overrightarrow{PQ} and $\overrightarrow{P'Q'}$

(ii) What is the shape of $PQQ'P'$?

6. (a) The following are the ages in years of members of a group:
8, 11, 8, 10, 6, 7, $3x$, 11, 11. If the mean age is 9 years, find

- (i) x
- (ii) the modal age
- (iii) the median age.

- (b) Draw a bar chart for the distribution

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1(a) (i)

$$\begin{aligned} & 2xy - 8x + 3y - 12 \\ \Rightarrow & 2x(y - 4) + 3(y - 4) \\ \Rightarrow & \underline{(y - 4)(2x + 3)} \end{aligned}$$

1. Factorize $2xy - 8x$ and $3y - 12$ separately
2. Factorize $(y - 4)$ out

(ii)

Approach 1 [\(Using \$2xy - 8x + 3y - 12\$ \)](#)

since $x = 5$ and $y = 7$, we have

$$\begin{aligned} & 2(5)(7) - 8(5) + 3(7) - 12 \\ \Rightarrow & 70 - 40 + 21 - 12 \\ & = \underline{39} \end{aligned}$$

(ii)

Approach 2 [\[Using \$\(y - 4\)\(2x + 3\)\$ \]](#)

since $x = 5$ and $y = 7$, we have

$$\begin{aligned} & [7 - 4] [2(5) + 3] \\ & [3] [10 + 3] \\ \Rightarrow & 3 \times 13 \\ & = \underline{39} \end{aligned}$$

1 (b)

$$t = \frac{1}{p} + \frac{1}{q}, \text{ making } q \text{ the subject}$$

Method 1 ([Removing fractions first](#))

$$pq(t) = pq\left(\frac{1}{p}\right) + pq\left(\frac{1}{q}\right)$$

$$\Rightarrow pqt = q + p$$

$$\Rightarrow pqt - q = p$$

$$\Rightarrow q(pt - 1) = p$$

$$\Rightarrow \frac{q(pt - 1)}{(pt - 1)} = \frac{p}{(pt - 1)}$$

$$\Rightarrow \underline{\underline{q = \frac{p}{pt - 1}}}$$

Multiplying through by pq
(LCM of the denominators)
to remove fractions

Grouping all terms
containing q on one side

Factorizing q out

Dividing both sides by $(pt - 1)$

1 (b) Method 2 ([Separating term\(s\) containing \$q\$ on one side first](#))

$$t = \frac{1}{p} + \frac{1}{q}$$

$$t - \frac{1}{p} = \frac{1}{q}$$

$$\Rightarrow \frac{t}{1} - \frac{1}{p} = \frac{1}{q}$$

$$\Rightarrow \frac{pt - 1}{p} = \frac{1}{q}$$

$$q(pt - 1) = p$$

$$\Rightarrow \underline{\underline{q = \frac{p}{pt - 1}}}$$

Separating term(s) containing q
on one side and simplifying
both sides

Cross multiplying

1 (c)

$$3 (\mathbf{U} + \frac{1}{2} \mathbf{V})$$

Method 1 (Evaluating within the bracket first)

$$\begin{aligned} &= 3 \left[\begin{pmatrix} -5 \\ 9 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} 8 \\ 12 \end{pmatrix} \right] \\ &= 3 \left[\begin{pmatrix} -5 \\ 9 \end{pmatrix} + \begin{pmatrix} \frac{1}{2} \times 8 \\ \frac{1}{2} \times 12 \end{pmatrix} \right] \\ &= 3 \left[\begin{pmatrix} -5 \\ 9 \end{pmatrix} + \begin{pmatrix} 4 \\ 6 \end{pmatrix} \right] \\ &= 3 \begin{pmatrix} -5+4 \\ 9+6 \end{pmatrix} \\ &= 3 \begin{pmatrix} -1 \\ 15 \end{pmatrix} = \underline{\underline{\begin{pmatrix} -3 \\ 45 \end{pmatrix}}} \end{aligned}$$

1 (c)

Method 2 (Expanding / Removing brackets first)

$$\begin{aligned} &3 (\mathbf{U} + \frac{1}{2} \mathbf{V}) \\ &= 3 \mathbf{U} + \frac{3}{2} \mathbf{V} \\ &= 3 \begin{pmatrix} -5 \\ 9 \end{pmatrix} + \frac{3}{2} \begin{pmatrix} 8 \\ 12 \end{pmatrix} \\ &= \begin{pmatrix} 3 \times -5 \\ 3 \times 9 \end{pmatrix} + \begin{pmatrix} \frac{3}{2} \times 8 \\ \frac{3}{2} \times 12 \end{pmatrix} \\ &= \begin{pmatrix} -15 \\ 27 \end{pmatrix} + \begin{pmatrix} 12 \\ 18 \end{pmatrix} \\ &= \underline{\underline{\begin{pmatrix} -3 \\ 45 \end{pmatrix}}} \end{aligned}$$

2 (a) (i)

Method 1 (Formula)

$$\text{Person's share} = \frac{\text{Person's ratio}}{\text{Total ratio}} \times \text{Total amount}$$

$$\begin{aligned} \text{Ama's share:} &= \frac{3}{7} \times \text{¢}1,743,000 \\ &= 3 \times \text{¢}249,000 = \text{¢}\underline{\underline{747,000}} \end{aligned}$$

Kofi's share:

Approach 1

$$\begin{aligned} &= \text{¢}1,743,000 - \text{¢}747,000 \\ &= \text{¢}\underline{\underline{996,000}} \end{aligned}$$

Approach 2

$$\begin{aligned} &= \frac{4}{7} \times 1,743,000 \\ &= 4 \times 249,000 = \text{¢}\underline{\underline{996,000}} \end{aligned}$$

2 (a) (i) Method 2 [\(Equivalent Fractions\)](#)

| | Ratio | Amount |
|-------|----------------------|------------------|
| Total | 3 + 4 = 7 | 1,743,000 |
| Ama | 3 | <i>a</i> |
| Kofi | 4 | k |

$$\frac{7}{3} = \frac{1,743,000}{a}$$

From the table above - using the 'Total' and 'Ama' rows,

$$7 \times a = 1,743,000 \times 3$$

Cross multiplying

$$\Rightarrow a = \frac{1,743,000 \times 3}{7}$$

Dividing both sides by 7 to find 'a'

$$\Rightarrow a = 249,000 \times 3$$

$$\Rightarrow \underline{\underline{a = 747,000}}$$

$$\Rightarrow \text{Ama's share} = \text{¢}\underline{747,000}$$

$$\begin{aligned} \text{Hence, Kofi's share} &= \text{¢}1,743,000 - \text{¢}747,000 \\ &= \text{¢}\underline{996,000} \end{aligned}$$

NB: Other approaches using the idea of Simple Proportion could also be used to solve the problem

2(a) (ii) Simple interest on Kofi's share

$$\begin{aligned} &= \text{Principal} \times \text{Rate} \times \text{Time} \\ &= 996,000 \times 20\% \times 2 \\ &= 996,000 \times \frac{20}{100} \times 2 \\ &= 9,960 \times 20 \times 2 \\ &= \text{GH¢}\underline{398,400.00} \end{aligned}$$

(iii) Kofi's total amount

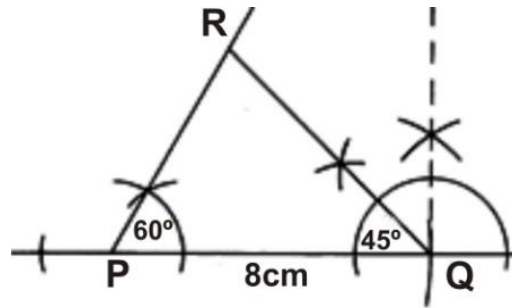
$$\begin{aligned} &= \text{Principal} + \text{S. interest} \\ &= 996,000 + 398,400 \\ &= \text{GH¢}\underline{1,394,400} \end{aligned}$$

2 (b) Changing $2\ 4\ 3_{\text{five}}$ to a base ten numeral.

| | | |
|-------|-------|-------|
| 2 | 4 | 3 |
| 5^2 | 5^1 | 5^0 |

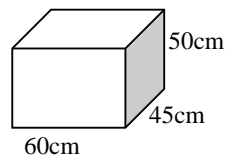
$$\begin{aligned} \Rightarrow & (2 \times 5^2) + (4 \times 5^1) + (3 \times 5^0) \\ &= (2 \times 25) + (4 \times 5) + (3 \times 1) \\ &= 50 + 20 + 3 \\ &= \underline{73} \end{aligned}$$

3 (a) (i)



(ii) $|QR| \approx \underline{\underline{7.1 \text{ cm}}}$

3 (b) (i)



Total surface area of a cuboid of length l , width w and height h

$$\begin{aligned}
 &= \text{Sum of all 6 faces areas of the cuboid} \\
 &= 2(l \times w) + 2(l \times h) + 2(w \times h) \\
 &= 2(60\text{cm} \times 45\text{cm}) + 2(60\text{cm} \times 50\text{cm}) + 2(45\text{cm} \times 50\text{cm}) \\
 &= 2(2700\text{cm}^2) + 2(3000\text{cm}^2) + 2(2250\text{cm}^2) \\
 &= 5400\text{cm}^2 + 6000\text{cm}^2 + 4500\text{cm}^2 \\
 &= \underline{\underline{15900 \text{ cm}^2}}
 \end{aligned}$$

3 (b) (ii) The volume = area of base \times height

$$= (\text{length} \times \text{width}) \times \text{height}$$

$$= (60\text{cm} \times 45\text{cm}) \times 50\text{cm}$$

$$= 2700 \text{ cm}^2 \times 50\text{cm}$$

$$= \underline{\underline{135,000 \text{ cm}^3}}$$

3 (b) (iii) Method 1 (Substituting first, then finding height)

If the tank contains $81,000\text{cm}^3$ then

$$\Rightarrow \text{Volume of water in the tank} = 81,000\text{cm}^3$$

$$\text{Volume} = \text{Area of base} \times \text{height}$$

$$\Rightarrow 81,000\text{ cm}^3 = 2700\text{ cm}^2 \times \text{height}$$

$$\Rightarrow \frac{81,000\text{ cm}^3}{2700\text{ cm}^2} = \text{height}$$

$$\Rightarrow 30\text{ cm} = \text{height (of water in the tank)}$$

$$\Rightarrow \text{The height of water in the tank} = \underline{\underline{30\text{ cm}}}$$

3 (b) (iii) Method 2 (Making height the subject first, then substituting)

$$\text{Length} \times \text{width} \times \text{height} = \text{Volume (of water)}$$

$$\begin{aligned}\Rightarrow \text{height} &= \frac{\text{Volume}}{\text{length} \times \text{width}} \\ &= \frac{81,000\text{ cm}^3}{60\text{cm} \times 45\text{cm}} \\ &= 30\text{ cm}\end{aligned}$$

$$\Rightarrow \text{The height of water in the tank} = \underline{\underline{30\text{ cm}}}$$

4 (a) Method 1 (Unitary Approach – the value of one item)

Since 45km requires 5 litres

$$\Rightarrow 1\text{ km requires } \frac{5}{45}\text{ litre} = \frac{1}{9}\text{ litre}$$

$$\therefore 117\text{ km requires } \frac{1}{9}\text{ litre} \times 117 = \underline{\underline{13\text{ litres}}}$$

4 (a) Method 2 (Equivalent Fractions)

| Distance (km) | Fuel (litres) |
|---------------|---------------|
| 45 | 5 |
| 117 | f |

$$\frac{45}{117} = \frac{5}{f}$$

From the table above,

$$45 \times f = 5 \times 117$$

Cross multiplying,

$$\Rightarrow \frac{45 f}{45} = \frac{5 \times 117}{45} = \frac{117}{9}$$

$$\Rightarrow f = 13$$

\therefore A journey of 117 km requires 13 litres of fuel

4 (a) Method 3 (If more, less divides ...)

If 45 km \rightarrow 5 litres

Then 117 km \rightarrow ? (more)

If more, less (i.e., 45km) divides; therefore we have

$$\frac{117 \text{ km}}{45 \text{ km}} \times 5 \text{ litres} = \frac{117}{45} \times 5 \text{ litres}$$

$$= \underline{\underline{13 \text{ litres}}}$$

4 (b) (i) $\frac{2}{3}(2x + 5) \leq 8\frac{2}{3}$

$$\Rightarrow \frac{2}{3}(2x + 5) \leq \frac{26}{3}$$

$$\Rightarrow 3 \times \frac{2}{3}(2x+5) \leq 3 \times \frac{26}{3}$$

$$\Rightarrow 2(2x+5) \leq 26$$

$$\Rightarrow 4x + 10 \leq 26$$

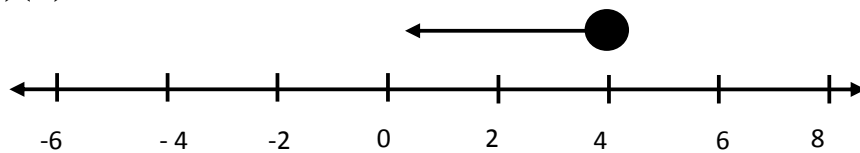
$$\Rightarrow 4x \leq 26 - 10$$

$$\Rightarrow 4x \leq 16$$

$$\Rightarrow x \leq 16 \div 4$$

$$\Rightarrow \underline{\underline{x \leq 4}}$$

4 (b)(ii)



4 (c) Method 1 ([Equivalent Fractions](#))

| | Percentage | Production |
|--------|-------------------------------|-----------------|
| After | 100% + 22½% = 122½% | 49,000 |
| Before | 100% | <i>x</i> |

From the table above, $\frac{122\frac{1}{2}\%}{100\%} = \frac{49,000}{x}$

$$\Rightarrow \frac{122\frac{1}{2}}{100} = \frac{49,000}{x} \Rightarrow \frac{122.5}{100} = \frac{49,000}{x}$$

Cross-multiplying, we have: $122.5 \times x = 49000 \times 100$

$$\Rightarrow \frac{122.5 \times x}{122.5} = \frac{49000 \times 100}{122.5}$$

Dividing both sides by 122.5
to find x

$$x = \frac{49000 \times 100}{122.5} \times \frac{10}{10}$$

Multiplying both numerator and denominator
by 10 (to convert 122.5 to 1225)

$$x = \frac{49000 \times 1000}{1225} = 40,000$$

\Rightarrow The factory was producing 40,000 tonnes before.

4 (c) Method 2 (If more, less divides ...)

If $122\frac{1}{2}\%$ \rightarrow 49,000 tonnes

Then 100 % \rightarrow ? (less)

If less, more (i.e., $122\frac{1}{2}\%$) divides; therefore we have

$$\begin{aligned} \frac{100\%}{122\frac{1}{2}\%} \times 49,000 \text{ tonnes} &= \frac{100}{122.5} \times 49,000 \text{ tonnes} \\ &= \underline{\underline{40,000 \text{ tonnes}}} \end{aligned}$$

4 (c) Method 3 (Equation)

Increased q'ty = $122\frac{1}{2}\%$ of Original q'ty = 49,000 tonnes

$$\Rightarrow \frac{122\frac{1}{2}}{100} \times \text{Original Quantity} = 49,000 \text{ tonnes}$$

$$\Rightarrow \frac{122.5}{100} \times \text{Original q'ty} = 49,000$$

Multiplying both sides by
 $\frac{100}{122.5}$ (to remove $\frac{122.5}{100}$)

To find original quantity

$$\Rightarrow \text{Original q'ty} = 49,000 \times \frac{100}{122.5}$$

$$= \frac{49,000 \times 1000}{1225}$$

Multiplying both numerator
and denominator by 10 (to
convert 122.5 to 1225)

$$= 40,000$$

⇒ It was producing 40,000 tonnes before

5 (a), (b) **Approach 1** ([Inspection / Construction](#))

[NB: Translating PQ by vector $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$ simply means moving PQ 5 units to the left (-

5), and 0 units downwards [i.e., no movement downwards (0).

So, e.g., the point Q(4,5) moves to Q'(-1,5)

NB: **Horizontal** direction movement **first**; **Vertical** direction movement **second** (always)

5 (a), (b) **Approach 2** ([The rule / formula](#))

Translating (x, y) by vector $\begin{pmatrix} a \\ b \end{pmatrix}$

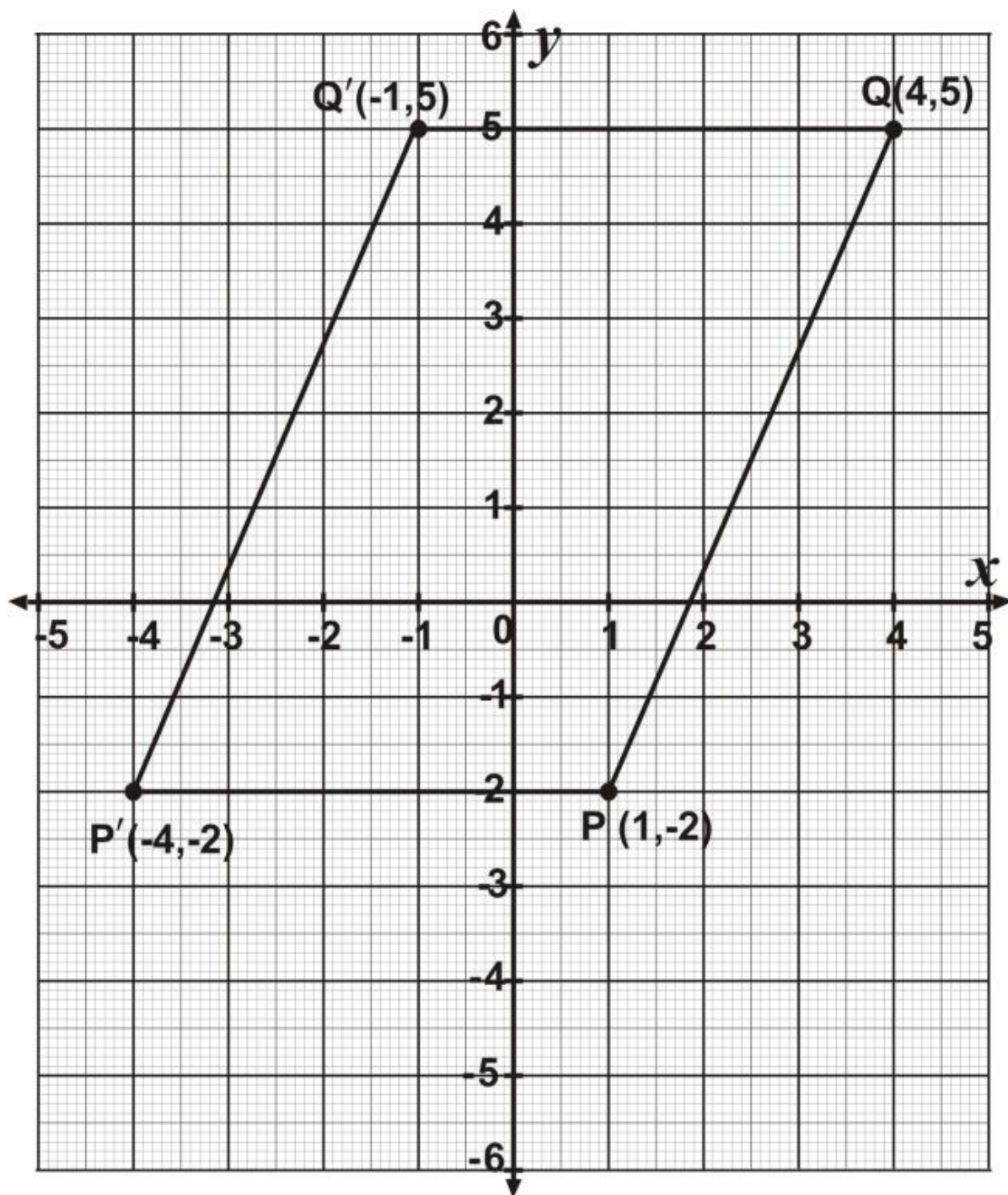
$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x + a \\ y + b \end{pmatrix}$$

$$\begin{aligned} \Rightarrow \quad OP \begin{pmatrix} 1 \\ -2 \end{pmatrix} &\rightarrow OP' \begin{pmatrix} 1 + -5 \\ -2 + 0 \end{pmatrix} \\ OP \begin{pmatrix} 1 \\ -2 \end{pmatrix} &\rightarrow OP' \begin{pmatrix} -4 \\ -2 \end{pmatrix}, \quad \therefore P'(-4, -2) \end{aligned}$$

$$\begin{aligned} \Rightarrow \quad OQ \begin{pmatrix} 4 \\ 5 \end{pmatrix} &\rightarrow OQ' \begin{pmatrix} 4 + -5 \\ 5 + 0 \end{pmatrix} \\ OQ \begin{pmatrix} 4 \\ 5 \end{pmatrix} &\rightarrow OQ' \begin{pmatrix} -1 \\ 5 \end{pmatrix}, \quad \therefore Q'(-1, 5) \end{aligned}$$

Plot and join P'(-4,-2) and Q'(-1,5) as the image of PQ under a translation by

the vector $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$



5 (c) (ii) Angle PQQ' \approx 67°

Angle PP'Q' \approx 67°

5 (d) (i) Vectors PQ and P'Q'

Method 1 [\(Inspection\)](#)

From P to Q, we move 3 units to the right (horizontal),

followed by 7 units upwards (vertical)

$$\Rightarrow \text{Vector PQ } (\overrightarrow{PQ}) = \underline{\underline{\begin{pmatrix} 3 \\ 7 \end{pmatrix}}}$$

From P' to Q', we move 3 units to the right (horizontal),

followed by 7 units upwards (vertical)

$$\Rightarrow \text{Vector P'Q' } (\overrightarrow{P'Q'}) = \underline{\underline{\begin{pmatrix} 3 \\ 7 \end{pmatrix}}}$$

NB:

Horizontal direction
movement first; Vertical
direction movement
second (always)

5 (d) (i) Method 2 (Calculation / Rule)

$$\text{Vector PQ} = \vec{OQ} - \vec{OP}$$

$$= \begin{pmatrix} 4 \\ 5 \end{pmatrix} - \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 4 - 1 \\ 5 - (-2) \end{pmatrix}$$

$$= \begin{pmatrix} 4 - 1 \\ 5 + 2 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 3 \\ 7 \end{pmatrix}}}$$

$$\text{Vector P'Q'} = \vec{OQ'} - \vec{OP'}$$

$$= \begin{pmatrix} -1 \\ 5 \end{pmatrix} - \begin{pmatrix} -4 \\ -2 \end{pmatrix} = \begin{pmatrix} -1 - (-4) \\ 5 - (-2) \end{pmatrix}$$

$$= \underline{\underline{\begin{pmatrix} -1 + 4 \\ 5 + 2 \end{pmatrix}}} = \underline{\underline{\begin{pmatrix} 3 \\ 7 \end{pmatrix}}}$$

(ii) PQQ'P' is a parallelogram

6 (a) (i) If the mean age = 9 years, then

$$\frac{8 + 11 + 8 + 10 + 6 + 7 + 3x + 11 + 11}{9} = 9$$

$$\Rightarrow \frac{72 + 3x}{9} = 9$$

$$\Rightarrow 72 + 3x = 9 \times 9$$

$$\Rightarrow 72 + 3x = 81$$

$$\Rightarrow 3x = 81 - 72$$

$$\Rightarrow 3x = 9$$

$$\Rightarrow x = \frac{9}{3}$$

$$\Rightarrow x = 3$$

6 (a) (ii) The modal age is 11 years

6 (a) (iii) Since $x = 3$, $\Rightarrow 3x = 3(3) = 9$

Therefore, the ages in years of the members are

8, 11, 8, 10, 6, 7, 9, 11, 11.

Hence re-arranging in ascending order, we have

6, 7, 8, 8, 9, 10, 11, 11, 11

The middle ages (in years) are 9 and 10; therefore

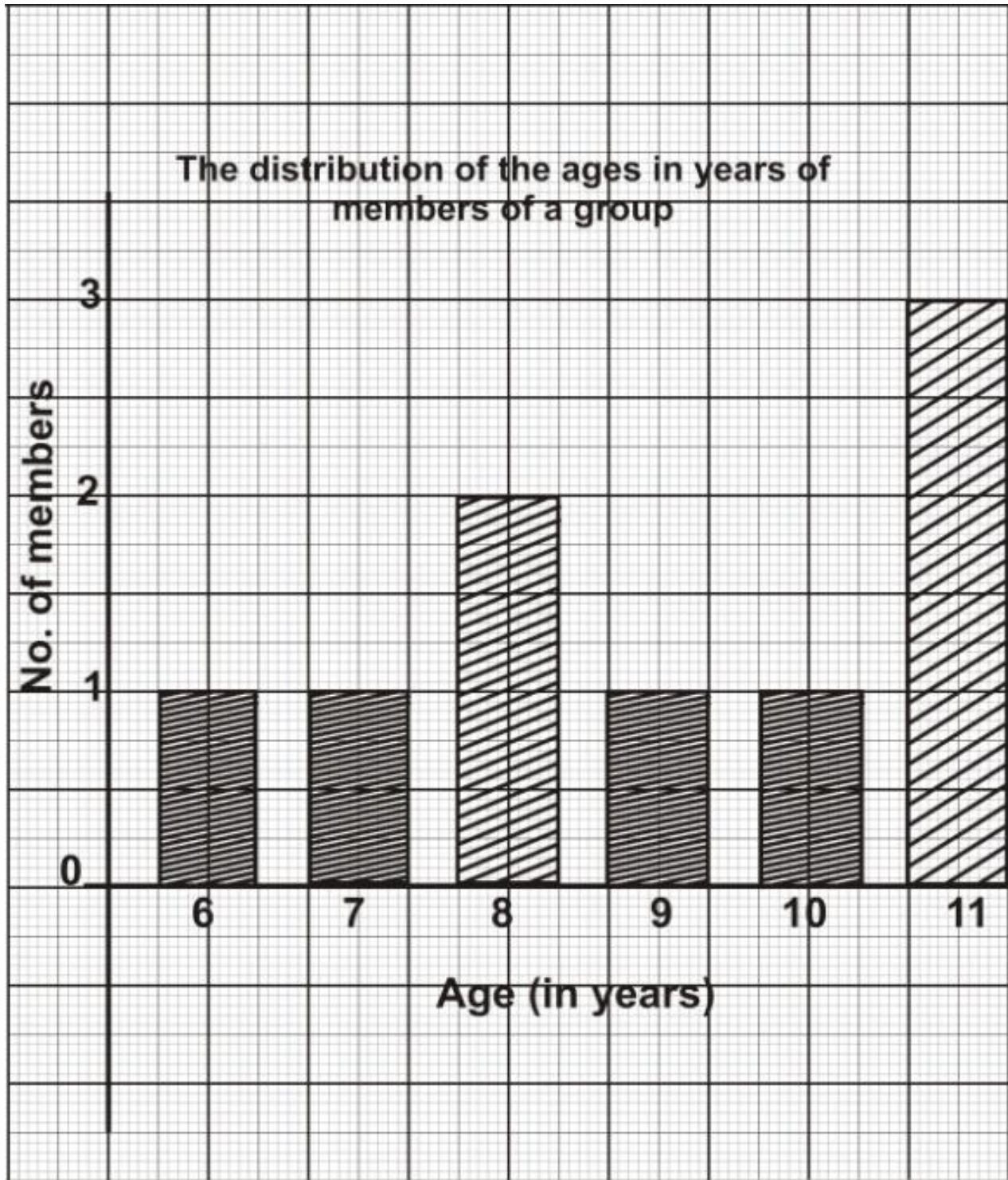
$$\text{The median age} = \frac{9+10}{2}$$

$$\text{or } \frac{1}{2}(9+10) = \underline{4.5 \text{ or } 4\frac{1}{2} \text{ years}}$$

6 (b) Hence the frequency table and bar chart are shown below

| Age (in yrs) | 6 | 7 | 8 | 9 | 10 | 11 |
|-----------------|---|---|---|---|----|----|
| No. of | 1 | 1 | 2 | 1 | 1 | 3 |

| | | | | | | |
|---------|--|--|--|--|--|--|
| members | | | | | | |
|---------|--|--|--|--|--|--|



April 2003

MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. $P = \{3, 6, 9, 12, 15\}$. Which of the following best describes the set P?

A) The set of multiples of 3 less than 18
B) The set of multiples of 3
C) The set of odd numbers
D) The set of odd numbers less than 16

2. If $Q = \{2, 4, 6, 7, 8, 10\}$ and $R = \{3, 5, 7, 9, 10, 11\}$, find $Q \cap R$.

A. $\{2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$
B. $\{7, 10\}$
C. $\{10\}$
D. $\{7\}$

3.



Find the set of missing numbers on the number line above.

A. $\{-21, -6, 11\}$ B. $\{-21, -10, 11\}$ C. $\{-25, -6, 15\}$ D. $\{-25, -10, 15\}$

4. If 7.2 and 7.9 are two points on a number line, find the number in the middle of these points.

A) 7.35 B) 7.45 C) 7.55 D) 7.65

5. Find the least common multiple (LCM) of 12 and 20.

A) 24 B) 48 C) 60 D) 80

6. Express 72 as a product of prime factors.
A) 2×3 B) $2^2 \times 3^2$ C) $2^2 \times 3^3$ D) $2^3 \times 3^2$
7. If $3t - 2(t + 12) = 11$, find the value of t.
A) -35 B) -13 C) 13 D) 35
8. What is the value of the digit 8 in the number 78000 ?
A) 8 ten thousands B) 8 thousands C) 8 hundreds D) 8 tens
9. Find the product of 17 and 121.
A) 968 B) 1,751 C) 2,057 D) 8,591
10. Araba owes ₦550,000.00 at the bank. She goes to pay ₦150,000.00. How much does Araba owe the bank now?
A) ₦700,000.00 B) ₦600,000.00 C) ₦500,000.00 D) ₦400,000.00
11. Evaluate $\frac{37}{100} \times \frac{7}{10}$
A) 0.259 B) 2.590 C) 25.900 D) 259.000
12. Express 1.25 as a mixed fraction in its lowest form.
A) $1\frac{1}{25}$ B) $1\frac{4}{25}$ C) $1\frac{1}{4}$ D) $1\frac{3}{4}$
13. The total number of match sticks in 6 match boxes was 270. Find the total number of sticks in 20 similar boxes.
A) 710 B) 800 C) 810 D) 900
14. A car travels at an average speed of 45 km per hour. What distance does it cover in 12 hours?
A) 450km B) 480km C) 500km D) 540km
15. Calculate the simple interest on ₦130,000.00 for $2\frac{1}{2}$ years at 12% per annum.
A) ₦78,000.00 B) ₦39,000.00 C) ₦36,000.00 D) ₦31,200.00
16. Express $\frac{2}{5}$ as a percentage

- A) 20% B) 25% C) 40% D) 80%

17. Kwame gets a commission of 20% on bread sold. In one week, Kwame's commission was ₵45,000.00. How much bread did he sell during that week?

- A) ₵205,000.00
B) ₵220,000.00
C) ₵225,000.00
D) ₵235,000.00

18. Write 83000 in standard form.

- A) 8.3×10^{-4}
B) 8.3×10^{-3}
C) 8.3×10^3
D) 8.3×10^4

19. The following marks are the marks obtained by pupils in a test:

2, 3, 5, 2, 3, 4, 2, 3, 5, 3.

What is the mode?

- A) 2 B) 3 C) 4 D) 5

20. The following marks are the marks obtained by pupils in a test:

2, 3, 5, 2, 3, 4, 2, 3, 5, 3. Calculate the mean

- A) 3.0 B) 3.2 C) 4.0 D) 4.2

21. There are 12 red and 8 blue balls in a bag. If a ball is selected at random from the bag, what is the probability that it is red?

- A) $\frac{2}{5}$ B) $\frac{2}{3}$ C) $\frac{3}{5}$ D) $\frac{4}{5}$

22. If $y = \frac{1}{3}(x - 2)$ express x in terms of y .

A) $x = 3y - 2$

B) $x = 3y + 2$

C) $x = \frac{3}{2}y$

D) $x = -\frac{3}{2}y$

23. Simplify $6a^2 \times 4a^2b^2$

A) $10a^4b^2$

B) $24a^2b^2$

C) $24a^4b^2$

D) $24a^2b^4$

24. Change 17_{ten} to a base two numeral.

A) 101

B) 1001

C) 1000

D) 10001

25. Which of the following statements is true?

A) $8+4 < 10$

B) $7+4 < 10$

C) $6+4 < 10$

D) $5+4 < 10$

26. Find the set of integers within the interval $-2 < x < 2$

A. $\{-2, -1, 2\}$

B. $\{-2, -1, 0\}$

C. $\{-1, 0, 1\}$

D. $\{-1, 1, 2\}$

27. Use the mapping below to answer question 27

| | | | | | |
|---|----|----|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | -4 | -2 | 0 | 2 | m |

What is the rule for this mapping ?

A) $x \rightarrow 2(x-3)$

B) $x \rightarrow x-5$

C) $x \rightarrow 2(x-2)$

D) $x \rightarrow 2x-3$

28.

| | | | | | |
|---|----|----|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | -4 | -2 | 0 | 2 | m |

Find m

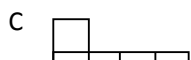
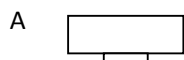
A) -4

B) 4

C) 6

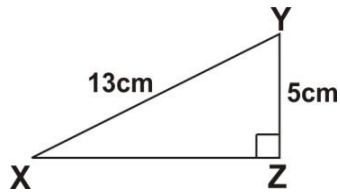
D) 8

29. Which of the following represents the net of a pyramid?



30. A rectangular tank has dimensions 2.5 m by 4 m by 5 m. It is filled with water to the brim. If 35 m^3 of the water is used, how much water is left in the tank?
- A) 50 m^3 B) 35 m^3 C) 25 m^3 D) 15 m^3

31.

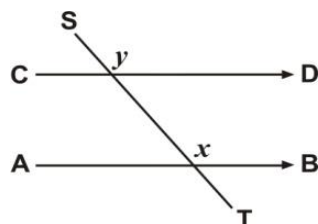


In the triangle XYZ, angle XZY = 90° , $|XY| = 13\text{cm}$ and

$|YZ| = 5\text{cm}$. What is the length of XZ ?

- A) 4cm B) 8cm C) 12cm D) 65cm
32. How many lines of symmetry has an equilateral triangle ?
- A) 1 B) 2 C) 3 D) 4
33. The value of an obtuse angle lies between
- A) 0° and 90°
- B) 90° and 180°
- C) 90° and 270°
- D) 180° and 360°

34.



In the diagram above, AB is parallel to CD. Angles x and y are

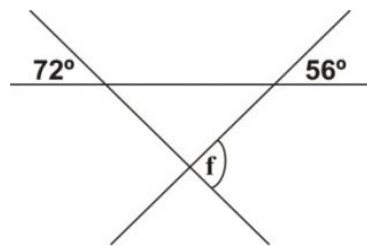
- A) alternate angles

- B) corresponding angles
- C) vertically opposite angles
- D) co-interior angles

35. If $\mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$, find $2\mathbf{a} + \mathbf{b}$.

- A. $\begin{pmatrix} 7 \\ -2 \end{pmatrix}$ B. $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$ C. $\begin{pmatrix} 8 \\ -7 \end{pmatrix}$ D. $\begin{pmatrix} 1 \\ 6 \end{pmatrix}$

36.



Find the size of the angle marked f , in the diagram above.

- A) 56° B) 72° C) 108° D) 128°

37. The dimensions of a cuboid are 2cm, P cm and 5cm. Which of the following is an expression for the volume of the cuboid?

- A. $7P \text{ cm}^3$
- B. $(7+P) \text{ cm}^3$
- C. $10P \text{ cm}^3$
- D. $(10+P) \text{ cm}^3$

38. Simplify $5(3t + 1) - 6(t - 1)$.

- A) $9t + 11$ B) $9t + 7$ C) $9t + 1$ D) $9t - 5$

39. Simplify: $(\frac{2}{3} - \frac{1}{2}) \div \frac{1}{6}$

- A) $\frac{1}{36}$ B) $\frac{1}{12}$ C) 1 D) 6

40. The point P moves in a plane such that it is always at equal distance from two fixed points, A and B in the same plane. Which of these is the locus of the point P ?

- A) The bisector of angle PAB
- B) A circle centre B and radius AB
- C) A circle with AB as the diameter
- D) The perpendicular bisector of line AB.

April 2003

MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. A) The set of multiples of 3 less than 18
2. B. $\{7, 10\}$
3. D. $\{-25, -10, 15\}$
4. C) 7.55
5. C) 60
6. D) $2^3 \times 3^2$
7. C) 2,057
8. D) 35
9. B) 8 thousands
10. D) ₦400,000.00
11. A) 0.259
12. C) $1 \frac{1}{4}$
13. D) 900
14. D) 540km
15. B) ₦39,000.00

16. C) 40%

17. C) ₦225,000.00

18. D) 8.3×10^4

19. B) 3

20. B) 3.2

21. C) $\frac{3}{5}$

22. B) $x = 3y + 2$

23. C) $24a^4b^2$

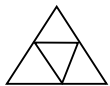
24. D) 10001

25. D) $5+4 < 10$

26. C. $\{-1,0,1\}$

27. A) $x \rightarrow 2(x-3)$

28. B) 4

29. B 

30. D) $15m^3$

31. C) 12cm

32. C) 3

33. B) 90° and 180°

34. B) corresponding angles

35. A. $\begin{pmatrix} 7 \\ -2 \end{pmatrix}$

36. D) 128°

37. C. $10Pcm^3$

38. A) $9t + 11$
39. C) 1
40. D) The perpendicular bisector of line AB.

April 2003

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. ϵ = $\{1, 2, 3, 4, \dots, 18\}$

 A = $\{\text{Prime numbers}\}$

 B = $\{\text{Odd numbers greater than 3}\}$

(a) If A and B are subsets of the Universal set, ϵ , list the members of A and B

(b) Find the set

(i) $A \cap B$;

(ii) $A \cup B$

(c) (i) Illustrate ϵ , A and B on a Venn diagram.

(ii) Shade the region for prime factors of 18 on the Venn diagram

2. (a) If $2n - 5m + 10 = 0$, find

(i) m, when $n = 2$;

(ii) n, when $m = 5$.

- (b) Simplify $\frac{6.4 \times 0.25 \times 16}{0.08 \times 0.5}$ leaving your answer in standard form
- (c) A number of sweets were shared among 8 children and each child received 30. If 12 children shared the same number of sweets, how many will each receive?

3. The table below shows the distribution of the ages (in years) of children in a nursery school.

| Age (years) | 1 | 2 | 3 | 4 | 5 |
|--------------------|---|---|---|---|---|
| Number of children | 6 | 4 | 2 | 3 | 5 |

- (a) Find
- the modal age
 - the mean age
- (b) Draw a bar chart for the distribution.
- (c) What is the probability that a child chosen at random from the school is 4 years old?

4. (a) If $\mathbf{p} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} 0 \\ -2 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} -3 \\ 7 \end{pmatrix}$, find $\mathbf{p} + 2\mathbf{q} + \mathbf{r}$

(b) Find the solution set of the inequality $x - \frac{4}{5} \leq \frac{1}{5}$, if the domain is the set $\{-2, -1, 0, 1, 2\}$.

(c) A rectangular sheet of metal has length 44cm and breadth 10cm. It is folded to form a cylinder with the breadth becoming the height.

Calculate

- the radius of the cylinder formed;
- the volume of the cylinder.

(Take $\pi = \frac{22}{7}$)

5. (a) Using a pair of compasses and ruler only,

(i) construct the triangle ABC with $|AB| = 8$ cm, $|BC| = 8$ cm and $|AC| = 7$ cm.

(ii) Bisect angle ABC and let the bisector meet AC at D. Produce |BD| to P such that $|BD| = |DP|$. Join AP and CP.

(b) Measure (i) angle ADB; (ii) $|AP|$.

(c) What kind of quadrilateral is ABCP?

April 2003

MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1 (a)

$$\begin{array}{lcl} A & = & \{2, 3, 5, 7, 11, 13, 17\} \\ B & = & \{5, 7, 9, 11, 13, 15, 17\} \end{array}$$

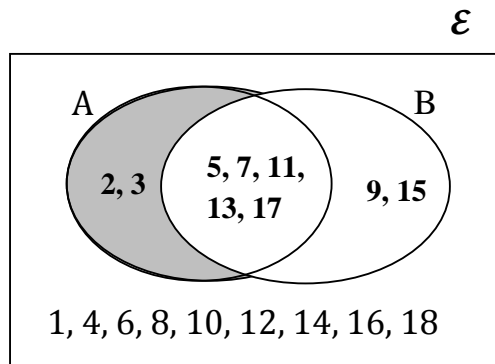
(b) (i)

$$A \cap B = \{5, 7, 11, 13, 17\}$$

(ii)

$$A \cup B = \{2, 3, 5, 7, 9, 11, 13, 15, 17\}$$

(c)(i), (ii)



2 (a) (i) When $n = 2$, we have

$$\begin{aligned}
& 2(2) - 5m + 10 = 0 \\
\Rightarrow & 4 - 5m + 10 = 0 \\
\Rightarrow & 4 + 10 = 0 + 5m \\
\Rightarrow & 14 = 5m \\
\Rightarrow & \frac{14}{5} = m \\
\Rightarrow & m = \frac{14}{5} \\
\Rightarrow & m = \underline{\underline{2\frac{4}{5}}}
\end{aligned}$$

(ii) When $m = 5$, we have

$$\begin{aligned}
& 2n - 5(5) + 10 = 0 \\
\Rightarrow & 2n - 25 + 10 = 0 \\
\Rightarrow & 2n - 15 = 0 \\
\Rightarrow & 2n = 15 \\
\Rightarrow & n = \frac{15}{2} \\
\Rightarrow & n = \underline{\underline{7\frac{1}{2}}}
\end{aligned}$$

2 (b)
$$\frac{6.4 \times 0.25 \times 16}{0.08 \times 0.5}$$

Method 1 [\(Converting Decimals to Common Fractions\)](#)

$$\begin{aligned}
& = (6.4 \times 0.25 \times 16) \div (0.08 \times 0.5) \\
& = \left(\frac{64}{10} \times \frac{25}{100} \times \frac{16}{1} \right) \div \left(\frac{8}{100} \times \frac{5}{10} \right) \\
& = \left(\frac{64}{10} \times \frac{25}{100} \times \frac{16}{1} \right) \times \left(\frac{100}{8} \times \frac{10}{5} \right) \\
& = \frac{64 \times 25 \times 16}{8 \times 5} \\
& = \frac{8 \times 5 \times 16}{1 \times 1} \\
& = 640 = \underline{\underline{6.4 \times 10^2}}
\end{aligned}$$

2 (b) **Method 2** [\(Converting Decimals to Whole Numbers\)](#)

Multiplying both numerator and denominator by 1000
(to convert to whole numbers)

$$\begin{aligned} & \frac{6.4 \times 0.25 \times 16}{0.08 \times 0.5} \times \frac{1000}{1000} \\ = & \frac{64 \times 25 \times 16}{8 \times 5} \\ = & \frac{8 \times 5 \times 16}{1 \times 1} \\ = & 640 = \underline{\underline{6.4 \times 10^2}} \end{aligned}$$

2 (c) Method 1 (Simple Sharing)

Total no. of sweets = 8×30 sweets = 240 sweets

Now, $240 \div 12 = 20$

\therefore If 12 children shared 240 sweets, each gets 20 sweets

2 (c) Method 2 (Simple Proportion)

In sharing the same number of sweets,

If for 8 children, each receives 30 sweets,

then for 12 children, each receives ?(less) sweets

If less, more (i.e., 12 children) divides,

$$\Rightarrow \frac{8 \text{ children}}{12 \text{ children}} \times 30 \text{ sweets} = \underline{\underline{20 \text{ sweets}}}$$

3 (a) (i)

The modal age is the age that occurs most

$$\Rightarrow \underline{\underline{\text{The modal age} = 1 \text{ year}}}$$

3 (a) (i)

Approach 1

$$\begin{aligned} \text{The mean age} &= \frac{\text{The sum of ages}}{\text{The total number of children}} \\ &= \frac{(1 \times 6) + (2 \times 4) + (3 \times 2) + (4 \times 3) + (5 \times 5)}{6 + 4 + 2 + 3 + 5} \\ &= \frac{6 + 8 + 6 + 12 + 25}{6 + 4 + 2 + 3 + 5} \end{aligned}$$

$$= \frac{57}{20}$$

$$= \underline{\underline{2\frac{17}{20} \text{ years}}} \quad \text{or} \quad \underline{\underline{2.85 \text{ years}}}$$

3 (a)(i)

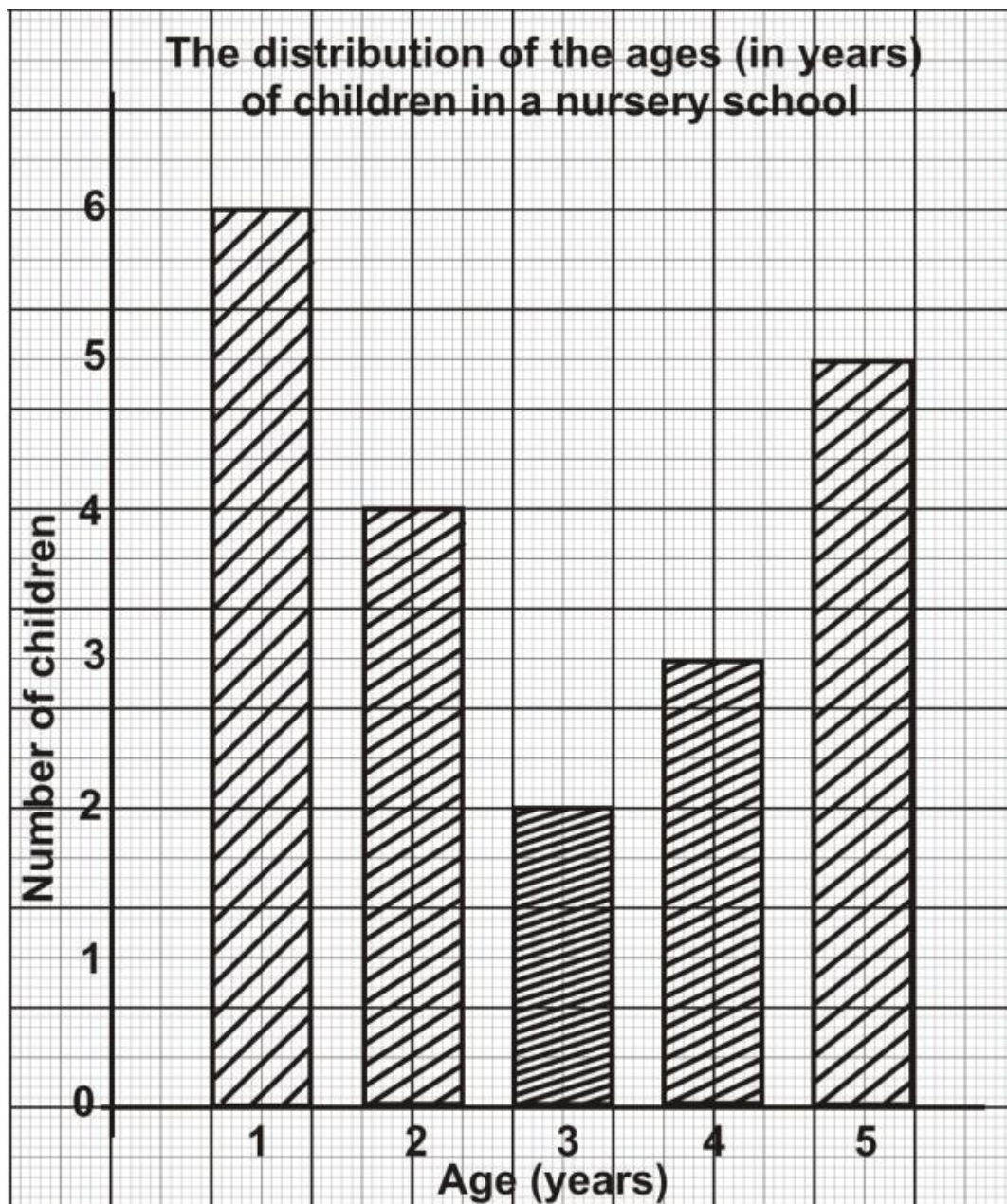
Approach 2

| Age (years) (x) | No. of Children (f) | $f x$ |
|-----------------------------------|----------------------------|-------------------------------------|
| 1 | 6 | 6 |
| 2 | 4 | 8 |
| 3 | 2 | 6 |
| 4 | 3 | 12 |
| 5 | 5 | 25 |
| $\Sigma f = 20$ | | $\Sigma f x = 57$ |

$$\begin{aligned} \text{The mean age} &= \frac{\Sigma f x}{\Sigma f} = \frac{57}{20} \\ &= \underline{\underline{2\frac{17}{20} \text{ years}}} \quad \text{or} \quad \underline{\underline{2.85 \text{ years}}} \end{aligned}$$

3 (b)

Vertical Axis Scale: 3 cm to 1 child



3 (c) $P(4 \text{ years old}) = \frac{\text{Number of children aged 4 years}}{\text{Total number of children}}$

$$= \frac{3}{20}$$

4 (a)

$$= \begin{pmatrix} 4 \\ 5 \end{pmatrix} + 2 \begin{pmatrix} 0 \\ -2 \end{pmatrix} + \begin{pmatrix} -3 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} 4 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \times 0 \\ 2 \times -2 \end{pmatrix} + \begin{pmatrix} -3 \\ 7 \end{pmatrix}$$

$$\begin{aligned}
 &= \begin{pmatrix} 4 + 0 + (-3) \\ 5 + (-4) + 7 \end{pmatrix} \\
 &= \begin{pmatrix} 4 + 0 - 3 \\ 5 - 4 + 7 \end{pmatrix} \\
 &= \underline{\underline{\begin{pmatrix} 1 \\ 8 \end{pmatrix}}}
 \end{aligned}$$

4 (b)

Method 1

$$x - \frac{4}{5} \leq \frac{1}{5}, \quad \text{domain} = \{-2, -1, 0, 1, 2\}$$

$$\Rightarrow x \leq \frac{1}{5} + \frac{4}{5}$$

Grouping constants

$$\Rightarrow x \leq 1$$

$$\Rightarrow \underline{\underline{\text{Truth set} = \{-2, -1, 0, 1\}}}$$

4 (b)

Method 2

$$x - \frac{4}{5} \leq \frac{1}{5} \quad \text{domain} = \{-2, -1, 0, 1, 2\}$$

$$5(x) - 5\left(\frac{4}{5}\right) \leq 5\left(\frac{1}{5}\right)$$

Multiplying through by 5
to remove fractions

$$\Rightarrow 5x - 4 \leq 1$$

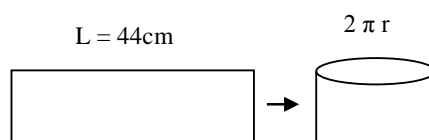
$$\Rightarrow 5x \leq 1 + 4$$

$$\Rightarrow \frac{5x}{5} \leq \frac{5}{5}$$

$$\Rightarrow x \leq 1$$

$$\Rightarrow \underline{\underline{\text{Truth set} = \{-2, -1, 0, 1\}}}$$

4 (c) (i) **METHOD 1** (Length of rectangle = Circumference of circle)



Approach 1 (Substituting first, then finding r)

$$\begin{aligned}L &= 2 \pi r \\ \Rightarrow 44\text{cm} &= 2 \times \frac{22}{7} \times r \\ \Rightarrow \frac{44\text{ cm}}{2 \times \frac{22}{7}} &= r \\ \Rightarrow \frac{44\text{cm} \times 7}{2 \times 22} &= r \\ \Rightarrow 7\text{cm} &= r \\ \Rightarrow \text{Radius of the cylinder formed} &= \underline{7\text{ cm}}\end{aligned}$$

Dividing both sides by
 $2 \times \frac{22}{7}$ to find r

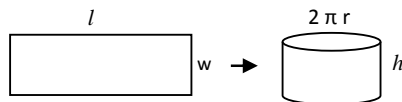
4 (c) (i)

Approach 2 (Making r the subject first, then substituting)

$$\begin{aligned}L &= 2 \pi r \\ \Rightarrow \frac{L}{2 \pi} &= r \\ \Rightarrow \frac{44\text{cm}}{2 \times \frac{22}{7}} &= r \\ \Rightarrow \frac{44\text{cm}}{\frac{44}{7}} &= r \\ \Rightarrow 44\text{cm} \div \frac{44}{7} &= r \\ \Rightarrow 44\text{ cm} \times \frac{7}{44} &= r \\ \Rightarrow 7\text{cm} &= r \\ \Rightarrow \text{Radius of the cylinder formed} &= \underline{7\text{ cm}}\end{aligned}$$

4 (c) (i)

METHOD 2 (Area of rectangle = Curved surface area of cylinder)



Approach 1 (Substituting first)

$$l \ w = 2 \pi r h$$

$$\begin{aligned}
\Rightarrow 44\text{cm} \times 10\text{cm} &= 2 \times \frac{22}{7} \times r \times 10\text{cm} \\
\Rightarrow \frac{44\text{cm} \times 10\text{cm}}{2 \times \frac{22}{7} \times 10\text{cm}} &= r \\
\Rightarrow \frac{44\text{cm} \times 10\text{cm} \times 7}{2 \times 22 \times 10\text{cm}} &= r \\
\Rightarrow 7\text{cm} &= r \\
\Rightarrow \underline{\underline{\text{Radius of the cylinder formed} = 7\text{ cm}}}
\end{aligned}$$

4 (c) (i)

Approach 2 (Making r the subject first)

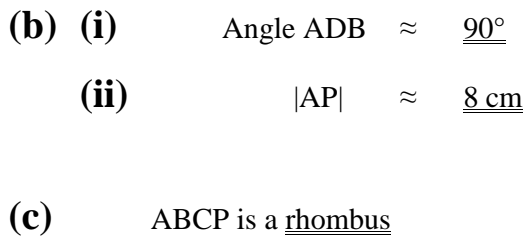
$$\begin{aligned}
l \quad w &= 2 \pi r h \\
\Rightarrow \frac{l \quad w}{2 \pi h} &= r \\
\Rightarrow \frac{44\text{cm} \times 10\text{cm}}{2 \times \frac{22}{7} \times 10\text{cm}} &= r \\
\Rightarrow \frac{44\text{cm}}{\frac{44}{7}} &= r \\
\Rightarrow 44\text{cm} \div \frac{44}{7} &= r \\
\Rightarrow 44\text{cm} \times \frac{7}{44} &= r \\
\Rightarrow 7\text{cm} &= r \\
\Rightarrow \underline{\underline{\text{Radius of the cylinder formed} = 7\text{ cm}}}
\end{aligned}$$

4 (c) (ii)

Volume of cylinder = Area of base \times height

$$\begin{aligned}
&= \pi r^2 \times h \\
&= \frac{22}{7} \times (7\text{cm})^2 \times 10\text{cm} \\
&= \frac{22}{7} \times 7\text{cm} \times 7\text{cm} \times 10\text{cm} \\
&= 22 \times 7\text{cm}^2 \times 10\text{cm} \\
&= \underline{\underline{1540\text{ cm}^3}}
\end{aligned}$$

5 (a)



(ii) $|AP| \approx \underline{\underline{8 \text{ cm}}}$

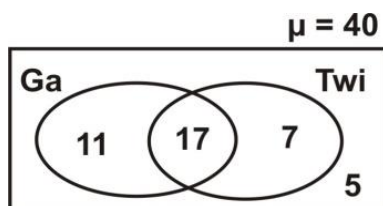
(c) ABCP is a rhombus

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MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

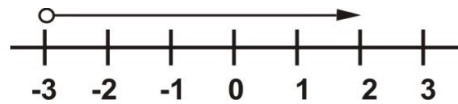
1. State the property used in the operation $a(b+c) = ab + ac$.
A) Associative B) Distributive C) Commutative D) Universal
2. Simplify $0.1 \times 0.02 \times 0.003$
(leaving *your* answer *in standard form*)
A) 6×10^{-7} B) 6×10^{-6} C) 6×10^5 D) 6×10^6
3. Express $\frac{1}{25}$ as a decimal fraction.
A) 0.4 B) 0.04 C) 0.004 D) 0.0004
4. In an examination, 25% of the candidates failed to obtain the pass mark. The number of candidates who passed was 150. How many candidates failed?
A) 113 B) 100 C) 50 D) 38
5. How many faces has a cube ?
A) 8 B) 6 C) 5 D) 4
6. Simplify $2^8 \div 2^3$
A) 2^{24} B) 2^{10} C) 2^5 D) 2^3



The Venn diagram above shows the number of pupils in a class of 40, who speak Twi or Ga or neither.

7. How many pupils speak both Twi and Ga?
 A) 17 B) 11 C) 7 D) 5
8. How many pupils speak neither Twi nor Ga?
 A) 17 B) 11 C) 7 D) 5
9. Find the least common multiple (LCM) of the numbers 10, 15 and 25.
 A) 30 B) 60 C) 120 D) 150

10. Which of the following expressions is illustrated on the number line below?



- A) $x < -3$ B) $x \leq -3$ C) $x > -3$ D) $x \geq -3$
11. Simplify $\frac{2a}{3} - \frac{a-b}{2}$
 A) $\frac{a+3b}{6}$ B) $\frac{a-3b}{6}$ C) $\frac{a-b}{6}$ D) $\frac{7a-3b}{6}$
12. Correct 0.00025 to one significant figure.
 A) 0.2 B) 0.003 C) 0.0002 D) 0.0003

13. If $y : 28 = 5 : 7$, find y .
 A) 5 B) 20 C) 31.2 D) 37.5

14. Convert 121_{five} to a base ten numeral.
 A) 21 B) 35 C) 36 D) 40

15. In the mapping

$$\begin{array}{cccccc} x & = & 1 & 2 & 3 & 4 & 5 \\ \downarrow & & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ y & = & 4 & 7 & 10 & k & 16 \end{array}$$

Find the image of 4 under the mapping.

- A) 11 B) 12 C) 13 D) 14

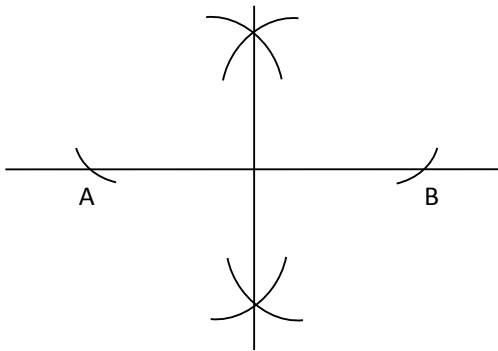
16. The point K (3,4) is rotated through 180° about the origin. Find its image.

- A. (-3, 4) B. (-4, 3) C. (-3, -4) D. (3, -4)

17. Arrange the following fractions in descending order of magnitude: $\frac{1}{2}$, $\frac{17}{20}$, $\frac{3}{4}$

- A) $\frac{3}{4}$, $\frac{17}{20}$, $\frac{1}{2}$
B) $\frac{17}{20}$, $\frac{3}{4}$, $\frac{1}{2}$
C) $\frac{1}{2}$, $\frac{3}{4}$, $\frac{17}{20}$
D) $\frac{1}{2}$, $\frac{17}{20}$, $\frac{3}{4}$

18. Which of the following best describes the construction below?



- A. Constructing an angle of 60°
B. Constructing the perpendicular bisector of AB
C. Constructing a circle about the midpoint of AB
D. Constructing an angle of 180°

19. Find the image of the point K (3, 5) when it is reflected in the x-axis.

- A. (3, 5) B. (5, 3) C. (3, -5) D. (-3, -5)

20. A set of furniture was sold for ₦300,000.00 at a profit of 20%. Find the cost price.

- A) ₦250,000
B) ₦240,000
C) ₦200,000
D) ₦180,000

21. Make x the subject of the relation, $v^2 = u^2 + 2ax$.

- A) $x = \frac{v^2 - u^2}{2a}$

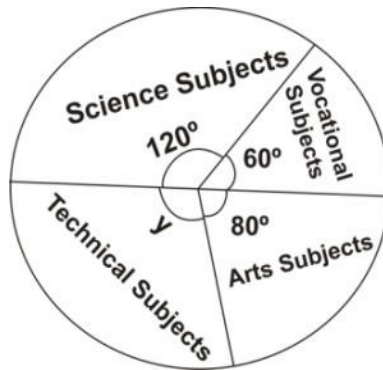
B) $x = \frac{v^2 - u^2}{a^2}$

C) $x = \frac{u^2 + v^2}{2a}$

D) $x = \frac{v^2 - u^2}{2a}$

22. Three baskets contain 95 oranges, x oranges and 2x oranges. How many oranges are in the three baskets?

A) 96x B) 95 + 3x C) 95 + 2x² D) 98x



The pie chart shows the distribution of programmes offered by 720 students at Kofikrom.

Use this information to answer Questions 23 and 24

23. Find the value of the angle marked y.

A) 90° B) 100° C) 110° D) 120°

24. How many more students offered Science subjects than Arts subjects?

A) 40 B) 80 C) 160 D) 240

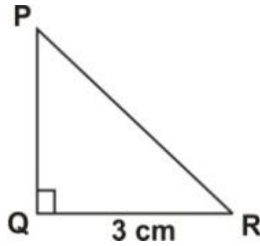
25. Kofi is two years older than Ama. If the sum of their ages is 16, find Ama's age.

A) 7 yrs B) 9 yrs C) 14 yrs D) 18 yrs

26. $J = \frac{1}{2}mv^2$. If $v = 4$ and $J = 12$, find m.

A) 1.5 B) 3.0 C) 3.6 D) 6.3

27. PQR is a right-angled triangle. The area of the triangle is 6cm^2 and $|QR| = 3\text{cm}$. Find $|PQ|$.

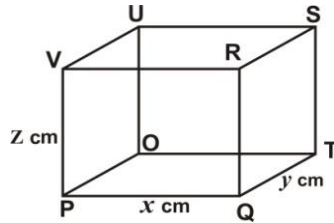


- A) 2cm B) 3cm C) 4cm D) 6cm
28. A rectangle has a length of 8cm and a breadth of 6cm. How long is its diagonal?
A) 10 B) 14 C) 28 D) 50
29. Simplify $\frac{1}{3} (2\frac{2}{3} + \frac{5}{6})$.
A) $\frac{13}{4}$ B) $\frac{7}{6}$ C) $\frac{13}{18}$ D) $\frac{31}{18}$
30. A man divided his 360 cattle among his three sons in the ratio 7:6:5. How many cattle did the one who had the smallest share receive?
A) 100 B) 120 C) 140 D) 160
31. The marks obtained by 9 students in a test are 3, 3, 4, 5, 6, 7, 7, 7, 8.
Find the median
A) 4 B) 5 C) 6 D) 7
32. The marks obtained by 9 students in a test are 3, 3, 4, 5, 6, 7, 7, 7, 8.
What is the mode?
A) 3 B) 4 C) 6 D) 7
33. What is the fifth term of the sequence $\frac{1}{3}, \frac{2}{5}, \frac{3}{7}, \dots$?
A) $\frac{4}{9}$ B) $\frac{5}{11}$ C) $\frac{6}{13}$ D) $\frac{7}{15}$
34. 30 men dig a pit in 21 days. How many days will 14 men take to dig the pit, working at the same rate?
A) 20 B) 25 C) 30 D) 45

35. A bag contains 6 white and 8 red balls. What is the probability that a ball picked at random will be a white ball?

A) $\frac{1}{7}$ B) $\frac{3}{7}$ C) $\frac{4}{7}$ D) $\frac{6}{7}$

36. The figure below is a cuboid with dimensions x cm by y cm by z cm. Find the area of the face PQRV.

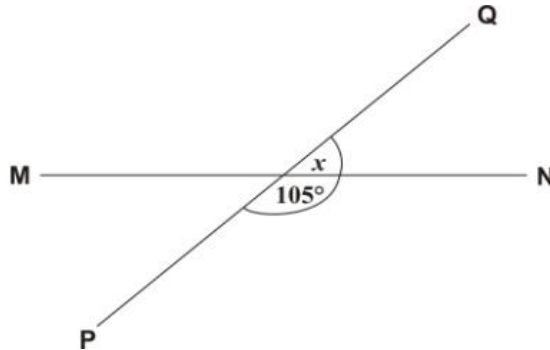


A) $xy \text{ cm}^2$ B) $yz \text{ cm}^2$ C) $x^2 \text{ cm}^2$ D) $xz \text{ cm}^2$

37. A rod 200cm long is broken into two parts. The shorter part is one-quarter of the length of the rod. Express the shorter part as a percentage of the longer part.

A) 25% B) 30% C) 33.33% D) 66.67%

38. In the figure below, MN and PQ are straight lines. Find the value of the angle marked x in the figure.



A) 65° B) 75° C) 85° D) 155°

39. Find the value of x in the equation $\frac{x}{4} = 2$

A) 2 B) 4 C) 6 D) 8

40. The circumference of a circular track is 15.4m. Find the diameter of the track. (Take $\pi = \frac{22}{7}$)

A) 4.9 m B) 22 m C) 24 m D) 24.5 m

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. B) Distributive
2. B) 6×10^{-6}
3. B) 0.04
4. C) 50
5. B) 6
6. C) 2^5
7. A) 17
8. D) 5
9. D) 1311_{five}
10. D) 150
11. C) $x > -3$
12. A) $\frac{a+3b}{6}$
13. D) 0.0003
14. B) 20

15. C) 36
16. C. (-3, -4)
17. B) $17/20, 3/4, 1/2$
18. C. (3, -5)
19. A) €250,000
20. D) $x = \frac{v^2 - u^2}{2a}$
21. B) $95 + 3x$
22. B) 100°
23. B) 80
24. A) 7 yrs
25. A) 1.5
26. C) 4cm
27. C) 13
28. A) 10
29. B) $7/6$
30. A) 100
31. C) 6
32. D) 7
33. B) $\frac{5}{11}$
34. D) 45
35. B) $3/7$
36. D) $x \text{ z cm}^2$
37. C) 33.33%

38. B) 75°

39. D) 8

40. A) 4.9 m

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Simplify $2\frac{3}{4} \div (3\frac{3}{8} - 1\frac{1}{2})$
- (b) There are 50 pupils in a class. Out of this number, $\frac{1}{10}$ speaks French only and $\frac{4}{5}$ of the remainder speak both French and English. If the rest speak English only,
- (i) find the number of students who speak
- (α) both French and English
- (β) only English
- (ii) draw a Venn diagram to illustrate the above information
2. A shop sells a pencil at ₦500.00 and a pen at ₦2,000.00
- a) If Afua bought 8 pencils and 5 pens, how much did she pay together for them?
- b) The price of a pencil is increased by 20% and a pen by 10%. Find how much Otu will pay for 10 pencils and 8 pens.

3. a) Using a ruler and a pair of compasses only, construct
- triangle ABC such that $AB = 12\text{cm}$, $AC = 8\text{cm}$ and $\angle BAC = 30^\circ$;
 - a perpendicular from C to meet AB at M.
- b) Measure
- angle ABC;
 - $|CM|$.
- c) Calculate the area of triangle ABC.

4. (a) Solve the inequality $\frac{5x-3}{6} - \frac{2x-4}{4} < 2$

- (b) (i) Copy and complete the table of values for the relation, $y = 2x + 1$.

| | | | | | | | | |
|-----|----|----|----|---|---|---|---|---|
| x | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| y | -5 | -3 | | 1 | | | 7 | |

- Using a scale of 2cm to 1 unit on the x -axis and 2cm to 2units on the y -axis, plot the ordered pairs (x, y) on a graph sheet.
- Use a ruler to join the points plotted.
- Use your graph to find
 - x , when $y = 4$;
 - y , when $x = -2.5$

5. The table shows the number of students in a JSS class who prepared various dishes for their practical.

| Dishes | No. of students |
|------------------------------|-----------------|
| Fufu and light soup | 5 |
| Banku and Okro stew | 20 |
| Fried Rice | 30 |
| Fried Plantain and Beans | 25 |
| Boiled yam and palaver sauce | 10 |

- (a) (i) Draw a pie chart for the distribution above.

- (ii) What dish was prepared most?
 - (iii) What percentage of students prepared Fried Rice?
-
- (b) What is the probability that a student chosen at random cooked Fried Plantain and Beans?

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1 (a) $2\frac{3}{4} \div (3\frac{3}{8} - 1\frac{1}{2})$

$$\Rightarrow \frac{11}{4} \div (\frac{27}{8} - \frac{3}{2})$$
$$\Rightarrow \frac{11}{4} \div (\frac{27 - 12}{8})$$
$$\Rightarrow \frac{11}{4} \div \frac{15}{8}$$
$$\Rightarrow \frac{11}{4} \times \frac{8}{15}$$
$$\Rightarrow \frac{22}{15} = \underline{\underline{1\frac{7}{15}}}$$

1 (b) (i)

a) If $(\frac{1}{10} \text{ of } 50)$ pupils speak French only

$$\Rightarrow \frac{1}{10} \times 50 = 5 \text{ speak French only}$$

\therefore The remainder $= 50 - 5 = 45$

But $\frac{4}{5}$ of the remainder speak both French and English

$$\Rightarrow \frac{4}{5} \text{ of } 45 \text{ speak both French and English}$$
$$\Rightarrow \frac{4}{5} \times 45 = \underline{\underline{36}}$$

⇒ 36 pupils speak both French and English

β) If the rest speak English only

⇒ Total no. – (F only + both F and E)

⇒ 50 – (5 + 36)

⇒ 50 – 41

⇒ **9**

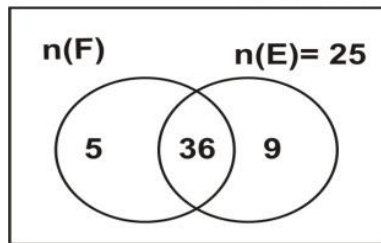
∴ 9 students speak only English

(ii) Let $n(U)$ = No. of pupils in the class

$n(F)$ = No. of French speakers

$n(E)$ = No. of English speakers

$n(U) = 50$



2 (a) Cost of 8 pencils = $8 \times \text{¢}500$ = ¢4,000

Cost of 5 pens = $5 \times \text{¢}2,000$ = ¢10,000

∴ Total cost = ¢4,000 + ¢10,000

= ¢ 14,000

(b) New (increased) price of pen

= Original price + Increase

= ¢2,000 + (20% × ¢2,000)

= ¢2000 + $\left(\frac{20}{100} \times \text{¢}2000\right)$

= ¢2,000 + ¢400

= ¢2,400

New (increased) price of a pencil

= Original price + Increase

= ¢500 + (10% × ¢500)

= ¢500 + ¢50

NB:

We also could have used the idea of Simple Proportion (Equivalent fractions / 'If more, less divides ...')

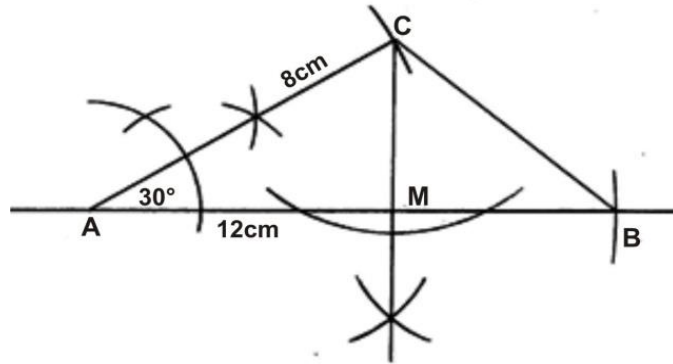
$$= \text{¢}550$$

$$\text{New price of 10 pencils} = 10 \times \text{¢}550 = \text{¢}5,500$$

$$\text{New price of 8 pens} = 8 \times \text{¢}2,400 = \text{¢}19,200$$

$$\therefore \text{The total price} = \text{¢}5,500 + \text{¢}19,200 = \text{¢}24,700$$

3 (a)



- (b) (i) angle ABC $\approx 39^\circ$
(ii) $|CM| \approx \underline{4.0 \text{ cm}}$

(c) Area of triangle = $\frac{1}{2}bh$
Area of ABC = $\frac{1}{2} \times |AB| \times |CM|$
= $\frac{1}{2} \times 12\text{cm} \times 4\text{cm}$
= $6\text{cm} \times 4\text{cm}$
= $\underline{24\text{cm}^2}$

4 (a)

$$\frac{5x-3}{6} - \frac{2x-4}{4} < 2$$

Approach 1

$$\begin{aligned} \frac{2(5x-3) - 3(2x-4)}{12} &< 2 \\ \Rightarrow \frac{2(5x-3) - 3(2x-4)}{12} &< 2 \\ \Rightarrow \frac{10x-6-6x+12}{12} &< 2 \\ \Rightarrow \frac{10x-6x-6+12}{12} &< 2 \end{aligned}$$

$$\begin{aligned}
\Rightarrow \quad & \frac{4x+6}{12} < 2 \\
\Rightarrow \quad & 4x+6 < 12 \times 2 \\
\Rightarrow \quad & 4x < 24 - 6 \\
\Rightarrow \quad & \frac{4x}{4} < \frac{18}{4} \\
\Rightarrow \quad & \underline{\underline{x < 4\frac{1}{2}}} \quad \text{or} \quad \underline{\underline{x < 4.5}}
\end{aligned}$$

4 (a)

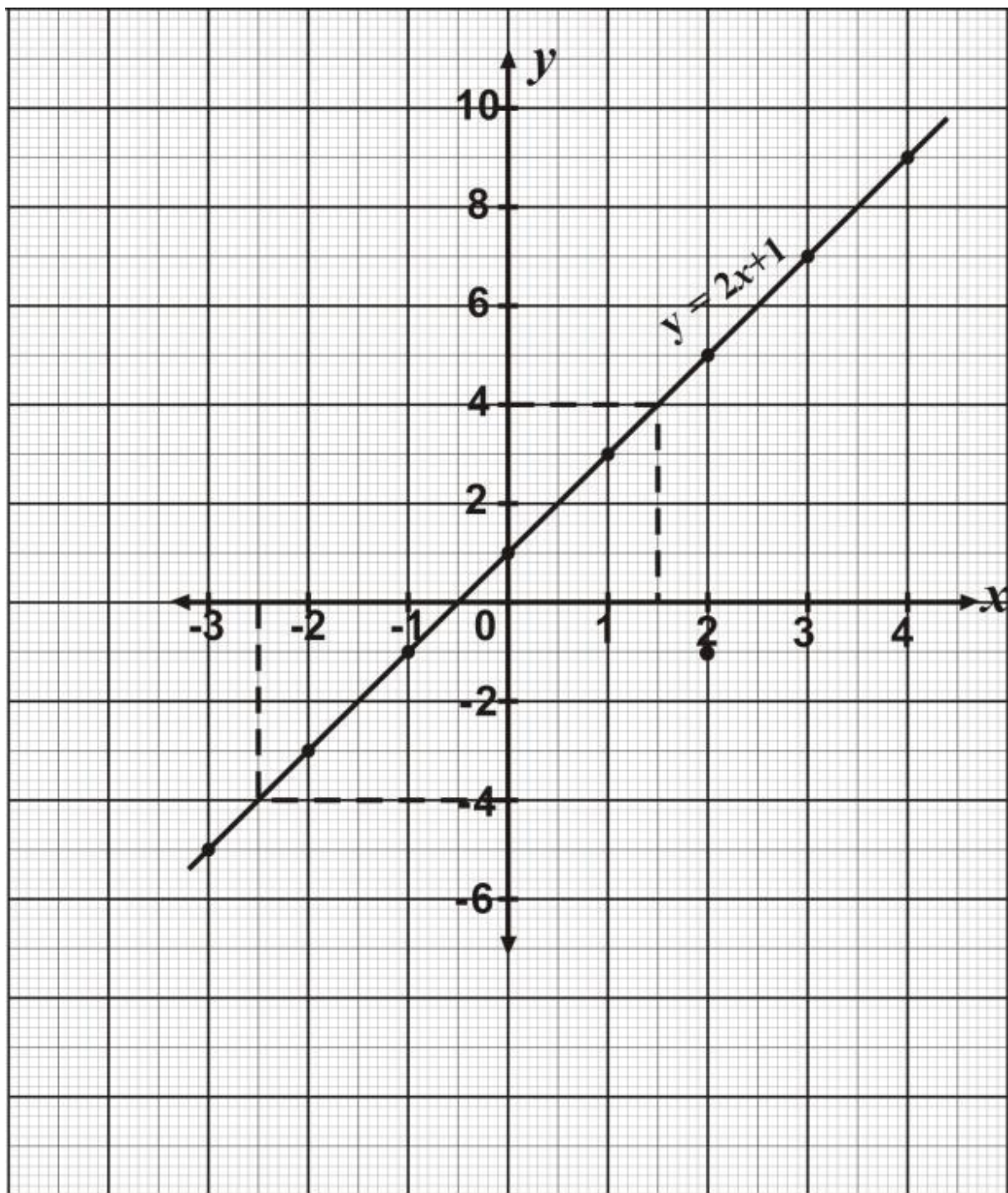
Approach 2

$$\begin{aligned}
& \frac{5x-3}{6} - \frac{2x-4}{4} < 2 \\
\Rightarrow \quad & 12\left(\frac{5x-3}{6}\right) - 12\left(\frac{2x-4}{4}\right) < 12 \times 2 \\
\Rightarrow \quad & 2(5x-3) - 3(2x-4) < 12 \times 2 \\
\Rightarrow \quad & 10x - 6 - 6x + 12 < 24 \\
\Rightarrow \quad & 10x - 6x - 6 + 12 < 24 \\
\Rightarrow \quad & 4x + 6 < 24 \\
\Rightarrow \quad & 4x < 24 - 6 \\
\Rightarrow \quad & \frac{4x}{4} < \frac{18}{4} \\
\Rightarrow \quad & \underline{\underline{x < 4\frac{1}{2}}} \quad \text{or} \quad \underline{\underline{x < 4.5}}
\end{aligned}$$

4 (b) (i) By substitution of the x values in the given relation, the table is completed as shown below:

| | | | | | | | | |
|---|----|----|----|---|---|---|---|---|
| x | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| y | -5 | -3 | -1 | 1 | 3 | 5 | 7 | 9 |

(ii), (iii) The straight line graph is shown below



(iv) From the graph,

α) When $y = 4$, $\underline{x = 1.5}$

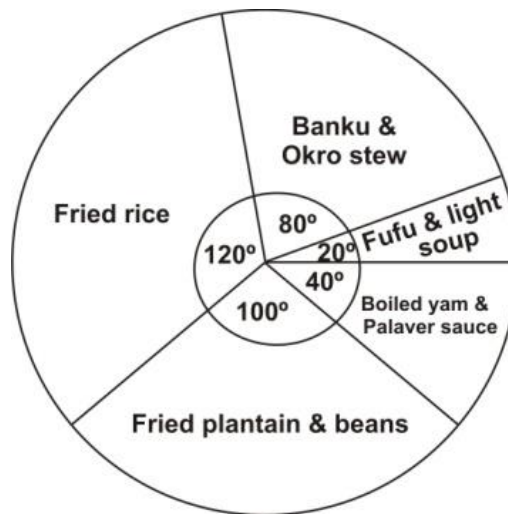
β) When $x = -2.5$, $\underline{y = -4}$

5 (a) (i)

| Grade | Frequency | Angle of sector |
|-------|-----------|-----------------|
|-------|-----------|-----------------|

| | | |
|------------------------------|-----------|--|
| Fufu and light soup | 5 | $\frac{5}{90} \times 360^\circ = 20^\circ$ |
| Banku and Okro stew | 20 | $\frac{20}{90} \times 360^\circ = 80^\circ$ |
| Fried Rice | 30 | $\frac{30}{90} \times 360^\circ = 120^\circ$ |
| Fried Plantain and Beans | 25 | $\frac{25}{90} \times 360^\circ = 100^\circ$ |
| Boiled yam and palaver sauce | 10 | $\frac{10}{90} \times 360^\circ = 40^\circ$ |
| TOTAL | 90 | 360° |

Pie chart showing the distribution of students in a JSS class who prepared various dishes



(a) (ii) Fried Rice was prepared most

(iii)
$$\frac{\text{No. of students who prepared fried rice}}{\text{Total no. of students}} \times 100\%$$

$$= \frac{30}{90} \times 100\%$$

$$= \underline{\underline{33\frac{1}{3} \%}}$$

(b) P(Fried Plantain and Beans)

$$= \frac{\text{No. of students for Fried Plantain and Beans}}{\text{Total number of students}}$$

$$= \frac{25}{90} = \underline{\underline{\frac{5}{18}}}$$

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MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. If $P = \{\text{multiples of 4 less than 16}\}$, find P .
A. $\{4,8,10\}$ B. $\{4,8,12\}$ C. $\{1,4,8,12\}$ D. $\{4,8,12,16\}$

2. The addition below was carried out in base x . Find x .

$$\begin{array}{r} 243 \\ + 221 \\ \hline 1014_x \end{array}$$

- A) four B) five C) six D) seven
3. A farmer left home at 4:35 am and arrived on his farm at 6:18 am. How long did he take to get to his farm?
A) 1 hour 23 minutes
B) 1 hour 43 minutes
C) 2 hours 43 minutes
D) 10 hours 53 minute
4. Express 2474.5 in standard form
A) 2.4745×10^2
B) 2.4745×10^3
C) 2.4745×10^{-2}
D) 2.4745×10^{-3}

5. Simplify $1\frac{1}{2} + 2\frac{1}{4} - 3\frac{5}{8}$
A) $\frac{1}{8}$ B) $\frac{3}{8}$ C) $\frac{3}{16}$ D) $\frac{5}{16}$

6. Find the next two numbers in the sequence 2, 5, 9, 14, 20, _ , _ .
 A) 26, 34 B) 26,35 C) 27,34 D) 27,35
7. The sum of three numbers is 28,542. Two of the numbers are 10,250 and 9,750. Find the third number.
 A) 8,452 B) 8,542 C) 9,452 D) 9,542
8. 135 pencils were to be packed into boxes. Each box could take 12 pencils. Find the number of boxes that were fully packed.
 A) 10 boxes B) 11 boxes C) 12 boxes D) 13 boxes
9. Which of the fractions $\frac{13}{20}$, $\frac{3}{5}$, $\frac{3}{4}$ and $\frac{7}{10}$ is the greatest ?
 A) $\frac{3}{5}$ B) $\frac{3}{4}$ C) $\frac{7}{10}$ D) $\frac{13}{20}$
10. Out of ₦550,000.00 given to a school, an amount of ₦325,000.00 was used. What fraction of the total amount was used?
 A) $\frac{4}{13}$ B) $\frac{9}{13}$ C) $\frac{9}{22}$ D) $\frac{13}{22}$
11. Kofi bought four pencils at ₦200.00 each and five pens at ₦350.00 each. How much did he pay altogether?
 A) ₦2,400.00 B) ₦2,450.00 C) ₦2,550.00 D) ₦2,650.00
12. John's uncle sent him ₦120,000.00 through a bank which charges 5% commission. How much commission was paid ?
 A) ₦5,000.00 B) ₦6,000.00 C) ₦7,000.00 D) ₦7,200.00
13. 8 girls can weed a plot of land in 10 days. How many days will 5 girls take to weed the same plot of land, working at the same rate?
 A) 6 days B) 8 days C) 12 days D) 16 days
14. A mapping is defined by $x \rightarrow x^2 - 1$. What is the image of 3 under the mapping?
 A) 5 B) 6 C) 7 D) 8
15. A typist charges ₦2,000.00 for the first 5 sheets typed and ₦600.00 for any additional sheet. How much will Barbara pay, if she presents 20 sheets for typing ?

A) ¢8,000.00 B) ¢11,000.00 C) ¢12,000.00 D) ¢19,000.00

16. Ama covered a distance of 100m in 12 seconds. Express her speed in kilometres per hour.

A) 5km/h B) 10 km/h C) 20 km/h D) 30 km/h

17. Yakubu, Seidu and Amina shared an amount of money in the ratio 3:4:5. Find how much was shared, if Amina received ¢40,000.00

- A) ¢72,000.00
- B) ¢80,000.00
- C) ¢96,000.00
- D) ¢120,000.00

18. Abban paid ¢630,000.00 for a bicycle at a discount of 10%. Find the actual selling price of the bicycle

- A) ¢567,000.00
- B) ¢573,000.00
- C) ¢693,000.00
- D) ¢700,000.00

19. The population of a town in 1990 was 88,000. The population increased by 20% in 1998. Find the population in 1998.

A) 70,400 B) 94,600 C) 96,800 D) 105,600

20. If $a * b = 2a - b$, find $3 * 2$

A) 1 B) 4 C) 5 D) 6

21. If $r = \frac{m+1}{m-2}$, express m in terms of r .

A) $m = \frac{2r+1}{r-1}$

B) $m = \frac{2r+1}{r+1}$

C) $m = \frac{2r-1}{r-1}$

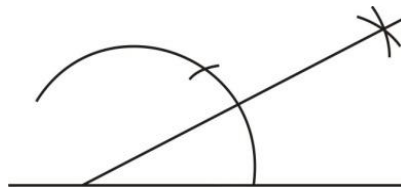
D) $m = \frac{2r-1}{r+1}$

Use the information below to answer questions 22 and 23

Forty per cent of students in a class speak Ga and seventy-five per cent speak Twi. Each student speaks at least one of the two languages.

22. What percentage of the class speaks both Ga and Twi?
 A) 5% B) 10% C) 15% D) 30%
23. If there are 40 students in the class, how many of them speak Twi?
 A) 10 B) 16 C) 24 D) 30
24. A point (2, 1) is reflected in the y-axis. Find its image.
 A. (-1, 2) B. (1, -2) C. (-2, 1) D. (2, -1)
25. Expand $(2a + b)(a - b)$.
 A) $2a^2 - 3ab - b^2$
 B) $2a^2 - ab - b^2$
 C) $2a^2 + ab + b^2$
 D) $2a^2 + 3ab + b^2$
26. If $\mathbf{s} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$, find $3\mathbf{s} + \mathbf{r}$.
 A. $\begin{pmatrix} 0 \\ 14 \end{pmatrix}$ B. $\begin{pmatrix} 0 \\ 6 \end{pmatrix}$ C. $\begin{pmatrix} 6 \\ 6 \end{pmatrix}$ D. $\begin{pmatrix} 6 \\ 14 \end{pmatrix}$
27. Solve for y in the equation $\frac{1}{3}y + \frac{1}{5}y = 8$
 A) 15 B) 30 C) 45 D) 60

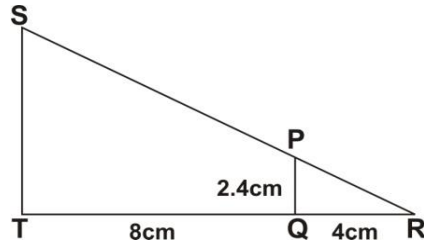
28.



Which of the following statements best describes the construction above?

- A) Constructing 30°
- B) Constructing 60°
- C) Constructing 120°
- D) Constructing 135°

29.



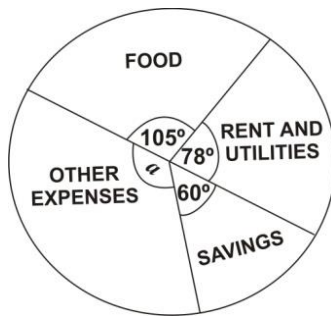
In the diagram, ΔSTR is the enlargement of ΔPQR .

If $|TQ| = 8\text{cm}$, $|QR| = 4\text{cm}$ and $|PQ| = 2.4\text{cm}$, find $|ST|$.

- A) 4.8cm
- B) 7.2cm
- C) 8.4cm
- D) 9.6cm

Use the following information to answer questions 30 to 32

The pie chart below shows how a man spends his monthly salary.



30. Find the value of a
- A) 75°
 - B) 78°
 - C) 117°
 - D) 120°
31. If the man earns ₦720,000.00 monthly, find how much he spends on food.
- A) ₦120,000.00
 - B) ₦180,000.00
 - C) ₦210,000.00
 - D) ₦240,000.00

32. What percentage of his salary does he save?

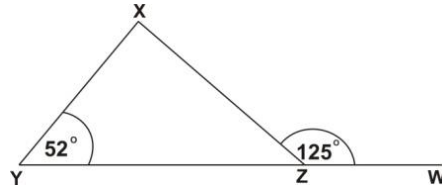
A) 16.7%

B) 21.7%

C) 25.0%

D) 29.2%

33.



In the diagram, XYZ is a triangle. YW is a straight line. Angle XYZ = 52° and angle XZW = 125° . Find angle YXZ.

A) 35° B) 55° C) 73° D) 107°

34. There are 18 girls and 22 boys in a class. A prefect is to be chosen at random from the class. What is the probability that the prefect will be a girl?

A) $\frac{1}{18}$ B) $\frac{9}{20}$ C) $\frac{11}{20}$ D) $\frac{9}{11}$

35. The length of a rectangle is three times its width. If its perimeter is 24cm, find its width.

A) 3 cm

B) 4 cm

C) 6 cm

D) 8 cm

36. The interior angle of a regular polygon is 135° . How many sides has the polygon ?

A) 6

B) 8

C) 9

D) 12

37. A square of side 4cm is enlarged by a scale factor of 3. Calculate the area of the enlarged square.

A) 36cm^2 B) 72cm^2 C) 96cm^2 D) 144cm^2

38. A rectangular tank has length 3m, width 2m and height 1.5m.

If the tank is filled with water to $\frac{2}{3}$ of its capacity, calculate the volume of water in the tank.

A) 4.5m^3 B) 6.0m^3 C) 7.5m^3 D) 13.5m^3

39. A rectangular tank has length 3m, width 2m and height 1.5m.

The Alpha Water Company charges ₦40,000.00 for every 1 m^3 of water. Find how much it will cost to fill the tank completely.

A) ₦180,000.00

B) ₦240,000.00

C) ₦300,000.00

D) ₦360,000.00

40. Express 34m 5cm 6mm in millimetres.

- A) 3,456 mm B) 34,056 mm C) 34,506 mm D) 340,506 mm

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. B. {4,8,12}
2. B) five
3. B) 1 hour 43 minutes
4. B) 2.4745×10^3
5. A) $\frac{1}{8}$
6. D) 27,35
7. B) 8,542
8. B) 11 boxes
9. B) $\frac{3}{4}$
10. D) $\frac{13}{22}$
11. C) ₦2,550.00
12. B) ₦6,000.00
13. D) 16 days
14. D) 8
15. B) ₦11,000.00
16. D) 30 km/h

17. C) ₱96,000.00
18. D) ₱700,000.00
19. D) ₱105,600
20. B) 4
21. A) $m = \frac{2r+1}{r-1}$
22. C) 15%
23. D) 30
24. C. (-2, 1)
25. B) $2a^2 - ab - b^2$
26. A. $\begin{pmatrix} 0 \\ 14 \end{pmatrix}$
27. A) 15
28. A) Constructing 30°
29. B) 7.2cm
30. 30. C) 117°
31. 31. C) ₱210,000.00
32. 32. A) 16.7%
33. C) 73°
34. B) $9/20$
35. A) 3 cm
36. B) 8
37. B) 6.0m^3
38. D) 144cm^2
39. D) ₱360,000.00

40. B) 34,056 mm

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Simplify $2\frac{3}{4} \div (3\frac{3}{8} - 1\frac{1}{12})$

(b) A ribbon of length 3m is to be cut into strips of length 14cm.
 - (i) How many strips of length 14cm were cut?
 - (ii) What length of ribbon remained?
 - (c) One-fourth of a number is added to one-fifth of the same number. If the result is 18, find the number.
-
2. A trader took a loan of ₦1,800,000.00 at an interest of $12\frac{1}{2}$ per cent per annum. It was agreed that the loan and the interest must be paid in one year in equal monthly instalments.
 - (a) Calculate
 - (i) the interest on the loan
 - (ii) the amount to be paid at the end of the year;
 - (iii) the monthly instalment.
 - (b) Another trader took a loan at the same rate of interest and conditions. If she had to pay ₦200,000.00 monthly instalment, find to the nearest cedi how much loan she took.

3. A teacher conducted a class test and the result is displayed in a frequency table below.

| Marks | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----------|---|---|---|---|----|---|---|---|---|
| Frequency | 2 | 4 | 2 | 2 | 10 | 5 | 6 | 7 | 2 |

- (a) Using the frequency table, find
- the modal mark for the class
 - the number of candidates who wrote the test
 - the mean mark for the test.
- (b) If the teacher decides that the pass mark is 4, what is the probability that a student chosen at random from the class failed the test?
- (c) Draw a bar chart for the distribution

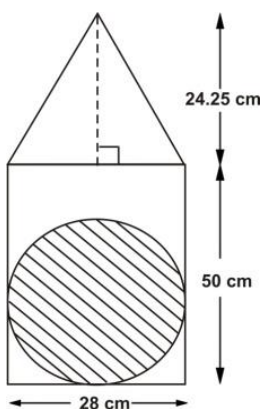
4. (a) Three numbers are in the ratio 2:3:4 and their average is 36.

- Calculate the sum of the three numbers
- Find the greatest number.

- (b) It costs ₦875,000.00 to tile a rectangular floor measuring 7m by 5m.
How much does it cost to tile a floor measuring 8m by 4m if the same types of tiles are used?

- (c) It is estimated that the population of a village increases by 10 per cent every five years. If the population of the village is 150,000 this year, what would be the estimated population ten years from now?

5.



The above diagram is a plane figure made up of a rectangle of sides 50cm by 28cm and an equilateral triangle of height 24.25cm. A circle is cut out of the rectangle as shown. If the circle touches three sides of the triangle,

Calculate

- (a) the perimeter of the figure
- (b) the area of the remaining portion of the figure.

[Take $\pi = \frac{22}{7}$]

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

$$\begin{aligned} 1 \text{ (a)} \quad & 2\frac{3}{4} \div (3\frac{3}{8} - 1\frac{1}{12}) \\ \Rightarrow & \frac{11}{4} \div (\frac{27}{8} - \frac{13}{12}) \\ \Rightarrow & \frac{11}{4} \div (\frac{81 - 26}{24}) \\ \Rightarrow & \frac{11}{4} \div \frac{55}{24} \\ \Rightarrow & \frac{11}{4} \times \frac{24}{55} \\ \Rightarrow & \frac{6}{5} = \underline{\underline{1\frac{1}{5}}} \end{aligned}$$

$$\begin{aligned} 1 \text{ (b) (i)} \quad & \text{No. of strips} = 3\text{m} \div 14\text{cm} \\ & = 300\text{ cm} \div 14\text{cm} \\ & = 21\frac{3}{7} \\ \Rightarrow & \underline{\underline{21 \text{ strips of length } 14 \text{ cm were cut}}} \end{aligned}$$

(ii) Method 1

$\frac{3}{7}$ of 14cm remained

$$\Rightarrow \frac{3}{7} \times 14\text{cm}$$

$$\Rightarrow \quad \mathbf{6 \text{ cm}}$$

$$\Rightarrow \quad \underline{\underline{\text{Remaining length} = 6 \text{ cm}}}$$

(ii) Method 2

$$\text{Total length cut} \quad = \quad 21 \times 14\text{cm} \quad = \quad 294\text{cm}$$

$$\begin{aligned} \therefore \text{Remaining length} &= 300 \text{ cm} - 294\text{cm} \\ &= \underline{\underline{6 \text{ cm}}} \end{aligned}$$

1 (c)

Let the number = n , then

$$\Rightarrow \quad \frac{1}{4}n + \frac{1}{5}n = 18$$

Approach 1 [\(Simplifying the LHS first\)](#)

$$\Rightarrow \quad \frac{n}{4} + \frac{n}{5} = 18$$

$$\Rightarrow \quad \frac{5n + 4n}{20} = 18$$

$$\Rightarrow \quad \frac{9n}{20} = 18$$

$$\Rightarrow \quad 9n = 18 \times 20$$

$$\Rightarrow \quad 9n = 360$$

$$\Rightarrow \quad n = 360 \div 9$$

$$\Rightarrow \quad \underline{\underline{n = 40}}$$

1 (c)

Approach 2 [\(Multiplying by 20 first – to clear fractions\)](#)

$$20 \times \left(\frac{1}{4}n\right) + 20 \times \left(\frac{1}{5}n\right) = 20 \times 18$$

$$\Rightarrow \quad 5n + 4n = 20 \times 18$$

$$\Rightarrow \quad 9n = 360$$

$$\Rightarrow \quad \frac{9n}{9} = \frac{360}{9}$$

$$\Rightarrow \quad \underline{\underline{n = 40}}$$

2 (a) (i)

$$\text{Simple interest} = \text{Principal} \times \text{Rate} \times \text{Time}$$

$$= 1,800,000 \times 12\frac{1}{2}\% \times 1$$

$$= 1,800,000 \times \frac{25}{2}\% \times 1$$

$$\begin{aligned}
&= 1,800,000 \times \frac{25}{2 \times 100} \times 1 \\
&= 9000 \times 25 \times 1 \\
&= \underline{\underline{225,000}}
\end{aligned}$$

(ii) The amount to be paid = Principal + S. Interest

$$\begin{aligned}
&= 1,800,000 + 225,000 \\
&= \underline{\underline{2,025,000}}
\end{aligned}$$

(iii) The monthly instalment = $\frac{\text{Amount to be paid}}{\text{No. of months}}$

$$\begin{aligned}
&= \frac{2,025,000}{12} \\
&= \underline{\underline{168,750}}
\end{aligned}$$

2 (b) Monthly instalment = $\frac{\text{Total amount}}{\text{No. of months}}$

$$\begin{aligned}
&= \frac{\text{Principal} + \text{Simple interest}}{\text{No. of months}} \\
&= \frac{P + \text{PRT}}{\text{No. of months}} \\
\Rightarrow 200,000 &= \frac{P + P \times 12.5\% \times 1}{12}
\end{aligned}$$

Solving for P by cross multiplying, we have:

$$\begin{aligned}
\Rightarrow 200,000 \times 12 &= P + P \times 12.5\% \\
\Rightarrow 200,000 \times 12 &= P + \frac{12.5P}{100} \\
\Rightarrow 200,000 \times 12 &= P + 0.125P \\
\Rightarrow 2,400,000 &= P(1 + 0.125) \\
\Rightarrow 2,400,000 &= P(1.125) \\
\Rightarrow \frac{2,400,000}{1.125} &= P \\
\Rightarrow \text{¢}2,133,333.33 &= P
\end{aligned}$$

\therefore The loan she took \approx ¢2,133,333 (to the nearest cedi)

3 (a) (i)

The modal mark

= the mark with the highest frequency

⇒ The modal mark = 5

(ii)

Total number of candidates

= $2 + 4 + 2 + 2 + 10 + 5 + 6 + 7 + 2$

= 40 pupils

3 (a) (iii)

Using the frequency table,

Approach 1

$$\begin{aligned}\text{The mean} &= \frac{\text{The sum of marks}}{\text{The total number of candidates}} \\ &= \frac{(1 \times 2) + (2 \times 4) + (3 \times 2) + (4 \times 2) + (5 \times 10) + (6 \times 5) + (7 \times 6) + (8 \times 7) + (9 \times 2)}{2 + 4 + 2 + 2 + 10 + 5 + 6 + 7 + 2} \\ &= \frac{2 + 8 + 6 + 8 + 50 + 30 + 42 + 56 + 18}{40} \\ &= \frac{220}{40} = \underline{\underline{5 \frac{1}{2}}} \text{ or } \underline{\underline{5.5}}\end{aligned}$$

3 (a) (iii)

Approach 2

| Marks (x) | Frequency (f) | $f x$ |
|------------------|----------------------|-------------------|
| 1 | 2 | 2 |
| 2 | 4 | 8 |
| 3 | 2 | 6 |
| 4 | 2 | 8 |
| 5 | 10 | 50 |
| 6 | 5 | 30 |
| 7 | 6 | 42 |
| 8 | 7 | 56 |
| 9 | 2 | 18 |
| $\Sigma f = 40$ | | $\Sigma fx = 220$ |

$$\begin{aligned}\text{The mean mark} &= \frac{\Sigma f x}{\Sigma f} = \frac{220}{40} \\ &= \underline{\underline{5 \frac{1}{2}}} \text{ or } \underline{\underline{5.5}}\end{aligned}$$

3 (b)

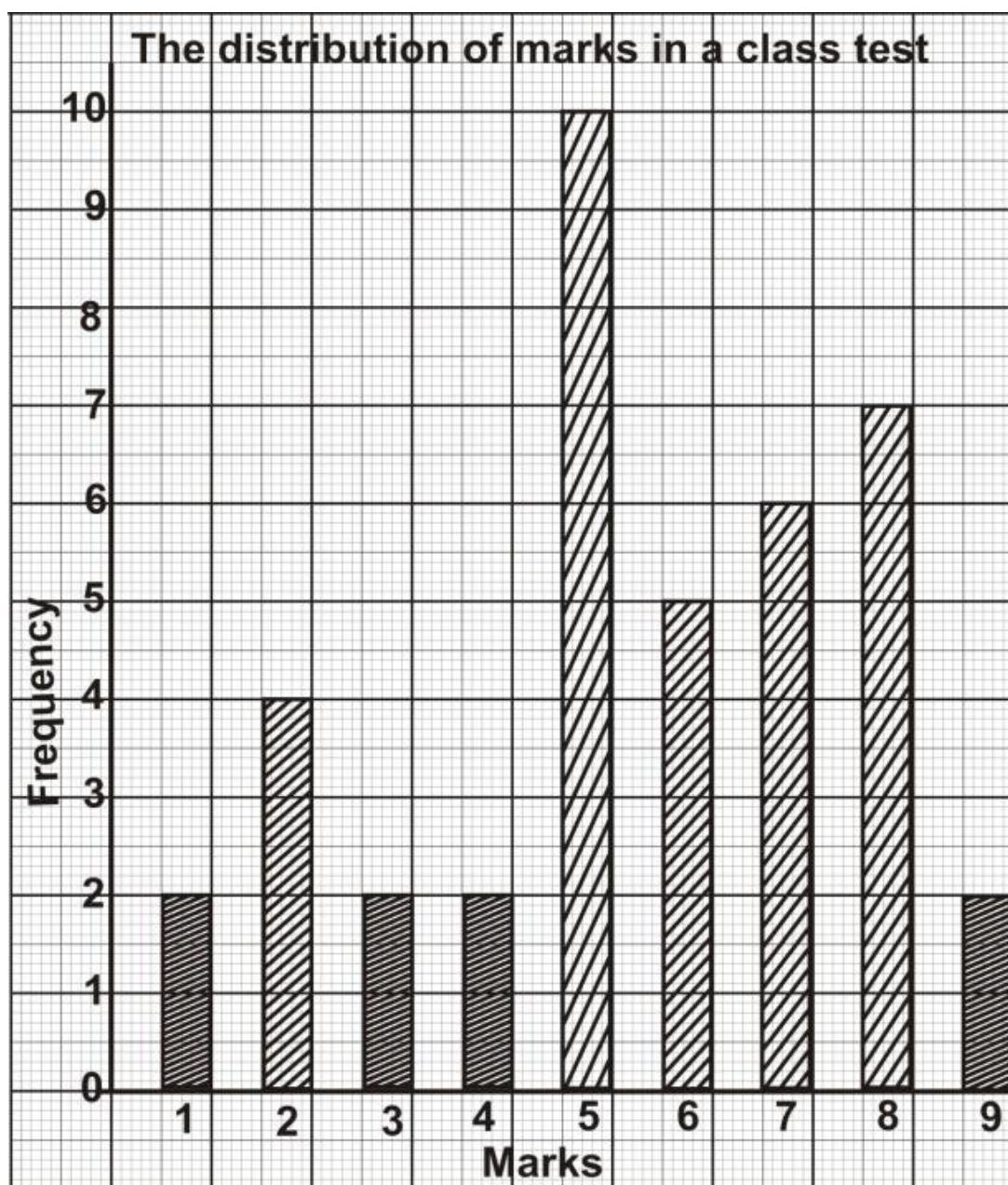
Probability that a student chosen at random failed the test

$$= \frac{\text{Number of students that failed}}{\text{Total number of students}} = \frac{2+4+2}{40} = \frac{8}{40} = \frac{1}{5}$$

Probability that a student chosen at random failed the test = $\frac{1}{5}$

3 (c)

Vertical Axis Scale: 2cm to 1 student / pupil



4 (a)

Method 1 [\(Unitary Approach – the value of one\(1\) item\)](#)

$$\text{The average ratio} = \frac{2+3+4}{3} = \frac{9}{3} = 3$$

Now, if the average ratio, 3, \rightarrow 36,

Then ratio 1 \rightarrow $36 \div 3 = 12$,

\therefore The sum of ratios, 9, (i.e., 2+3+4) $\rightarrow 9 \times 12 = 108$

\Rightarrow The sum of the three numbers = 108

4 (a)

Method 2 [\(Equivalent Fractions\)](#)

| | Ratio | Actual no. |
|---------|-----------------------|------------|
| Average | $\frac{2+3+4}{3} = 3$ | 36 |
| Sum | $2+3+4 = 9$ | x |

From the table above, $\frac{3}{9} = \frac{36}{x}$

Cross multiplying, we have $\Rightarrow 3 \times x = 36 \times 9$

$$\Rightarrow \frac{3x}{3} = \frac{36 \times 9}{3}$$

$$\Rightarrow x = 108$$

\therefore The sum of the three numbers is 108

4 (a)

Method 3 [\(If more, less divides ...\)](#)

If the average ratio, 3 \rightarrow 36

Then sum of ratios, 9 \rightarrow ? (more)

If more, less (i.e., 3) divides;

$$\Rightarrow \frac{9}{3} \times 36 = \underline{108}$$

4 (b)

Approach 1 [\(Equivalent Fractions\)](#)

| | Area | Cost |
|--|------|------|
|--|------|------|

| | | |
|-----------------------|--|------------------|
| 1 st floor | 7m by 5m = 7m × 5m = 35 m² | ¢875, 000 |
| 2 nd floor | 8m by 4m = 8m × 4m = 32 m² | <i>x</i> |

From the table above, $\frac{35}{32} = \frac{875,000}{x}$

Cross multiplying, we have

$$35 \times x = 875,000 \times 32$$

$$\Rightarrow \frac{35x}{35} = \frac{875,000 \times 32}{35}$$

$$\Rightarrow x = 25,000 \times 32$$

$$\Rightarrow x = 800,000$$

$$\therefore \text{The cost of tiling a 8m by 4m floor} = \underline{\underline{¢800,000.00}}$$

4 (b) Approach 2 [\(If more, less divides ...\)](#)

| | Area | Cost |
|-----------------------|--|------------------|
| 1 st floor | 7m by 5m = 7m × 5m = 35 m² | ¢875, 000 |
| 2 nd floor | 8m by 4m = 8m × 4m = 32 m² | ? |

If 35 m² area costs ¢875,000

Then 32 m² area costs ? (less)

If less, more (i.e., 35m²) divides, therefore we have

$$\frac{32 \times \text{¢}875,000}{35} = \underline{\underline{\text{¢}800,000}}$$

$$\therefore \text{The cost of tiling a 8m by 4m floor} = \underline{\underline{\text{¢}800,000.00}}$$

4 (c) METHOD 1 [\(Formula 1\)](#)

$$\text{New population} = \frac{\text{New population percentage}}{\text{Old population percentage}} \times \text{Old population}$$

$$\begin{aligned}
 \text{Population in 5 yrs} &= \frac{110\%}{100\%} \times 150,000 \\
 &= 110 \times 1,500 = \underline{165,000}
 \end{aligned}$$

$$\begin{aligned}
 \therefore \text{Population in 10 yrs} &= \frac{110\%}{100\%} \times 165,000 \\
 &= 110 \times 1,650 = \underline{181,500}
 \end{aligned}$$

4 (c) **METHOD 2** [\(Formula 2\)](#)

Estimated population in 5 years' time

$$\begin{aligned}
 &= \text{Current population} + \text{Increase} \\
 &= 150,000 + (10\% \times 150,000) \\
 &= 150,000 + \left(\frac{10}{100} \times 150,000\right) \\
 &= 150,000 + 15,000 \\
 &= \underline{165,000}
 \end{aligned}$$

Estimated population in 10 years' time

$$\begin{aligned}
 &= \text{Current population} + \text{Increase} \\
 &= 165,000 + (10\% \times 165,000) \\
 &= 165,000 + 16,500 \\
 &= \underline{181,500}
 \end{aligned}$$

4 (c) **METHOD 3** [\(Equivalent Fractions\)](#)

[NB: The percentage of the original quantity is always 100%]

| | Percentage | Population |
|-------------------------|-----------------------------|-----------------|
| This year (original) | 100% | 150,000 |
| 5 years' time | 100% + 10% = 110% | <i>x</i> |

From the table above, $\frac{100\%}{110\%} = \frac{150,000}{x}$

Cross multiplying, we have $100 \times x = 150,000 \times 110$

$$\Rightarrow x = \frac{150,000 \times 110}{100} = 1,500 \times 110 = \underline{\underline{165,000}}$$

\Rightarrow The population in 5 years' time is 165,000

\therefore Similarly,

| | Percentage | Population |
|-----------------------------|-----------------------------|----------------|
| 5 years' time (original) | 100% | 165,000 |
| 10 years' time | 100% + 10% = 110% | y |

From the table above, $\frac{100\%}{110\%} = \frac{165,000}{y}$

Cross-multiplying, we have $100 \times y = 165,000 \times 110$

$$\Rightarrow y = \frac{165,000 \times 110}{100} = 1,650 \times 110$$

$$\Rightarrow y = 181,500$$

\therefore The estimated population 10 years from now = 181,500

4 (c)

METHOD 4 ('If more, less divides ...')

If this year: 100% \rightarrow 150,000

Then in 5 years: 110% \rightarrow ? (more)

If more, less (i.e., 100%) divides; \therefore we have

$$\frac{110\%}{100\%} \times 150,000 = 110 \times 1,500 = \underline{\underline{165,000}}$$

If in 5 years: 100% \rightarrow 165,000

Then in 10 yrs 110% \rightarrow ? (more)

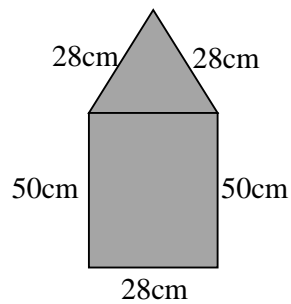
If more, less (i.e., 100%) divides; \therefore we have

$$\frac{110}{100} \times 165,000 = 110 \times 1,650 = 181,500$$

\therefore The estimated population 10 years from now = 181,500

5 (a)

Perimeter of the figure (distance around the figure)



NB:

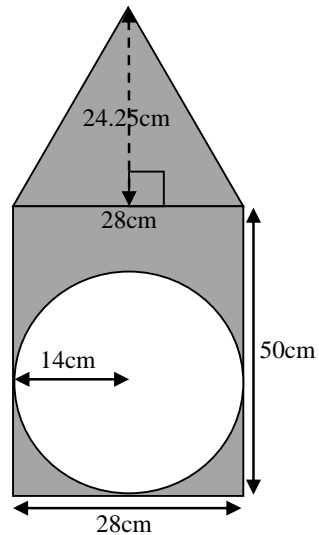
The triangle is equilateral

Taken from the base, in the anticlockwise direction,

$$\begin{aligned}\text{Perimeter} &= 28\text{cm} + 50\text{cm} + 28\text{cm} + 28\text{cm} + 50\text{cm} \\ &= \underline{184\text{ cm}}\end{aligned}$$

5 (b)

Area of remaining portion (after circle is cut out)



Approach 1

$$= \text{Area of entire figure} - \text{Area of circle}$$

$$= [\text{rectangle} + \text{triangle}] - [\text{circle}]$$

$$= [(l \times w) + (\frac{1}{2} \times b \times h)] - [\pi r^2]$$

$$= [(50 \times 28) + (\frac{1}{2} \times 28 \times 24.25)] - [\frac{22}{7} \times (14)^2]$$

$$= [(50 \times 28) + (14 \times 24.25)] - [\frac{22}{7} \times 14 \times 14]$$

$$= [1400 + 339.5] - [616]$$

$$= 1739.5 - 616$$

$$= 1123.5$$

$$\Rightarrow \text{Area of the remaining portion} = \underline{1123.5\text{ cm}^2}$$

5 (b)

Approach 2

$$\begin{aligned} &= \text{Area of triangle} + \text{Area of [rectangle - circle]} \\ &= \left(\frac{1}{2} \times b \times h\right) + [(l \times w) - \pi r^2] \\ &= \left(\frac{1}{2} \times 28 \times 24.25\right) + [(50 \times 28) - \frac{22}{7} \times (14)^2] \\ &= 339.5 + (1400 - 616) \\ &= 339.5 + 784 \\ &= 1123.5 \\ \Rightarrow \text{Area of the remaining portion} &= \underline{\underline{1123.5 \text{ cm}^2}} \end{aligned}$$

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MATHEMATICS

SECTION A
OBJECTIVE TEST
1 hour

- $R = \{1, 3, 5, 7\}$ and $S = \{2, 4, 6, 8\}$. Find $R \cup S$.

 - $\{ \}$
 - $\{1, 2, 3, 5, 6, 8\}$
 - $\{1, 2, 3, 4, 5, 7, 8\}$
 - $\{1, 2, 3, 4, 5, 6, 7, 8\}$
 - $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
- Find the missing members in the set $\{5, 10, 15, _, 25, _, _, 40\}$

 - 20 and 30
 - 30 and 35
 - 20 and 35
 - 20, 30 and 35
 - 30, 35 and 45
- What property of addition is defined by $(a+b)+c = a+(b+c)$?

 - Union
 - Inverse
 - Commutative
 - Distributive
 - Associative
- Find the highest (greatest) common factor of 63 and 81.

| | | | | |
|------|------|------|-------|-------|
| A) 3 | B) 7 | C) 9 | D) 21 | E) 27 |
|------|------|------|-------|-------|
- Change 124_{five} to a base ten numeral.

| | | | | |
|-------|-------|-------|-------|-------|
| A) 24 | B) 35 | C) 39 | D) 42 | E) 55 |
|-------|-------|-------|-------|-------|

6. Kofi bought 4 books at an average price of ₦2,500.00. If the total cost of 3 of the books was ₦6,500.00, find the cost of the fourth book.
- A) ₦3,500.00
B) ₦4,000.00
C) ₦4,500.00
D) ₦6,500.00
E) ₦10,000.00
7. Find the sum of all even numbers between 70 and 80.
- A) 200 B) 223 C) 280 D) 300 E) 375
8. By how much is $\frac{5}{6}$ greater than $\frac{3}{4}$?
- A) $\frac{1}{12}$ B) $\frac{1}{6}$ C) $\frac{5}{12}$ D) $\frac{2}{3}$ E) $\frac{4}{5}$
9. Evaluate 0.25×0.006 , correct to three decimal places.
- A) 0.001 B) 0.002 C) 0.015 D) 0.075 E) 0.105
10. Express $\frac{5}{8}$ as a decimal fraction
- A) 0.125 B) 0.375 C) 0.625 D) 0.750 E) 0.875
11. The following are the angles formed at the centre of a circle:
 30° , 70° , 120° , $2x$ and $5x$. Find the value of x .
- A) 20 B) 40 C) 70 D) 100 E) 140
12. On a map 1cm represents 4.5km. What is the actual distance between two towns which are 4cm apart on the map?
- A) 9km B) 16km C) 18km D) 19km E) 21km
13. If $2y = 6 - 3x$, find y when $x = 0$
- A) -3 B) -2 C) 0 D) 2 E) 3
14. How many lines of symmetry has an isosceles triangle ?
- A) 1 B) 2 C) 3 D) 4 E) 5
15. Kofi's age in the next ten years will be four times his age five years ago. How old is Kofi now?
- A) 5 B) 6 C) 10 D) 15 E) 20

16. A point P (3, 4) is rotated through an angle of 90° anticlockwise about the origin O. Find the image P_1 of rotation
- A. (3, -4) B. (4, -3) C. (-3, 4) D. (-4, 3) E. (-4, -3)
17. Which of the following is not quadrilateral?
- A) square
B) rectangle
C) rhombus
D) triangle
E) parallelogram
18. Express 2345 in standard form.
- A) 2.345×10^1
B) 2.345×10^2
C) 2.345×10^3
D) 2.345×10^4
E) 2.345×10^5
19. Solve the inequality $3(x - 1) \leq 12$
- A) $x \leq -5$ B) $x \leq -3$ C) $x \leq 3$ D) $x \leq 5$ E) $x \leq \frac{13}{3}$
20. Kofi and Ama shared an amount of money in the ratio 3:2 respectively. If Kofi had ₵60,000.00, how much was shared?
- A) ₵36,000.00
B) ₵40,000.00
C) ₵90,000.00
D) ₵100,000.00
E) ₵120,000.00
21. Workers are required to pay $4\frac{1}{2}\%$ of their salaries into an educational fund. A worker's salary is ₵120,000.00. How much does he pay into the educational fund?
- A) ₵5,332.00
B) ₵5,400.00
C) ₵6,000.00
D) ₵10,800.00

E) ¢11,500.00

22. Araba bought an electric cooker for ¢540,000.00 at a discount of 10%. Find the actual price of the electric cooker.

A) ¢469,000.00

B) ¢496,000.00

C) ¢594,000.00

D) ¢600,000.00

E) ¢605,000.00

23. Given that $\sqrt{p^2 \times q^2} = p \times q$, find the value of a , if $a = \sqrt{13^2 \times 15^2}$

A) 28

B) 175

C) 195

D) 247

E) 494

24. A mapping is defined by $n \rightarrow 2n - 3$. What is the image of -2 under the mapping?

A) -1

B) -5

C) -7

D) 7

E) 1

25. Simplify $4p + 6p^2 - 2p + 2p^2$

A) $2p + 8p^2$

B) $6p + 8p^2$

C) $2p - 8p^2$

D) $6p - 8p^2$

E) $-4 + 10p^2$

26. Make q the subject of the relation $W = \frac{n - q}{q}$

A) $q = \frac{n - 1}{w}$

B) $q = \frac{n + 1}{w}$

C) $q = \frac{n + 2}{1 + w}$

D) $q = \frac{n}{1 + w}$

E) $q = \frac{n}{w - 1}$

27. Given that $E = \frac{1}{2} mc^2$, find E when $m = 10$ and $c = 4$

A) 20

B) 40

C) 60

D) 80

E) 160

28. The scores obtained by 8 pupils in a test are 2, 3, 3, 5, 7, 8, 8 and 10.

What is the median score?

A) 3

B) 5

C) 6

D) 7

E) 8

29. Find the mean score.

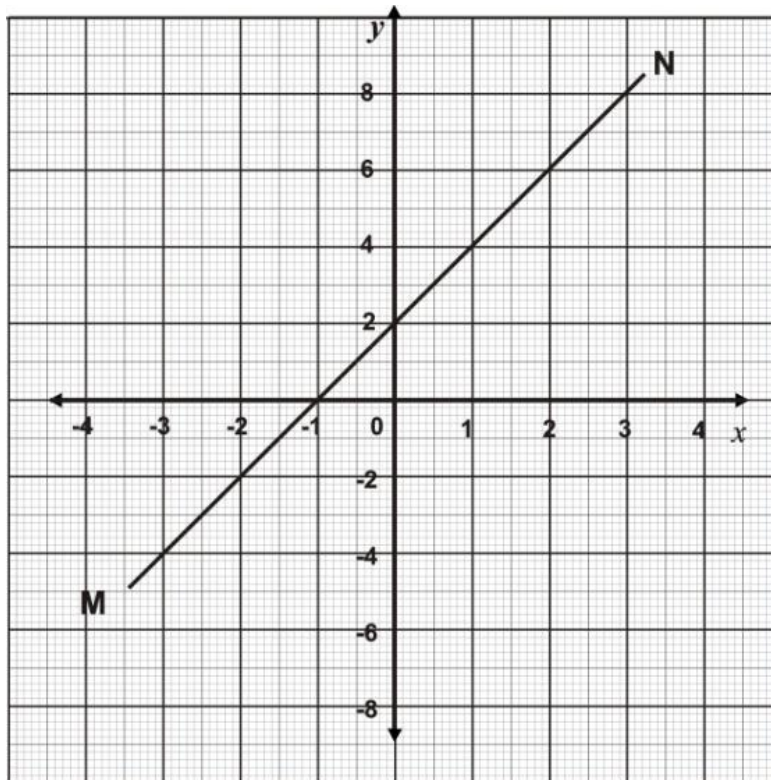
- A) 4.50 B) 5.75 C) 6.00 D) 8.75 E) 10.00

30. The scores obtained by 8 pupils in a test are: 2, 3, 3, 5, 7, 8, 8 and 10.

What is the probability that a pupil chosen at random scores 8 marks?

- A) $\frac{1}{8}$ B) $\frac{4}{23}$ C) $\frac{1}{4}$ D) $\frac{1}{3}$ E) $\frac{1}{2}$

The graph of the straight line MN is shown below. Use it to answer questions 31 and 32



31. Determine the value of x when y is 3

- A) $\frac{1}{2}$ B) $1\frac{1}{2}$ C) 2 D) 3 E) 8

32. Find the gradient of line MN.

- A) -2 B) -1 C) 1 D) $\frac{3}{2}$ E) 2

33. State the rule for the mapping

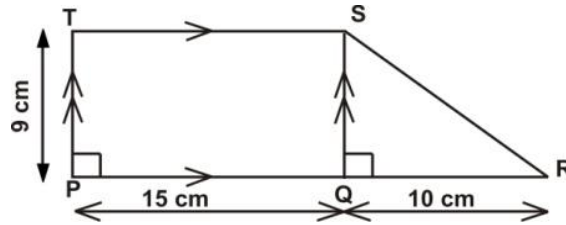
| | | | | | |
|---|---|---|---|----|----|
| x | 1 | 2 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 1 | 4 | 9 | 16 | 25 |

- A) $x \rightarrow x$ B) $x \rightarrow 2x$ C) $x \rightarrow 3x$ D) $x \rightarrow x^2$ E) $x \rightarrow x^3$

34. The area of a rectangle is 18cm^2 . One of its sides is 9cm long. Find its perimeter.

- A) 11cm B) 18cm C) 22cm D) 36cm E) 54cm

35. Calculate the area of figure PQRST

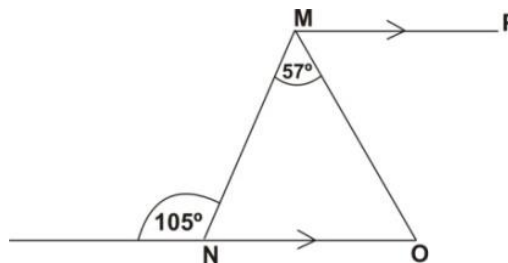


- A) 112.5 cm^2
 B) 135.0 cm^2
 C) 180.0 cm^2
 D) 215.0 cm^2
 E) 315.0 cm^2

36. In an enlargement with scale factor k , which of the following statements is not true?

- A) Each length is multiplied by k
 B) Each angle remains the same
 C) The shape of the figure does not change
 D) The size of the figure does not change
 E) Corresponding lines are parallel

Use the diagram below to answer questions 37 and 38



Line MP is parallel to line QNO. Angle NMO = 57° and angle MNQ = 105°

37. Find the angle MON

- A) 48° B) 52° C) 58° D) 65° E) 75°

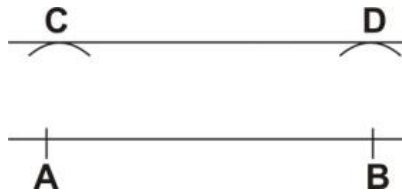
38. Angle MON and PMO are

- A) Alternate angles
- B) vertically opposite angles
- C) Corresponding angles
- D) adjacent angles
- E) Complementary angles

39. If $\mathbf{u} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$, find $2\mathbf{u} + 3\mathbf{v}$.

- A. $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$ B. $\begin{pmatrix} 11 \\ 5 \end{pmatrix}$ C. $\begin{pmatrix} 11 \\ 13 \end{pmatrix}$ D. $\begin{pmatrix} 14 \\ 0 \end{pmatrix}$ E. $\begin{pmatrix} 14 \\ 12 \end{pmatrix}$

40.



Which of the following statements best describes the construction above?

- A) Construction of a horizontal line CD
- B) Construction of a line parallel to AB
- C) Construction of the bisector of AB.
- D) Construction of a top line
- E) Construction of a vertical line.

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. D. $\{1,2,3,4,5,6,7,8\}$
2. D) 20, 30 and 35
3. E) Associative
4. C) 9
5. C) 39
6. A) ₦3,500.00
7. D) 300
8. A) $\frac{1}{12}$
9. B) 0.002
10. C) 0.625
11. A) 20
12. C) 18km
13. E) 3
14. A) 1
15. C) 10

16. D. $(-4, 3)$
17. D) triangle
18. C) 2.345×10^3
19. D) $x \leq 5$
20. D) $\text{¢}100,000.00$
21. B) $\text{¢}5,400.00$
22. D) $\text{¢}600,000.00$
23. C) 195
24. C) -7
25. A) $2p + 8p^2$
26. D) $q = \frac{n}{1+w}$
27. D) 80
28. C) 6
29. B) 5.75
30. C) $\frac{1}{4}$
31. A) $\frac{1}{2}$
32. E) 2
33. D) $x \rightarrow x^2$
34. C) 22 cm
35. C) 180.0 cm^2
36. D) The size of the figure does not change
37. A) 48°
38. 38. Alternate angles

39. D. $\begin{pmatrix} 14 \\ 0 \end{pmatrix}$

40. B)construction of a line parallel to AB

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MATHEMATICS

SECTION B ESSAY 1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal marks

1. (a) M is a set consisting of all positive integers between 1 and 10. P and Q are subsets of M such that

$$P = \{\text{factors of } 6\}, \quad Q = \{\text{multiples of } 2\}$$

- (i) List the elements of M, P and Q
- (ii) Represent M, P and Q on a Venn diagram
- (iii) Find $P \cap Q$

(b) (i) Solve the inequality: $\frac{2x-2}{4} - \frac{2x-1}{3} \leq 1$

- (ii) Illustrate your answer on the number line

2. (a) Express 131_{five} as a binary numeral

- (b) Three children, Kwabena, Esi and Yaw were given 160 oranges to share. Kwabena gets $\frac{1}{4}$ of the oranges. Esi and Yaw share the remainder in the ratio 3:2 respectively.

- (i) Find how many oranges Esi received
- (ii) How many more oranges did Yaw receive than Kwabena?

3. (a) Using a ruler and a pair of compasses only, construct triangle XYZ, such that $|XY| = 6\text{cm}$, $|XZ| = 8\text{cm}$ and $|YZ| = 10\text{cm}$.
- (b) (i) Construct the mediator of line YZ
- (ii) construct the mediator of line XZ
- (iii) Locate O, the point of intersection of the mediators of lines YZ and XZ.
- (iv) With centre O and radius OY, draw a circle.
- (c) Measure the radius of the circle you have drawn in (b) (iv) above and hence calculate the circumference of the circle. [Take $\pi = 3.14$]

4. a) (i) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes OX and OY on a graph sheet.
- (ii) On the same graph sheet, mark the x-axes from -5 to 5 and the y-axis from -6 to 6 .
- b) On the same graph sheet, plot the points A (2, 5), B(4, 3) and C (1, 1). Join the points A,B and C to form a triangle.
- c) Reflect triangle ABC in the y-axis such that $A \rightarrow A_1$, $B \rightarrow B_1$ and $C \rightarrow C_1$. Label the vertices of triangle $A_1B_1C_1$
- d) Translate triangle $A_1B_1C_1$ by the vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ such that $A_1 \rightarrow A_2$, $B_1 \rightarrow B_2$, and $C_1 \rightarrow C_2$. Label the vertices of triangle $A_2B_2C_2$
- e) Join the vertices A_1 B_1 B_2 and C. Name the figure formed.
- f) Find $\vec{A_1B_1}$

5. (a) A cylinder closed at one end has radius 7 cm and height 20 cm.
- (i) Find its total surface area.
- (ii) If the cylinder is filled with water to a depth of 5cm, calculate the volume of the water in it.
- [Take $\pi = \frac{22}{7}$]

- (b) Evaluate $\frac{0.07 \times 0.6}{0.014 \times 0.03}$, leaving your answer in standard form

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MATHEMATICS

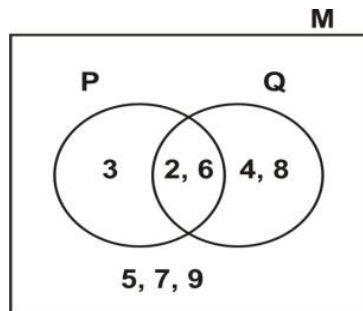
SECTION B ESSAY

SOLUTIONS

1 (a) (i)

$$\begin{aligned}M &= \{2, 3, 4, 5, 6, 7, 8, 9\} \\P &= \{2, 3, 6\} \\Q &= \{2, 4, 6, 8\}\end{aligned}$$

(ii)



(iii)

$$P \cap Q = \{2, 6\}$$

1 (b) (i)

$$\frac{2x-2}{4} - \frac{2x-1}{3} \leq 1$$

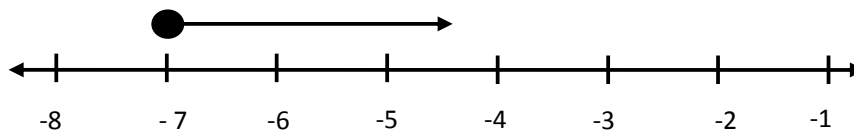
Approach 1 ([Simplifying the LHS first](#))

$$\begin{aligned}\frac{3(2x-2) - 4(2x-1)}{12} &\leq 1 \\ \Rightarrow \frac{6x-6-8x+4}{12} &\leq 1 \\ \Rightarrow \frac{6x-8x-6+4}{12} &\leq 1 \\ \Rightarrow \frac{-2x-2}{12} &\leq 1 \\ \Rightarrow -2x-2 &\leq 12 \times 1 \\ \Rightarrow -2x &\leq 12+2 \\ \Rightarrow \frac{-2x}{-2} &\geq \frac{14}{-2} \\ \Rightarrow \underline{\underline{x}} &\geq \underline{\underline{-7}}\end{aligned}$$

1 (b) (i) **Approach 2** ([Multiplying by 12 to clear fractions](#))

$$\begin{aligned}12\left(\frac{2x-2}{4}\right) - 12\left(\frac{2x-1}{3}\right) &\leq 12 \times 1 \\ \Rightarrow 3(2x-2) - 4(2x-1) &\leq 12 \\ \Rightarrow 6x - 6 - 8x + 4 &\leq 12 \\ \Rightarrow 6x - 8x - 6 + 4 &\leq 12 \\ \Rightarrow -2x - 2 &\leq 12 \\ \Rightarrow -12 - 2 &\leq 2x \\ \Rightarrow \frac{-14}{2} &\leq \frac{2x}{2} \\ \Rightarrow -7 &\leq x \\ \Rightarrow \underline{\underline{x}} &\geq \underline{\underline{-7}}\end{aligned}$$

1 (b) (ii)



2 (a)

First change to base ten, then change from base ten to base two (binary numeral)

Changing $1\ 3\ 1_{\text{five}}$ to a base ten numeral.

| | | |
|-------|-------|-------|
| 1 | 3 | 1 |
| 5^2 | 5^1 | 5^0 |

$$\begin{aligned}
 &\Rightarrow (1 \times 5^2) + (3 \times 5^1) + (1 \times 5^0) \\
 &= (1 \times 25) + (3 \times 5) + (1 \times 1) \\
 &= 25 + 15 + 1 \\
 &= 41_{\text{ten}}
 \end{aligned}$$

Changing 41_{ten} to base two (binary numeral)

| Base | Number | Remainder |
|------|--------|-----------|
| 2 | 41 | |
| | 20 | 1 |
| | 10 | 0 |
| | 5 | 0 |
| | 2 | 1 |
| | 1 | 0 |
| | 0 | 1 |



Reading the remainder column upwards, we have 101001_{two}

131_{five} expressed as a binary numeral = 101001_{two}

2 (b) (i)

Kwabena gets $\frac{1}{4}$ of 160 oranges

$$\Rightarrow \text{he gets } \frac{1}{4} \times 160 \text{ oranges} = 40 \text{ oranges}$$

$$\Rightarrow \text{The remainder} = 160 - 40 = 120 \text{ oranges}$$

Since Esi and Yaw shared the remainder in the ratio 3:2 respectively,

$$\Rightarrow \text{Esi received } \frac{3}{3+2} \times 120 \text{ oranges} = \frac{3}{5} \times 120 \text{ oranges}$$

$$= 3 \times 24 \text{ oranges}$$

$$\Rightarrow \underline{\text{Esi received 72 oranges}}$$

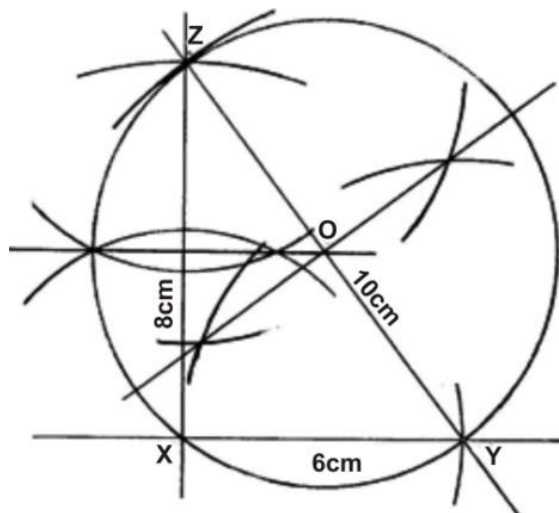
(ii) $\text{Yaw received } (120 - 72) \text{ oranges} = 48 \text{ oranges}$

$$\text{Yaw's share} - \text{Kwabena's share} = 48 \text{ oranges} - 40 \text{ oranges}$$

$$= \underline{8 \text{ oranges}}$$

$$\Rightarrow \text{Yaw received } \underline{8 \text{ more oranges}} \text{ than Kwabena}$$

3 (a), (b)



(c) $\text{Radius of circle} = \underline{5 \text{ cm}}$

$$\text{Circumference} = \pi d$$

$$= 3.14 \times 10 \text{ cm}$$

$$= \underline{31.4 \text{ cm}}$$

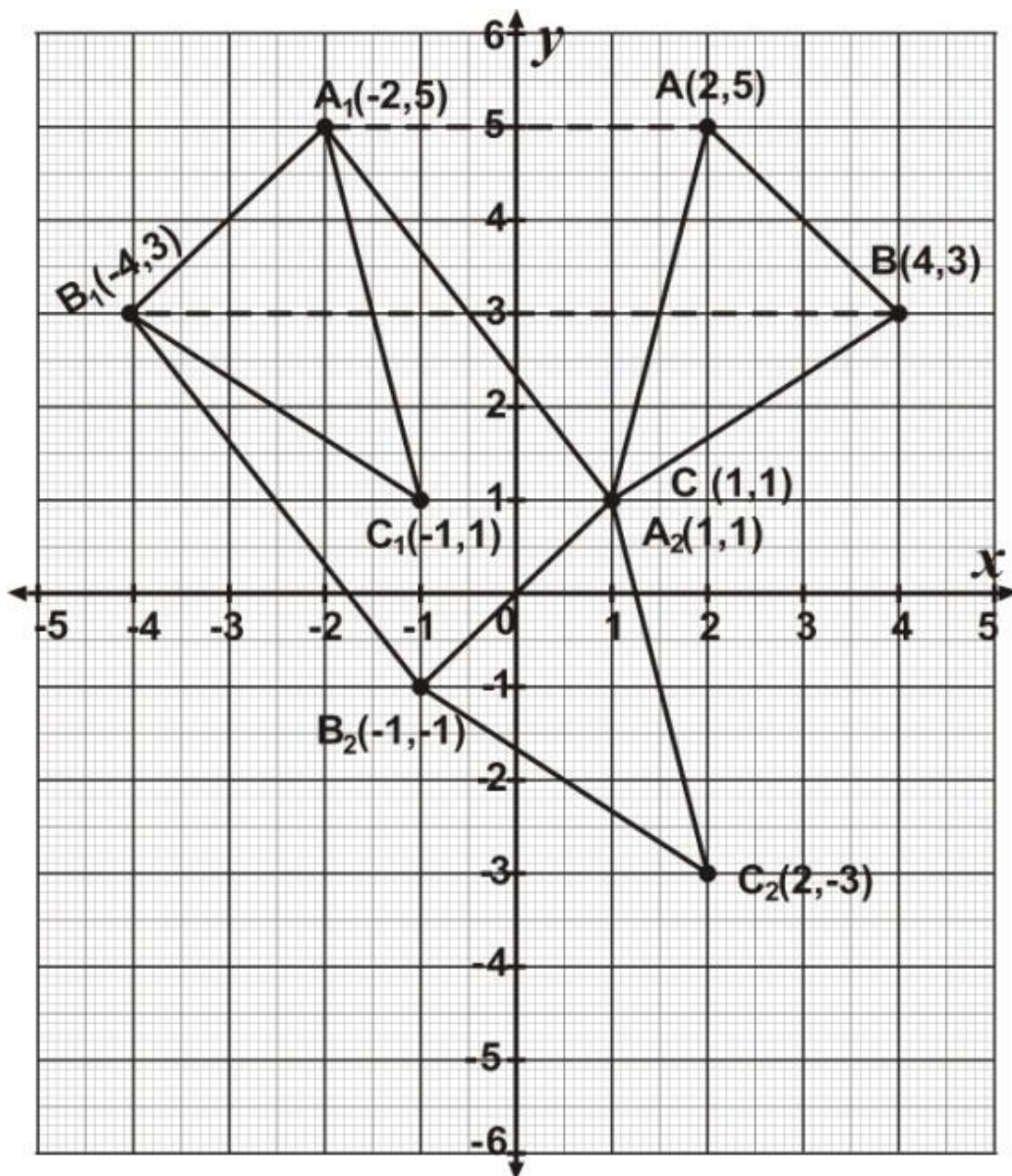
4 (a) – (e) **Approach 1** ([Inspection / Construction](#))

[NB: Translating $\triangle A_1B_1C_1$ by vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ simply means

moving $\triangle A_1B_1C_1$ 3 units to the right (3), and then 4 units downwards (-4).

So, e.g., the point $A_1(-2,5)$ moves to $A_2(1,1)$

NB: Horizontal direction movement first; Vertical direction movement second (always)



4 (c), (d) **Approach 2** [\(The rule / formula\)](#)c) Reflecting (x, y) in the y-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$\Rightarrow OA \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} -2 \\ 5 \end{pmatrix}, \therefore A_1(-2, 5)$$

$$\Rightarrow OB \begin{pmatrix} 4 \\ 3 \end{pmatrix} \rightarrow OB_1 \begin{pmatrix} -4 \\ 3 \end{pmatrix}, \therefore B_1(-4, 3)$$

$$\Rightarrow OC \begin{pmatrix} 1 \\ 1 \end{pmatrix} \rightarrow OC_1 \begin{pmatrix} -1 \\ 1 \end{pmatrix}, \therefore C_1(-1, 1)$$

\therefore Plot and join $A_1(-2, 5)$, $B_1(-4, 3)$ and $C_1(-1, 1)$ as the image of triangle ABC under a reflection in the y axis.

d) Translating (x, y) by vector $\begin{pmatrix} a \\ b \end{pmatrix}$

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x + a \\ y + b \end{pmatrix}$$

$$OA_1 \begin{pmatrix} -2 \\ 5 \end{pmatrix} \rightarrow OA_2 \begin{pmatrix} -2 + 3 \\ 5 + -4 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \therefore A_2(1, 1)$$

$$OB_1 \begin{pmatrix} -4 \\ 3 \end{pmatrix} \rightarrow OB_2 \begin{pmatrix} -4 + 3 \\ 3 + -4 \end{pmatrix} = \begin{pmatrix} -1 \\ -1 \end{pmatrix}, \therefore B_2(-1, -1)$$

$$OC_1 \begin{pmatrix} -1 \\ 1 \end{pmatrix} \rightarrow OC_2 \begin{pmatrix} -1 + 3 \\ 1 + -4 \end{pmatrix} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}, \therefore C_2(2, -3)$$

\therefore Plot and join $A_2(1, 1)$, $B_2(-1, -1)$ and $C_2(2, -3)$ as the image of triangle ABC under a translation by vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$

4 (f) $\overrightarrow{A_1 B_1}$ **Method 1** [\(By inspection\)](#)

From A_1 to B_1 , we move 2 units to the left [horizontal] (-2) ,
then 2 units downwards [vertical] (-2) , hence

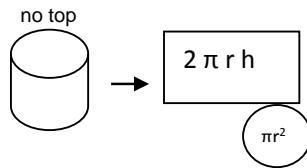
$$\text{Vector } A_1B_1 \quad (\overrightarrow{A_1B_1}) = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$$

NB: Horizontal direction movement first;
Vertical direction movement second (always)

4 (f) Method 2 (By calculation / the rule)

$$\begin{aligned} \text{Vector } A_1B_1 \quad (\overrightarrow{A_1B_1}) &= \overrightarrow{OB_1} - \overrightarrow{OA_1} \\ &= \begin{pmatrix} -4 \\ 3 \end{pmatrix} - \begin{pmatrix} -2 \\ 5 \end{pmatrix} \\ &= \begin{pmatrix} -4+2 \\ 3-5 \end{pmatrix} = \begin{pmatrix} -2 \\ -2 \end{pmatrix} \end{aligned}$$

5 (a)

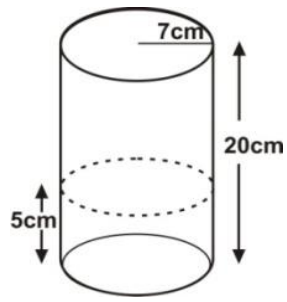


(i)

Total surface area of cylinder closed at one end

$$\begin{aligned} &= \text{Areas of (Curved surface+ bottom)} \\ &= 2 \pi r h + \pi r^2 \\ &= 2 \times \frac{22}{7} \times 7\text{cm} \times 20\text{cm} + \frac{22}{7} \times (7\text{cm})^2 \\ &= 2 \times \frac{22}{7} \times 7\text{cm} \times 20\text{cm} + \frac{22}{7} \times 7\text{cm} \times 7\text{cm} \\ &= 2 \times 22 \times 20\text{cm}^2 + 22 \times 7\text{cm}^2 \\ &= 880 \text{ cm}^2 + 154\text{cm}^2 \\ &= \underline{\underline{1034\text{cm}^2}} \end{aligned}$$

(ii)



Not drawn to scale

$$\begin{aligned}
 \text{Volume of water} &= \text{Area of base} \times \text{depth} \\
 &= \pi r^2 \times d \\
 &= \frac{22}{7} \times (7\text{cm})^2 \times 5\text{cm} \\
 &= \frac{22}{7} \times 7\text{cm} \times 7\text{cm} \times 5\text{cm} \\
 &= 22 \times 7\text{cm}^2 \times 5\text{cm} \\
 &= \underline{\underline{770\text{cm}^3}}
 \end{aligned}$$

$$\text{The volume of water in the cylinder} = \underline{\underline{770\text{cm}^3}}$$

5 (b)

$$\frac{0.07 \times 0.6}{0.014 \times 0.03}$$

Method 1 (Converting to common fractions)

$$\begin{aligned}
 &= (0.07 \times 0.6) \div (0.014 \times 0.03) \\
 &= \left(\frac{7}{100} \times \frac{6}{10}\right) \div \left(\frac{14}{1000} \times \frac{3}{100}\right) \\
 &= \left(\frac{7}{100} \times \frac{6}{10}\right) \times \left(\frac{1000}{14} \times \frac{100}{3}\right) \\
 &= \frac{7 \times 6 \times 100}{14 \times 3} \\
 &= 100 = \underline{\underline{1 \times 10^2}}
 \end{aligned}$$

5 (b)

Method 2 (Converting to whole numbers)

Multiplying both numerator and denominator by 100,000

(to convert to whole numbers)

$$\frac{0.07 \times 0.6}{0.014 \times 0.03} \times \frac{100,000}{100,000}$$

$$= \frac{7 \times 600}{14 \times 3}$$

$$= 100 = \underline{\underline{1 \times 10^2}}$$

August 2000

MATHEMATICS

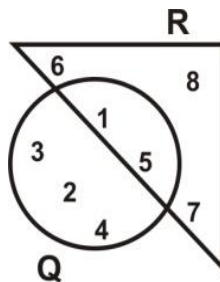
SECTION A OBJECTIVE TEST 1 hour

1. $M = \{1, 2, 3, 8, 10\}$ and $N = \{8, 1, x, 3, 2\}$.

If M is equal to N, what is the value of x?

- A) 1 B) 2 C) 3 D) 8 E) 10

2. In the Venn diagram Q is the set of numbers inside the circle and R is the set of numbers inside the triangle.



Find $Q \cap R$.

- A. $\{1, 5\}$
B. $\{2, 3, 4\}$
C. $\{6, 7, 8\}$
D. $\{1, 2, 3, 4, 5\}$
E. $\{1, 2, 3, 4, 5, 6, 7, 8\}$
3. Simplify: $11 - (11 - 4) + 13$.
A) -7 B) -17 C) 9 D) 17 E) 31
4. What is the value of '4' in the number 2,043,507?
A) Forty
B) Four hundred
C) Four thousand

- D) Forty thousand
E) Four hundred thousand

5. Which of the following is true?

- A) $\{0, 2, 6, 9, 12\}$ is a subset of even numbers
B) $\{-1, 0, 2, 3, 5\}$ is a subset of odd numbers.
C) $\{-2, -1, 1, 3, 9\}$ is a subset of integers.
D) $\{2, 3, 5, 7, 27\}$ is a subset of prime numbers
E) $\{9, 18, 21, 27, 36\}$ is a subset of multiples of 9.

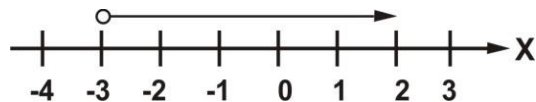
6. If $(23 \times 82) \times 79 = 148,994$, find the exact value of $(2.3 \times 82) \times 7.9$

- A) 1.48994 B) 14.8994 C) 148.994 D) 1489.94 E) 14899.4

7. Convert 206 to a base five numeral.

- A) 411_{five} B) 4011_{five} C) 3321_{five} D) 1311_{five} E) 1131_{five}

8. Which of the following inequalities is represented by the number line?



- A) $x \leq -3$ B) $x \geq -3$ C) $x < -3$ D) $x > -3$ E) $x = -3$

9. The product of three numbers is 1197. Two of the numbers are 3 and 21. Find the third number

- A) 19 B) 57 C) 63 D) 399 E) 1134

10. Simplify: $\begin{pmatrix} -2 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

- A. $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ B. $\begin{pmatrix} -1 \\ 8 \end{pmatrix}$ C. $\begin{pmatrix} -3 \\ 8 \end{pmatrix}$ D. $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$ E. $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$

11. A pencil sells at ₦180.00 and an eraser sells at ₦120.00. how much will you pay if you buy three pencils and four erasers ?

- A) ₦1,020.00
B) ₦1,080.00
C) ₦1,200.00
D) ₦1,280.00

E) ¢2,100.00

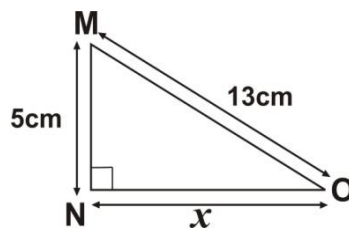
12. Simplify $\frac{0.12 \times 0.08}{2.40}$

- A) 0.4 B) 0.04 C) 0.004 D) 0.0004 E) 0.00004

13. How many lines of symmetry has a square ?

- A) 2 B) 3 C) 4 D) 6 E) 8

14. In the diagram, MNO is a right-angled triangle. $|MO| = 13\text{cm}$ and $|MN|$ is 5cm.



Find the value of x.

- A) 3 B) 4 C) 8 D) 12 E) 18

15. Amina spends $\frac{17}{35}$ of her pocket money on transport and food. If she spends $\frac{2}{7}$ on transport only, what fraction does she spend on food ?

- A) $\frac{1}{4}$ B) $\frac{1}{5}$ C) $\frac{5}{7}$ D) $\frac{15}{28}$ E) $\frac{18}{35}$

16. If $x \rightarrow 3x - 4$, what is the image of -2 ?

- A) -10 B) -2 C) -1 D) 2 E) 10

17. Simplify: $(2ab^2)(3a^2b)$

- A) $5a^2b^2$ B) $6a^2b^2$ C) $5a^2b^3$ D) $6a^3b^2$ E) $6a^3b^3$

18. It takes 15 men, 48 days to weed a plot of land. How many men can weed the same plot of land in 16 days, if they work at the same rate?

- A) 5 B) 18 C) 32 D) 45 E) 48

19. The ratio $9:x$ is equivalent to $36:20$. What is the value of x ?

- A) 4 B) 5 C) 6 D) 8 E) 10

20. In an enlargement, $PQ \rightarrow P'Q'$. $|PQ| = 3\text{cm}$ and $|P'Q'| = 15$. Calculate the scale factor of the enlargement.

- A) $\frac{1}{5}$ B) $\frac{2}{3}$ C) 5 D) 10 E) 45

21. Simplify: $7a - 3(b - a)$

- A) $4a - 3b$ B) $6a - 3b$ C) $8a - 3b$ D) $10a - 3b$ E) $10a + 3b$

22. A man deposited an amount of money in his savings account for 5 years. The rate of interest was 14% per annum. If the interest was ₦35,000.00, find the amount deposited.

- A) ₦85,000.00
B) ₦50,000.00
C) ₦39,900.00
D) ₦24,500.00
E) ₦15,000.00

23. Arrange the following fractions from the lowest to the highest: $\frac{3}{4}$, $\frac{2}{3}$ and $\frac{3}{5}$.

- A) $\frac{3}{5}$, $\frac{2}{3}$, $\frac{3}{4}$
B) $\frac{3}{5}$, $\frac{3}{4}$, $\frac{2}{3}$
C) $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$
D) $\frac{3}{4}$, $\frac{3}{5}$, $\frac{2}{3}$
E) $\frac{2}{3}$, $\frac{3}{5}$, $\frac{3}{4}$

24. The marked price of a radio set is ₦450,000. A discount of 5% of the marked price is allowed. What is the selling price of the radio set?

- A) ₦427,000
B) ₦427,500
C) ₦428,571
D) ₦472,500
E) ₦473,684

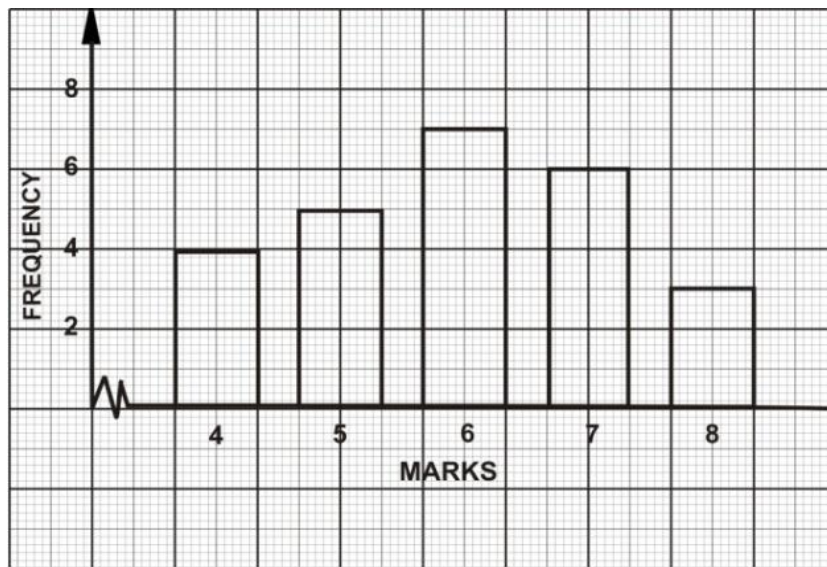
25. If 60% of the pupils in a school is 240, find the total enrolment in the school.

- A) 144 B) 160 C) 360 D) 384 E) 400

26. If $a * b = 2a - b$, evaluate $4 * 3$

- A) 1 B) 2 C) 3 D) 4 E) 5

The bar chart shows the mark distribution of pupils in a test. Use it to answer questions 27 and 28



27. What is the modal mark?

- A) 4 B) 5 C) 6 D) 7 E) 8

28. How many pupils took the test?

- A) 5 B) 20 C) 25 D) 30 E) 37

29. A school has a population of 600. Out of this, 120 are girls. What is the probability of meeting a pupil in the school who is a boy?

- A) $\frac{1}{4}$ B) $\frac{1}{5}$ C) $\frac{3}{5}$ D) $\frac{4}{5}$ E) $\frac{12}{25}$

30. If $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2}$, find k when $k_1 = 1$ and $k_2 = 2$.

- A) $\frac{1}{2}$ B) $\frac{2}{3}$ C) $\frac{3}{2}$ D) 2 E) 3

31. Solve the equation $13x - 2(3x + 4) = 22$.

- A) 2 B) 4 C) $\frac{18}{7}$ D) $\frac{26}{7}$ E) $\frac{30}{7}$

32. A rectangular tank is 4m long, 3m wide and 2.5m high. What is the volume of the tank?

- A) 24m^3 B) 30m^3 C) 36m^3 D) 48m^3 E) 60m^3

33. Write the rule for the mapping:

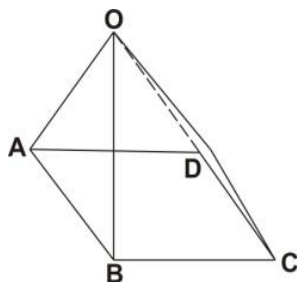
| | | | | |
|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 |
| ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 1 | 3 | 5 | 7 |

- A) $x \rightarrow 2x+1$ B) $x \rightarrow 2x-1$ C) $x \rightarrow 2(x+1)$ D) $x \rightarrow 2(x-1)$ E) $x \rightarrow x^2 - 1$

34. If $\mathbf{r} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ and $\mathbf{s} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, calculate $2\mathbf{r} - 3\mathbf{s}$

- A. $\begin{pmatrix} -5 \\ 12 \end{pmatrix}$ B. $\begin{pmatrix} -5 \\ -8 \end{pmatrix}$ C. $\begin{pmatrix} 13 \\ -3 \end{pmatrix}$ D. $\begin{pmatrix} 13 \\ -8 \end{pmatrix}$ E. $\begin{pmatrix} 13 \\ 8 \end{pmatrix}$

35. Name the geometrical figure shown in the diagram.



- A) parallelogram
B) triangle
C) cone
D) tetrahedron
E) pyramid

36. A car travels 72 kilometres in an hour. Find its speed in metres per second.

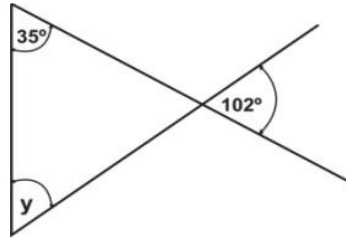
- A) 5 m s^{-1} B) 20 m s^{-1} C) 50 m s^{-1} D) 200 m s^{-1} E) 1200 m s^{-1}

37. The circumference of a circular track is 154m. Find the diameter of the track.

(Take $\pi = \frac{22}{7}$)

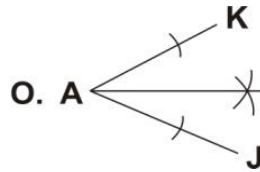
- A) 22.0 m B) 24.5 m C) 49.0 m D) 242.0 m E) 484.0 m

38. Find the value of the angle marked y in the diagram.



- A) 35° B) 43° C) 67° D) 78° E) 137°

39. Which of the following best describes the construction in the diagram?



- A) Constructing a 30° angle
 B) Constructing a 60° angle
 C) Bisecting a line segment
 D) Bisecting a given angle
 E) Drawing a perpendicular from a given point.

40. Ama is N years old now. How old will she be in 10 years?

- A. $(N - 10)$ years
 B. $(N + 10)$ years
 C. $(10 - N)$ years
 D. $10N$ years
 E. $10/N$ years

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. E) 10
2. A) $\{1, 5\}$
3. D) 17
4. D) Forty thousand
5. C) $\{-2, -1, 1, 3, 9\}$ is a subset of integers
6. D) 1489.94
7. D) 1311_{five}
8. D) $x > -3$
9. A) 19
10. E) $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$
11. A) ₦1,020.00
12. C) 0.004
13. C) 4
14. D) 12
15. B) $\frac{1}{5}$

16. A) -10
17. E) $6a^3b^3$
18. D) 45
19. B) 5
20. C) 5
21. D) $10a-3b$
22. B) $\text{¢}50,000.00$
23. A) $3/5, 2/3, 3/4$
24. B) $\text{¢}427,500$
25. E) 400
26. E) 5
27. C) 6
28. C) 25
29. D) $4/5$
30. B) $2/3$
31. E) $30/7$
32. B) $30m^3$
33. B) $x \rightarrow 2x-1$
34. D. $\begin{pmatrix} 13 \\ -8 \end{pmatrix}$
35. E) pyramid
36. B) 20 m s^{-1}
37. C) 49.0 m
38. B) 43°
39. D) bisecting a given angle

40. B. $(N + 10)$ years

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

Attempt **four** questions **only** from this section

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

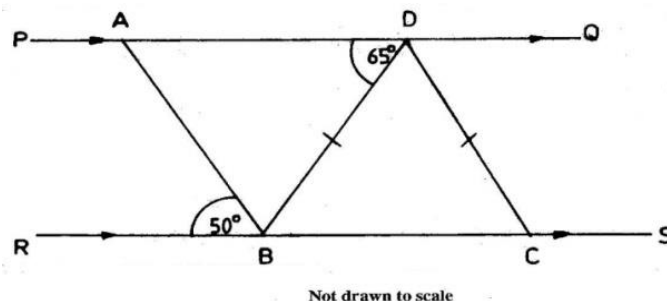
All questions carry equal

1. (a) Simplify: $\frac{2}{3}$ of $6\frac{3}{4} \div (2\frac{4}{15} - 1\frac{2}{3})$.

(b) Solve the equation $\frac{1}{3}(x+3) - 2(x-5) = 4\frac{1}{3}$

(c) If $3y = 2x^2 - 3x + 7$, find y , when $x = 5$.

2. (a) In the diagram, PADQ and RBCS are parallel lines. $|BD| = |DC|$, angle $ADB = 65^\circ$ and angle $ABR = 50^\circ$.



- (i) Calculate the angle BDC
- (ii) Calculate angle ABD
- (iii) Find angle BAD

(iv) What type of triangle is triangle ABD ?

- (b) Using a ruler and a pair of compasses only, construct triangle XYZ, with $|YZ| = 8\text{cm}$, angle $XYZ = 60^\circ$ and $|XY| = 9\text{cm}$.

Measure (i) angle YZX; (ii) $|XZ|$

3. Ama was granted a loan of ₦800,000.00 by a bank. The rate of interest was 42% per annum.

(a) Calculate

- (i) the interest at the end of the year;
(ii) the total amount Ama had to pay at the end of the year.

(b) Ama was able to pay only ₦700,000.00 at the end of the year.

- (i) Find how much Ama still owed the bank
(ii) Express the amount Ama owed after paying the ₦700,000.00 to the bank as a percentage of the loan she took from the bank.

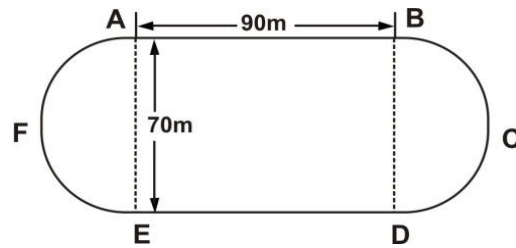
4. The following is a record of scores obtained by 30 JSS form 2 pupils in a test marked out of 5.

5, 3, 2, 4, 5, 2,
4, 3, 1, 1, 3, 3,
4, 2, 3, 4, 5, 3,
4, 3, 2, 4, 3, 1,
2, 2, 3, 3, 2, 4.

| Score (x) | Tally | Frequency (f) | fx |
|---------------|-------|-------------------|------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| Total | | | |

- a) Copy and complete the table.
b) Find the mean of the distribution.
c) If a pupil is selected at random from the form, what is the probability that he / she scored 4 marks ?

5.



The diagram shows a running track ABCDEFA. AB and ED are the straight sides. The ends AFE and BCD are semi-circular shapes.

$$|AB| = |ED| = 90\text{m} \text{ and } |AE| = |BD| = 70\text{m}.$$

Find

- the total length of the two semi-circular ends, AFE and BCD;
- the perimeter of the running track ABCDEFA;
- the total area of the running track ABCDEF.

(Take $\pi = \frac{22}{7}$)

August 2000

MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1 (a)

$$\frac{2}{3} \text{ of } 6\frac{3}{4} \div (2\frac{4}{15} - 1\frac{2}{3})$$

$$\Rightarrow \frac{2}{3} \text{ of } \frac{27}{4} \div (\frac{34}{15} - \frac{5}{3})$$

$$\Rightarrow \frac{2}{3} \text{ of } \frac{27}{4} \div (\frac{34 - 25}{15})$$

$$\Rightarrow \frac{2}{3} \times \frac{27}{4} \div \frac{9}{15}$$

$$\Rightarrow \frac{2}{3} \times \frac{27}{4} \times \frac{15}{9}$$

$$\Rightarrow \frac{15}{2}$$

$$\Rightarrow \underline{\underline{7\frac{1}{2}}}$$

1 (b)

$$\frac{1}{3}(x+3) - 2(x-5) = 4\frac{1}{3}$$

$$\Rightarrow \frac{1}{3}(x+3) - 2(x-5) = \frac{13}{3}$$

$$\Rightarrow 3 \times \frac{1}{3}(x+3) - 3 \times 2(x-5) = 3 \times \frac{13}{3}$$

$$\Rightarrow (x+3) - 6(x-5) = 13$$

$$\Rightarrow x+3-6x+30 = 13$$

$$\Rightarrow x-6x = 13-3-30$$

$$\Rightarrow -5x = -20$$

$$\Rightarrow \frac{-5x}{-5} = \frac{-20}{-5}$$

$$\Rightarrow \underline{\underline{x = 4}}$$

1 (c)

When $x = 5$, we have

$$3y = 2(5)^2 - 3(5) + 7$$

$$\Rightarrow 3y = 2 \times 25 - 3 \times 5 + 7$$

$$\Rightarrow 3y = 50 - 15 + 7$$

$$\Rightarrow 3y = 42$$

$$\Rightarrow y = \frac{42}{3}$$

$$\Rightarrow \underline{\underline{y = 14}}$$

2(a) (i)

$$\angle CBD = \angle ADB = 65^\circ \quad (\text{Alternate angles})$$

Also, $\angle BCD = \angle CBD = 65^\circ$ (base angles of isosceles Δ)

Now taking ΔBCD ,

$$\angle BDC + \angle CBD + \angle BCD = 180^\circ$$

$$\Rightarrow \angle BDC + 65^\circ + 65^\circ = 180^\circ$$

$$\Rightarrow \angle BDC + 130^\circ = 180^\circ$$

$$\Rightarrow \angle BDC = 180^\circ - 130^\circ$$

$$\Rightarrow \underline{\underline{\angle BDC = 50^\circ}}$$

(ii)

Since $\angle ABR$, $\angle ABD$ and $\angle CBD$ lie on a straight line,

$$\Rightarrow \angle ABR + \angle ABD + \angle CBD = 180^\circ$$

$$\Rightarrow 50^\circ + \angle ABD + 65^\circ = 180^\circ$$

$$\Rightarrow \angle ABD + 115^\circ = 180^\circ$$

$$\Rightarrow \angle ABD = 180^\circ - 115^\circ$$

$$\Rightarrow \underline{\underline{\angle ABD = 65^\circ}}$$

(iii)

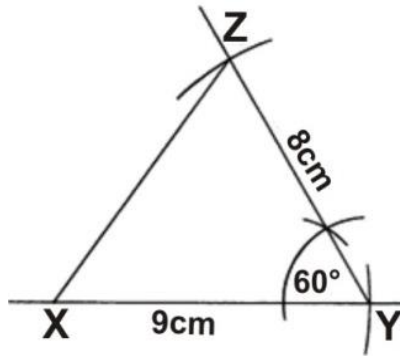
Taking ΔABD ,

$$\angle BAD + \angle ABD + \angle ADB = 180^\circ$$

$$\begin{aligned}
\Rightarrow \quad \angle BAD + 65^\circ + 65^\circ &= 180^\circ \\
\Rightarrow \quad \angle BAD + 130^\circ &= 180^\circ \\
\Rightarrow \quad \angle BAD &= 180^\circ - 130^\circ \\
\Rightarrow \quad \underline{\underline{\angle BAD = 50^\circ}}
\end{aligned}$$

(iv) Triangle ABD is isosceles (since it has two equal interior angles)

2(b)



(i) angle YZX \approx 67°

(ii) |XZ| \approx 8.5 cm

3(a)(i) Simple interest = Principal \times Rate \times Time

$$= 800,000 \times 42\% \times 1$$

$$= 800,000 \times \frac{42}{100}$$

$$= 8000 \times 42$$

$$= 336,000$$

\therefore The simple interest at the end of the year = ¢336,000.00

(ii) The amount to be paid

$$= \text{Principal} + \text{S. Interest}$$

$$= \text{¢}800,000 + \text{¢}336,000$$

$$= \underline{\underline{\text{¢}1,136,000}}$$

(b) (i) Amount still owed

$$= \text{Total amount} - \text{amount paid}$$

$$= \text{¢}1,136,000 - \text{¢}700,000$$

$$= \text{¢}436,000$$

(ii) Amount still owed as a percentage of loan taken

$$= \frac{\text{Amount still owed}}{\text{Loan taken (Principal)}} \times 100\%$$

$$= \frac{\text{¢}436,000}{\text{¢}800,000} \times 100\%$$

$$= \frac{436}{8} \%$$

$$= \underline{54.5\%} \quad \text{or} \quad \underline{54\frac{1}{2}\%}$$

4(a)

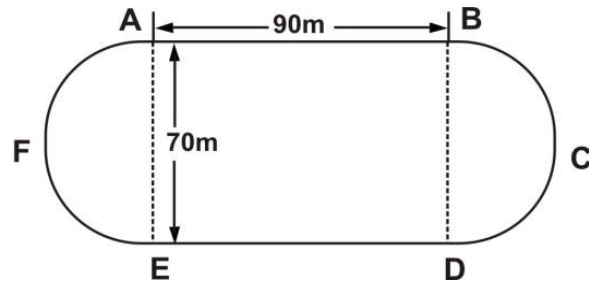
| Score (x) | Tally | Frequency (f) | fx |
|--------------|---------|------------------|----|
| 1 | /// | 3 | 3 |
| 2 | ### // | 7 | 14 |
| 3 | ### ### | 10 | 30 |
| 4 | ### // | 7 | 28 |
| 5 | /// | 3 | 15 |
| Total | | 30 | 90 |

4(b) The mean $= \frac{\Sigma f x}{\Sigma f} = \frac{90}{30} = \underline{\underline{3}}$

4(c) P(4 marks) $= \frac{\text{Number of pupils that obtained 4 marks}}{\text{Total number of pupils}}$

$$= \underline{\underline{\frac{7}{30}}}$$

5(a)



a) Total length of two semi-circular ends AFE and BCD

Approach 1

$$\begin{aligned}
 \text{Total length} &= 2 \text{ semi-circular arcs of diameter } 70\text{m} \\
 &= 2 \times \text{length of semi-circular arc} \\
 &= 2 \times \frac{1}{2} (\pi d) \\
 &= \pi d \\
 &= \frac{22}{7} \times 70\text{m} \\
 &= 22 \times 10\text{m} \\
 &= \underline{\underline{220 \text{ m}}}
 \end{aligned}$$

5(a)

Approach 2

$$\begin{aligned}
 \text{Total length} &= \text{AFE length} + \text{BCD length} \\
 &= \frac{1}{2} \pi d + \frac{1}{2} \pi d \\
 &= (\frac{1}{2} \times \frac{22}{7} \times 70\text{m}) + (\frac{1}{2} \times \frac{22}{7} \times 70\text{m}) \\
 &= 11 \times 10\text{m} + 11 \times 10\text{m} \\
 &= 110\text{m} + 110\text{m} \\
 &= \underline{\underline{220 \text{ m}}}
 \end{aligned}$$

(b)

Perimeter of running track ABCDEFA

$$\begin{aligned}
 \Rightarrow \text{Distance around the track} \\
 &= AB + BCD + ED + AFE \\
 &= 90\text{m} + 110\text{m} + 90\text{m} + 110\text{m} \\
 &= \underline{\underline{400 \text{ m}}}
 \end{aligned}$$

(c)

Total area of the running track ABCDEF

Approach 1

$$\begin{aligned}
 \text{Total area} &= \text{Two semi-circles area} + \text{rectangle area} \\
 &= 2 \left(\frac{1}{2} \pi r^2 \right) + l w \\
 &= \pi r^2 + l w
 \end{aligned}$$

$$\begin{aligned}
&= \frac{22}{7} \times (35)^2 + 90 \times 70 \\
&= \frac{22}{7} \times 35 \times 35 + 90 \times 70 \\
&= 22 \times 5 \times 35 + 90 \times 70 \\
&= 3850 + 6300 \\
&= 10150
\end{aligned}$$

\Rightarrow Total area of the running track ABCDEF = 10150 cm²

(c)

Approach 2

$$\begin{aligned}
\text{Total area} &= \text{Area of (AFE + ABDE + BCD)} \\
&= \frac{1}{2} \pi r^2 + l w + \frac{1}{2} \pi r^2 \\
&= [\frac{1}{2} \times \frac{22}{7} \times (35)^2] + [90 \times 70] + [\frac{1}{2} \times \frac{22}{7} \times (35)^2] \\
&= 1925 + 6300 + 1925 \\
&= 10150
\end{aligned}$$

\Rightarrow Total area of the running track ABCDEF = 10150 cm²

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MATHEMATICS

SECTION A OBJECTIVE TEST

1 hour

1. Set A is calledof set B, when all the numbers of set A are also members of set B.
 - A) the universal set
 - B) the union set
 - C) the null set
 - D) a subset
 - E) an empty set

2. $M = \{\text{multiples of 3 between 10 and 20}\}$
 $N = \{\text{even numbers between 10 and 20}\}.$
Find $M \cap N$.
 - A. $\{12, 18\}$
 - B. $\{12, 15, 18\}$
 - C. $\{12, 14, 16, 18\}$
 - D. $\{12, 14, 15, 16, 18\}$
 - E. $\{10, 12, 14, 15, 18, 20\}$

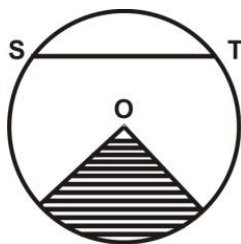
3. Express 24 as a product of prime factors.
 - A) 2×3
 - B) $2^2 \times 3$
 - C) $2^3 \times 3$
 - D) $2^2 \times 3^2$
 - E) $2^2 \times 3^3$

4. Write in standard form 1342.
 - A) 0.1342×10^{-3}
 - B) 0.1342×10^{-4}
 - C) 13.42×10^2
 - D) 1.342×10^3
 - E) 1.342×10^4

5. Change 10111_{two} to base ten.
 A) 15 B) 17 C) 23 D) 25 E) 29
6. If $Y = 595$ and $Z = 7071$, find the sum of Y and Z .
 A) 6466 B) 7566 C) 7666 D) 12,021 E) 13,021
7. Simplify: $\frac{1}{2} - \frac{1}{4} + \frac{1}{8}$
 A) $\frac{1}{8}$ B) $\frac{1}{6}$ C) $\frac{3}{8}$ D) $\frac{5}{8}$ E) $\frac{7}{8}$
8. A ribbon is 4 m long. How many pieces, each 30 cm long, can be cut from the ribbon?
 A) 7 B) 11 C) 12 D) 13 E) 14
9. Find the integers within the interval $5 < x < 9$
 A. {5,6,7} B. {5,6,7,8} C. {5,6,7,8,9} D. {6,7,8} E. {6,7,8,9}
10. Calculate, correct to two decimal places, $0.61 \div 0.8$
 A) 0.07 B) 0.08 C) 0.76 D) 0.83 E) 7.62

The diagram below shows a circle with centre O , S and T are points on the circle.

Use it to answer questions 11 and 12



11. What name is given to the shaded region ?
 A) sector
 B) segment
 C) radii
 D) arc
 E) cone
12. The line ST is called
 A) an arc

- B) a chord
- C) a diameter
- D) a radius
- E) a segment

13. Simplify: $2 \times 3^2 \times 3^4$
 A) 2×3^5 B) 2×3^6 C) 2×3^8 D) 2×9^6 E) 2×9^8
14. Which of the following fractions is the greatest? $\frac{1}{6}, \frac{1}{4}, \frac{1}{2}, \frac{1}{3}, \frac{1}{5}$
 A) $\frac{1}{6}$ B) $\frac{1}{5}$ C) $\frac{1}{4}$ D) $\frac{1}{3}$ E) $\frac{1}{2}$
15. The sum of the ages of a man and his wife is 81 years. The ratio of their ages is 5:4. Find the age of the younger person.
 A) 30 years B) 36 years C) 45 years D) 51 years E) 65 years
16. A car is travelling at 40km per hour. How far does it travel in $2\frac{1}{2}$ hours?
 A) 16km B) 80km C) 90km D) 100km E) 140km
17. There are 6 girls and 18 boys in a class. What percentage of the class are girls?
 A) 14.40% B) 25.00% C) 33.33% D) 66.67% E) 75.00%
18. Find the missing numbers in the sequence 4, 8, 12, _ , _ , _ , 28
 A) 14, 16, 22
 B) 14, 18, 22
 C) 6, 18, 22
 D) 16, 20, 24
 E) 16, 22, 24
19. A shop increased all its prices by 10%. Calculate the new price for an article which previously sold for ₦7,500.00
 A) ₦6,750.00
 B) ₦7,575.00
 C) ₦7,800.00
 D) ₦8,250.00
 E) ₦8,350.00

20. Simplify: $7(y + 1) - 2(2y + 3)$

- A) $3y - 5$ B) $3y - 2$ C) $3y + 1$ D) $3y + 4$ E) $3y + 13$

The table below shows the average monthly rainfall at Nankese from March, 1996 to August, 1996.

Use it to answer question 21 and 22

| Month | Mar | Apr | May | Jun | Jul | Aug |
|---------------|-----|-----|-----|-----|-----|-----|
| Rainfall (mm) | 99 | 145 | 277 | 450 | 267 | 142 |

21. Which month recorded the highest amount of rainfall?

- A) March B) April C) May D) June E) July

22. What was the total amount of rainfall recorded in April, May and July ?

- A) 422mm B) 689mm C) 72mm D) 994mm E) 1,139mm

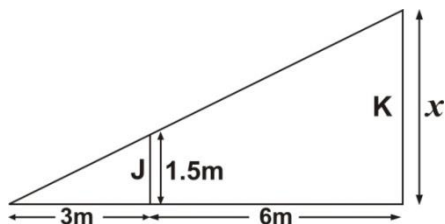
23. Find the median of the following numbers: 1, -1, -5, 3 and -4

- A) -1 B) -4 C) -5 D) 1 E) 3

24. There are 15 red and 25 black balls in a bag. Find the probability of selecting a black ball from the bag.

- A) $\frac{1}{25}$ B) $\frac{1}{15}$ C) $\frac{3}{8}$ D) $\frac{3}{5}$ E) $\frac{5}{8}$

In the diagram below, K is an enlargement of J. Use it answer questions 25 and 26



25. Calculate the scale factor

- A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) 2 D) 3 E) 9

26. Find the value of x.

- A) 3.0m B) 3.5m C) 4.5m D) 6.0m E) 9.0m

27. A trader received a commission of 25% on the sales he made in a month. His commission was ₦180,000.00. Find his total sales for the month.
- A) ₦135,000.00
 B) ₦150,000.00
 C) ₦240,000.00
 D) ₦540,000.00
 E) ₦720,000.00

28. Kwame travelled from Accra to Kumasi. He travelled $\frac{3}{10}$ of the journey by lorry, $\frac{2}{5}$ of the journey by taxi and the rest by train. What fraction of the journey did he travel by train ?
- A) $\frac{3}{10}$ B) $\frac{3}{5}$ C) $\frac{7}{10}$ D) $\frac{3}{25}$ E) $\frac{22}{25}$

29. If $4(m + 4) = 18$, find the value of m .
- A) $\frac{1}{2}$ B) $\frac{3}{2}$ C) $\frac{5}{2}$ D) $\frac{7}{2}$ E) $\frac{17}{2}$

Use the mapping below to answer questions 30 and 31

| | | | | | |
|---|---|---|---|---|-----|
| x | 1 | 2 | 3 | 4 | ... |
| ↓ | ↓ | ↓ | ↓ | ↓ | |
| y | 3 | 5 | 7 | 9 | ... |

30. What is the rule for the mapping ?
- A) $x \rightarrow 4 - x$ B) $x \rightarrow x - 2$ C) $x \rightarrow 2x$ D) $x \rightarrow 2x + 1$ E) $x \rightarrow 3x$
31. Find the value of y when x is 7.
- A) -3 B) 9 C) 14 D) 15 E) 21
32. A square of side 6cm has the same area as a rectangle of length 9cm. Find the breadth of the rectangle.
- A) 3cm B) 4cm C) 6cm D) 24cm E) 36cm
33. Factorize $3r^2s - 9rs^2$
- A. $rs(3r - s)$
 B. $3rs(s - 3r)$
 C. $3rs(r - 3s)$
 D. $r^2s^2(3r - 9s)$
 E. $3r^2s^2(s - 3r)$

34. The average mass of 4 boys is 45 kg. When a fifth boy joins them, the average mass changes to 40 kg. What is the mass of the fifth boy?

A) 5 kg B) 10 kg C) 15 kg D) 20 kg E) 25 kg

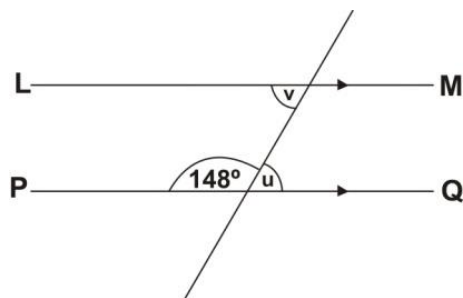
35. E is the point (4, 2) and F the point (2, 1). Calculate the gradient of the straight line EF.

A) $-\frac{1}{2}$ B) -2 C) 2 D) $\frac{1}{2}$ E) 0

36. $l = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and $k = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$. Find $l + k$.

A. $\begin{pmatrix} -1 \\ -1 \end{pmatrix}$ B. $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ C. $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ D. $\begin{pmatrix} 7 \\ -1 \end{pmatrix}$ E. $\begin{pmatrix} 7 \\ 1 \end{pmatrix}$

37.



In the diagram, ML and PQ are parallel lines. Find the value of v

A) 32° B) 40° C) 58° D) 140° E) 180°

38. Given the relation $\frac{1}{y} = \frac{1}{c} + \frac{1}{x}$ which of the following expressions is equal to y ?

A) $c + x$

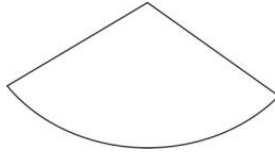
B) $\frac{2}{cx}$

C) $\frac{c+x}{2}$

D) $\frac{cx}{c+x}$

E) $\frac{c+x}{cx}$

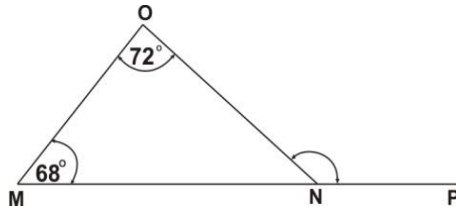
39.



The figure above is the net of

- A) a cylinder
- B) a triangle
- C) a pyramid
- D) a cone
- E) a sphere

40. In the diagram below, MNO is a triangle. Angle $MON = 72^\circ$ and angle $OMN = 68^\circ$. Find angle ONP



- A) 40° B) 68° C) 72° D) 112° E) 140°

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. D) a subset
2. A. $\{12, 18\}$
3. C) $2^3 \times 3$
4. D) 1.342×10^3
5. C) 23
6. C) 7666
7. C) $\frac{3}{8}$
8. D) 13
9. D. $\{6, 7, 8\}$
10. C) 0.76
11. A) sector
12. B) a chord
13. B) 2×3^6
14. E) $\frac{1}{2}$
15. B) 36 years

16. D) 100km
17. B) 25.00%
18. D) 16,20,24
19. D) ₪8,250.00
20. C) $3y + 1$
21. D) June
22. B) 689mm
23. A) -1
24. E) $\frac{5}{8}$
25. D) 3
26. C) 4.5m
27. E) ₪720,000.00
28. A) $\frac{3}{10}$
29. A) $\frac{1}{2}$
30. D) $x \rightarrow 2x + 1$
31. D) 15
32. B) 4 cm
33. C. $3rs(r - 3s)$
34. D) 20 kg
35. D) $\frac{1}{2}$
36. B. $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$
37. A) 32°
38. D) $\frac{cx}{c + x}$

39. D) a cone

40. E) 140°

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Kofi and Kojo were given ¢38,000.00 to share. Kojo had ¢7,500.00 more than Kofi. Find
 - (i) Kofi's share
 - (ii) Kojo's share
 - (b) A trader paid ¢1500.00 for 6 drinking cups. One of the cups got broken. He sold the remaining 5, making a profit of 10%. Calculate
 - (i) the cost price of each of the six cups;
 - (ii) the selling price of each of the five cups;
 - (iii) the profit made on each cup sold.
-
2. (a) Solve the inequality $\frac{2x-1}{4} - \frac{x-2}{3} > 1$
 - (b) Find the value of the expression $2x - 3y$, if $x = \frac{1}{3}$ and $y = -\frac{1}{2}$
 - (c) 25 students in a class took an examination in Mathematics and Science. 17 of them passed in Science and 8 passed in both Mathematics and Science. 3 students did not pass in any of the subjects.

Find

- (i) how many passed in Mathematics
- (ii) the probability of meeting a student who passed in one subject only.

3. (a) Using a pair of compasses and a ruler only,

(i) construct triangle ABC such that $|AB| = 10\text{cm}$, angle $ABC = 30^\circ$ and $|BC| = 8\text{cm}$. Measure angle ACB.

(ii) Construct a perpendicular from C to meet line AB at D. Measure $|CD|$.

(b) Calculate the area of triangle ABC.

4. a) (i) Using a scale of 2cm to 2 units on both axes, draw two perpendicular axes OX and OY on a graph sheet.

(ii) On the same graph sheet, mark the x-axis from -10 to 10 and the y-axis from -12 to 12 .

(iii) Plot the points A(0, 10), B(-6, -2), C(4, 3) and D(-3,-11).

Use a ruler to join the point A to B and also point C to D.

b) (i) Draw the line $x = -2$ to meet AB at P and CD at Q.

(ii) Use a protractor to measure angles BPQ and PQC.

(iii) What is the common name given to angles BPQ and PQC ?

(iv) State the relationship between lines AB and CD.

5. The table below shows the marks scored out of 10 by some candidates in a test.

| Mark | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------------|---|---|---|---|---|----|---|---|
| Number of candidates | 2 | 3 | 5 | 7 | 8 | 13 | 7 | 5 |

a) From the above table, find

- (i) the modal mark;
- (ii) how many candidates took the test;
- (iii) the mean mark for the test

- b) If 20% of the candidates failed,
 - (i) how many failed?
 - (ii) What is the least mark a candidate should score in order to pass?

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

- 1 (a) Since Kojo had ₵7,500 more than Kofi,
 \Rightarrow (Kojo's) = (₵7,500 + Kofi's) -----[1]
also Kofi's + (Kojo's) = ₵38,000 -----[2]
Then, from equations [1] and [2],
 \Rightarrow Kofi's + (₵7,500 + Kofi's) = ₵38,000 -----[3]

- (i) Let f = Kofi's share, then from [3],
 $\Rightarrow f + (₵7,500 + f) = ₵38,000$
 $\Rightarrow 2f + ₵7,500 = ₵38,000$
 $\Rightarrow 2f = ₵38,000 - ₵7,500$
 $\Rightarrow 2f = ₵30,500$
 $\Rightarrow \frac{2f}{2} = \frac{₵30,500}{2}$
 $\Rightarrow f = ₵15,250$

Therefore Kofi's share is ₵15,250.00

- (ii) Method 1

Since Kojo had ₵7,500 more than Kofi,
 \Rightarrow Kojo's share = ₵7,500 + ₵15,250

$$= \text{¢ } \underline{\underline{22,750.00}}$$

(ii) **Method 2**

$$\begin{aligned} \text{Kojo's share} &= \text{Total amt} - \text{Kofi's share} \\ &= \text{¢}38,000 - \text{¢}15,250 \\ &= \text{¢ } \underline{\underline{22,750.00}} \end{aligned}$$

1 (b) (i) If CP of 6 cups = ¢1500.00,
then CP of 1 cup = ¢1,500 ÷ 6
 = ¢250

1 (b) (ii) **METHOD 1** (Formula 1)

$$\begin{aligned} \text{SP} &= \frac{\text{SP Percentage}}{\text{CP Percentage}} \times \text{CP} \\ &= \frac{110 \%}{100 \%} \times \text{¢ } 250 \\ &= 11 \times \text{¢ } 25 \\ &= \text{¢ } \underline{\underline{275}} \end{aligned}$$

1 (b) (ii) **METHOD 2** (Formula 2)

$$\begin{aligned} \text{SP} &= \text{CP} + \text{Profit} \\ &= \text{¢}250 + 10\% \text{ of } \text{¢}250 \\ &= \text{¢}250 + \frac{10}{100} \times \text{¢}250 \\ &= \text{¢ } 250 + \text{¢}25 \\ &= \text{¢}275 \end{aligned}$$

$$\therefore \text{ The selling price of each of the five cups } = \text{¢ } \underline{\underline{275}}$$

1 (b) (ii) **METHOD 3** (Equivalent Fractions)

| | Percentage | Amount (¢) |
|-------------|-----------------------------|--------------|
| CP of 1 cup | 100% | 250 |
| SP of 1 cup | 100% + 10% = 110% | ? (x) |

From the table $\frac{100}{110} = \frac{250}{x}$

Cross-multiplying, we have $100 \times x = 250 \times 110$

$$\Rightarrow x = \frac{250 \times 110}{100} = 275$$

\therefore The selling price of each of the five cups = ¢ 275

1 (b) (ii) METHOD 4 [\(If more, less divides ...\)](#)

From the table above,

If 100% \rightarrow 250

Then 110% \rightarrow ? (more)

If more, less (i.e., 100%) divides; hence we have

$$\frac{110}{100} \times 250 = 11 \times 25 = \text{¢}275$$

\therefore The selling price of each of the five cups = ¢ 275

1 (b) (iii) Profit made on each cup sold

$$= \text{SP} - \text{CP}$$

$$= \text{¢}275 - \text{¢}250 = \underline{\underline{\text{¢}25}}$$

2 (a) Approach 1 [\(Simplifying the LHS first\)](#)

$$\frac{2x-1}{4} - \frac{x-2}{3} > 1$$

$$\Rightarrow \frac{3(2x-1) - 4(x-2)}{12} > 1$$

$$\Rightarrow \frac{6x-3-4x+8}{12} > 1$$

$$\begin{aligned}
\Rightarrow \quad & \frac{6x - 4x - 3 + 8}{12} > 1 \\
\Rightarrow \quad & \frac{2x + 5}{12} > 1 \\
\Rightarrow \quad & 2x + 5 > 12 \\
\Rightarrow \quad & 2x > 12 - 5 \\
\Rightarrow \quad & \frac{2x}{2} > \frac{7}{2} \\
\Rightarrow \quad & \underline{\underline{x > 3\frac{1}{2}}} \quad \text{or} \quad \underline{\underline{x > 3.5}}
\end{aligned}$$

2 (a) **Approach 2** [\(Multiplying by 12 to clear fractions\)](#)

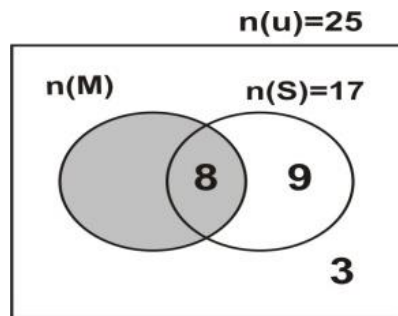
$$\begin{aligned}
& 12\left(\frac{2x-1}{4}\right) - 12\left(\frac{x-2}{3}\right) > 12 \times 1 \\
\Rightarrow \quad & 3(2x-1) - 4(x-2) > 12 \\
\Rightarrow \quad & 6x - 3 - 4x + 8 > 12 \\
\Rightarrow \quad & 6x - 4x + 8 - 3 > 12 \\
\Rightarrow \quad & 2x + 5 > 12 \\
\Rightarrow \quad & 2x > 12 - 5 \\
\Rightarrow \quad & \frac{2x}{2} > \frac{7}{2} \\
\Rightarrow \quad & \underline{\underline{x > 3\frac{1}{2}}} \quad \text{or} \quad \underline{\underline{x > 3.5}}
\end{aligned}$$

2 (b) $2x - 3y$, if $x = \frac{1}{3}$ and $y = -\frac{1}{2}$

$$\begin{aligned}
& 2\left(\frac{1}{3}\right) - 3\left(-\frac{1}{2}\right) \\
\Rightarrow \quad & 2 \times \frac{1}{3} - 3 \times -\frac{1}{2} \\
\Rightarrow \quad & \frac{2}{3} - \left(-\frac{3}{2}\right) \\
\Rightarrow \quad & \frac{2}{3} + \frac{3}{2} \\
\Rightarrow \quad & \frac{4}{6} + \frac{9}{6} \\
\Rightarrow \quad & \frac{13}{6} = \underline{\underline{2\frac{1}{6}}}
\end{aligned}$$

2 (c) (i) **Method 1**

Let $n(U)$ = No. of students in the class
 $n(M)$ = No. of students that passed in Maths
 $n(S)$ = No. of students that passed in Science = 17
 x = No. of students that passed in Science only ($= 17 - 8$) = 9

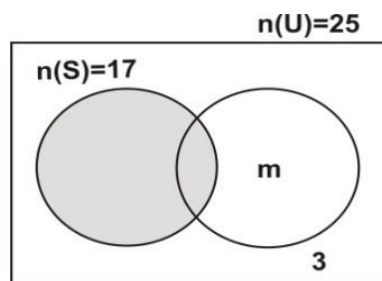


From the diagram above,

$$\begin{aligned} n(M) + 9 + 3 &= 25 \\ \Rightarrow n(M) + 12 &= 25 \\ \Rightarrow n(M) &= 25 - 12 \\ \Rightarrow n(M) &= \underline{13} \end{aligned}$$

2 (c)(i) **Method 2**

Let $n(U)$ = No. of students in the class
 $n(S)$ = No. of students that passed in Science
 m = No. of students that passed in Maths only



From the above diagram,

$$\begin{aligned} n(S) + m + 3 &= 25 \\ \Rightarrow 17 + m + 3 &= 25 \\ \Rightarrow 20 + m &= 25 \\ \Rightarrow m &= 25 - 20 \end{aligned}$$

$$\Rightarrow m = 5$$

$$\begin{aligned} &\text{But } n(\text{Maths}) \\ &= n(\text{Maths only}) + n(\text{both Maths and Science}) \\ &= 5 + 8 \\ &= \underline{13} \end{aligned}$$

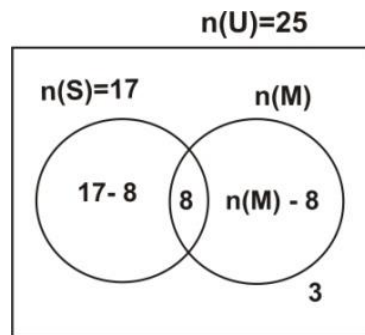
2 (c) (i) Method 3

Let $n(U)$ = No. of students in the class

$n(M)$ = No. of students that passed in Maths

$n(S)$ = No. of students that passed in Science

x = No. of students that passed in Science only



From the diagram above,

$$\begin{aligned} 17 - 8 + 8 + n(M) - 8 + 3 &= 25 \\ \Rightarrow 17 + 0 + n(M) - 8 + 3 &= 25 \\ \Rightarrow 17 - 8 + 3 + n(M) &= 25 \\ \Rightarrow 12 + n(M) &= 25 \\ \Rightarrow n(M) &= 25 - 12 \\ \Rightarrow n(M) &= \underline{13} \end{aligned}$$

\therefore No. of students that passed in Maths is 13

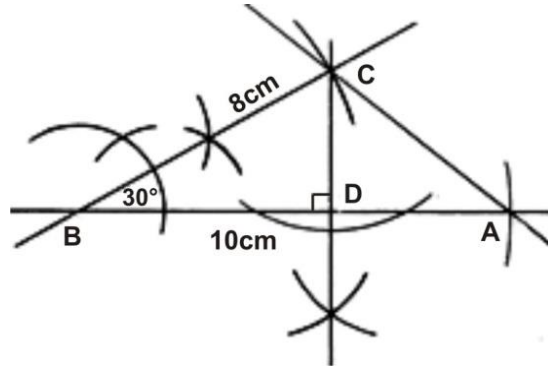
2 (c) (ii) p(one subject only)

$$\begin{aligned} &= \frac{\text{No. of students who passed one subject only}}{\text{Total No. of students}} \\ &= \frac{\text{No. of Science only} + \text{No. of Maths only}}{\text{Total No. of students}} \end{aligned}$$

$$= \frac{9 + 5}{25}$$

$$= \underline{\underline{\frac{14}{25}}}$$

3 (a)



(i) Angle ACB $\approx \underline{\underline{98^\circ}}$

(ii) $|CD| \approx \underline{\underline{3.9 \text{ cm}}}$

(b) Area of triangle $= \frac{1}{2} \times b \times h$

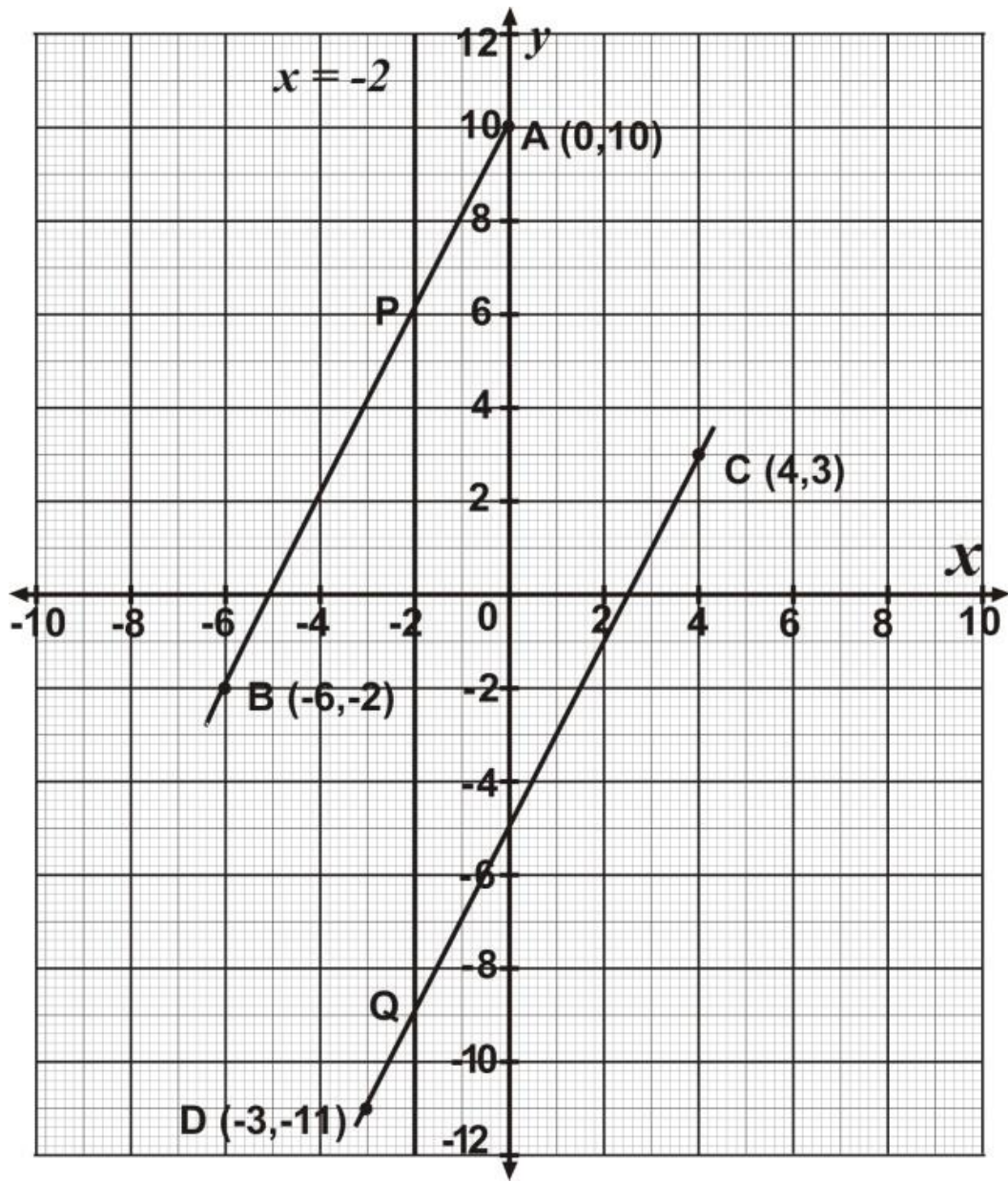
Area of ABC $= \frac{1}{2} \times |AB| \times |CD|$

$= \frac{1}{2} \times 10\text{cm} \times 3.9\text{cm}$

$= \frac{1}{2} \times 39 \text{ cm}$

$= \underline{\underline{19.5 \text{ cm}^2}}$

4 (a), (b)



4(b) (ii) angle BPQ = 25°

 angle PQC = 25°

(iii) angles BPQ and PQC are alternate angles

(iv) Lines AB and CD are parallel

5 (a)(i) The mark with the highest frequency is 6

\Rightarrow The modal mark = 6

$$(ii) \quad 2 + 3 + 5 + 7 + 8 + 13 + 7 + 5$$

$$= \underline{\underline{50 \text{ candidates}}}$$

(iii) Approach 1

$$\begin{aligned} \text{The mean mark} &= \frac{\text{The sum of marks}}{\text{Total number of candidates}} \\ &= \frac{(1 \times 2) + (2 \times 3) + (3 \times 5) + (4 \times 7) + (5 \times 8) + (6 \times 13) + (7 \times 7) + (8 \times 5)}{2 + 3 + 5 + 7 + 8 + 13 + 7 + 5} \\ &= \frac{2 + 6 + 15 + 28 + 40 + 78 + 49 + 40}{50} \\ &= \frac{258}{50} = \underline{\underline{5 \frac{4}{25}}} \quad \text{or} \quad \underline{\underline{5.16}} \end{aligned}$$

(iii) Approach 2

| Marks (x) | No. of candidates (f) | f x |
|-----------------------------------|--------------------------|-------------------------------------|
| 1 | 2 | 2 |
| 2 | 3 | 6 |
| 3 | 5 | 15 |
| 4 | 7 | 28 |
| 5 | 8 | 40 |
| 6 | 13 | 78 |
| 7 | 7 | 49 |
| 8 | 5 | 40 |
| $\Sigma f = 50$ | | $\Sigma fx = 258$ |

$$\begin{aligned} \text{The mean mark} &= \frac{\Sigma f x}{\Sigma f} = \frac{258}{50} \\ &= \underline{\underline{5 \frac{4}{25}}} \quad \text{or} \quad \underline{\underline{5.16}} \end{aligned}$$

5 (b)(i) Number of candidates who failed

$$\text{Total No. of candidates} = 2 + 3 + 5 + 7 + 8 + 13 + 7 + 5 = 50$$

Since 20% of the candidates failed

$$\Rightarrow 20\% \times 50 \text{ candidates failed}$$

$$\begin{aligned} &= \frac{20}{100} \times 50 \\ &= \underline{\underline{10 \text{ candidates failed}}} \end{aligned}$$

- (ii) From the given table, the 10 candidates who failed scored 3 or less, therefore the pass mark is 4

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MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. Two sets which have no common members are known as ...
 - A) Equal sets
 - B) Equivalent sets
 - C) Empty sets
 - D) Disjoint sets
 - E) Union

2. $P = \{0, 2, 4, 6\}$ and $Q = \{1, 2, 4, 5\}$. Find $P \cap Q$.
 - A. $\{0, 6\}$
 - B. $\{2, 4\}$
 - C. $\{0, 4\}$
 - D. $\{0, 2, 6\}$
 - E. $\{0, 1, 2, 4, 5\}$

3. Evaluate $\frac{1}{2} [(4 - 1) - (5 - 6)]$
A) -4.0 B) 1.0 C) 2.0 D) 3.0 E) 4.0

4. Find the highest(greatest) common factor of 35 and 70.
A) 5 B) 7 C) 10 D) 35 E) 70

5. Write 1101101_{two} in base ten
A) 31 B) 43 C) 108 D) 109 E) 218

6. State the property used in the statement: $p(q+r) = pq + pr$
 - A) Associative
 - B) Commutative

- C) Distributive
- D) Identity
- E) Universal

7. If $n^2 + 1 = 50$, find n

- A) 7 B) 24.5 C) 25 D) 49 E) $\sqrt{51}$

8. Evaluate $\frac{0.63 \times 0.70}{9.00}$

- A) 0.0049 B) 0.049 C) 0.49 D) 4.9 E) 49

9. In the relation $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ if $R_1 = 1$ and $R_2 = 3$, find R

- A) $\frac{1}{2}$ B) $\frac{2}{3}$ C) $\frac{3}{4}$ D) $\frac{3}{2}$ E) $\frac{4}{3}$

10. Arrange the following from the highest to the lowest: $\frac{2}{3}$, -9 , $\frac{3}{5}$ and 0

- A) $-9, \frac{3}{5}, \frac{2}{3}, 0$
- B) $-9, 0, \frac{3}{5}, \frac{2}{3}$
- C) $\frac{3}{5}, \frac{2}{3}, 0, -9$
- D) $\frac{3}{5}, \frac{2}{3}, -9, 0$
- E) $\frac{2}{3}, \frac{3}{5}, 0, -9$

11. The total numbers of goals scored each month by a football team are:

3, 4, 8, 2, 4, 6, 4, 8, 7 and 6. What is the mode?

- A) 2 B) 4 C) 5 D) 6 E) 8

12. A trader sold 90 oranges at 3 for ₺50.00. How much did she get from selling all the oranges?

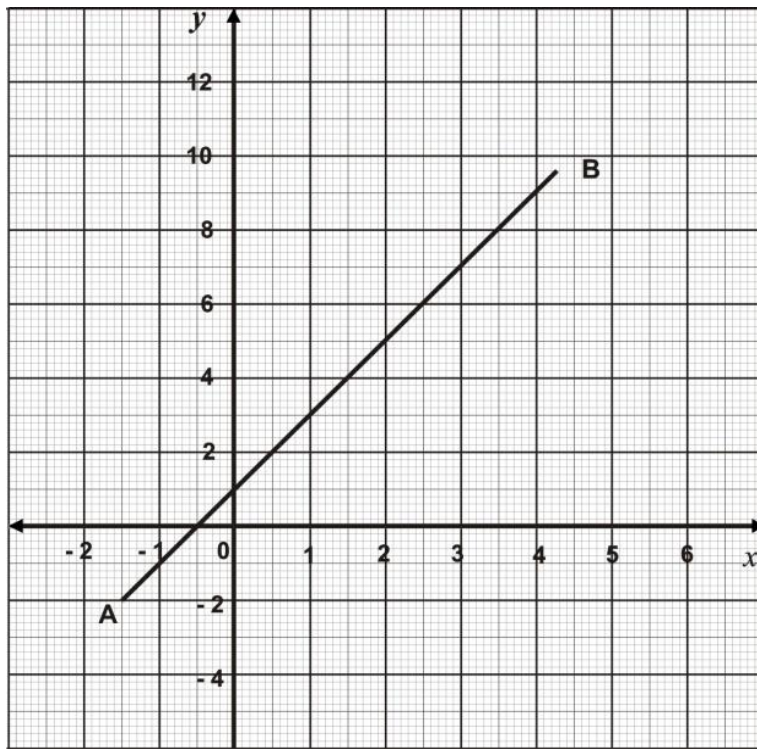
- A) ₺1,500.00
- B) ₺4,500.00
- C) ₺6,000.00
- D) ₺15,000.00
- E) ₺45,000.00

13. A man bought a car for ₺5.5million and sold it for ₺6.5million.

Find the percentage gain.

- A) 1.54% B) 1.82% C) 15.38% D) 18.18% E) 84.44%

14. On a map, two towns P and Q are 15.5 cm apart. The scale of the map is 1cm: 4km. Calculate the actual distance between P and Q.
A) 15.5km B) 31km C) 46km D) 60km E) 62km
15. Expand the expression $2(3a + 2b)$
A) $6a + 2b$ B) $5a + 4b$ C) $6a + 4b$ D) $10ab$ E) $12ab$
16. Mansah obtained 150 marks out of 240 marks in an English test. What was her percentage score?
A) 33.33% B) 37.5% C) 41.67% D) 62.5% E) 79.1%
17. The marks obtained by six boys in a test are: 14, 20, 25, 15, 28 and 16. Find the mean mark.
A) 19.66 B) 22.00 C) 23.20 D) 26.40 E) 28.00
18. Which of the following is equivalent to $2^2 \times 6^2$
A) 2×3^4 B) $2^2 \times 3^2$ C) $2^2 \times 3^4$ D) $2^4 \times 3$ E) $2^4 \times 3^2$
19. Kwaku had 300 mangoes. He sold 240 of them. What is the percentage of the mangoes left?
A) 8% B) 20% C) 25% D) 26% E) 80%
20. A bag contains 5 black and 6 white balls. What is the probability of picking a white ball?
A) $\frac{1}{11}$ B) $\frac{1}{6}$ C) $\frac{1}{5}$ D) $\frac{5}{11}$ E) $\frac{6}{11}$
21. Solve for h in the equation $15 - 2h = 6$
A) -10.5 B) -9.0 C) -4.5 D) 4.5 E) 10.5
22. What is the image of 3 in the mapping $x \rightarrow 3x + 7$?
A) 10 B) 13 C) 16 D) 24 E) 34
23. How many faces has a closed cylindrical object?
A) 1 B) 2 C) 3 D) 4 E) 34



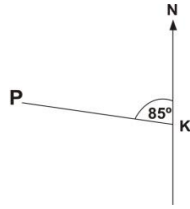
The graph of a straight line AB is shown above.

Use it to answer questions 24 and 25

24. Find the gradient of the line AB
- A) 1 B) 2 C) 3 D) 4 E) 5
25. Find the coordinates of the point at which the line cuts the y-axis.
- A. (1,0) B. (0,1) C. (-1,0) D. (0,-1) E. (0,0)
26. A man deposited an amount of ₵50,000.00 at a bank for 2 years at a rate of 20%. Find the simple interest.
- A) ₵1,000.00
 B) ₵2,000.00
 C) ₵10,000.00
 D) ₵20,000.00
 E) ₵200,000.00
27. Kofi received ₵800.00 commission on the sales he made on a particular day. This commission is 20% of sales he made. Calculate his total sales for the day.
- A) ₵1,200.00
 B) ₵2,400.00

- C) ₦3,200.00
- D) ₦4,000.00
- E) ₦4,800.00

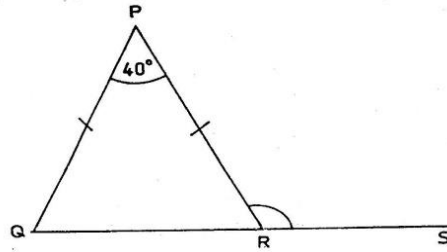
28.



Calculate the bearing of town P from town K in the diagram below.

- A) 005°
- B) 085°
- C) 095°
- D) 265°
- E) 275°

29. In the diagram below, PQR is an isosceles triangle. $|PQ| = |PR|$, $\angle QPR = 40^\circ$ and QRS is a straight line. Find angle PRS.



- A) 40°
- B) 70°
- C) 100°
- D) 110°
- E) 140°

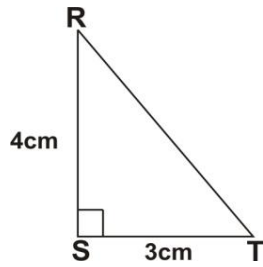
30. Factorize completely the expression $2xy - 8x + 5y - 20$

- A. $(2x+5)(y-4)$
- B. $(2x-5)(y+4)$
- C. $(2x-5)(y-4)$
- D. $(2x+5)(y+4)$
- E. $(x+5)(y-4)$

31. Ama is facing east. Through how many degrees should she turn clockwise to face north?

- A) 90°
- B) 135°
- C) 180°
- D) 225°
- E) 270°

32.



In the triangle RST, $\angle RST$ is 90° , $|RS| = 4\text{cm}$ and $|ST| = 3\text{cm}$. What is the length of RT ?

- A) 2cm B) 3cm C) 4cm D) 5cm E) 7cm

33. How many lines of symmetry has a rhombus ?

- A) 2 B) 3 C) 4 D) 5 E) 6

34. Given that $\mathbf{a} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, find $\mathbf{b} - \mathbf{a}$.

- A. $\begin{pmatrix} -2 \\ 6 \end{pmatrix}$ B. $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$ C. $\begin{pmatrix} -3 \\ 8 \end{pmatrix}$ D. $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$ E. $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$

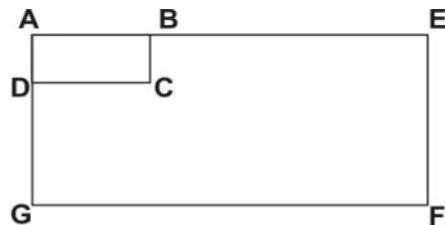
35. If $\mathbf{u} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$, find $2\mathbf{u} + \mathbf{v}$

- A. $\begin{pmatrix} 12 \\ 0 \end{pmatrix}$ B. $\begin{pmatrix} 12 \\ -1 \end{pmatrix}$ C. $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$ D. $\begin{pmatrix} 6 \\ 0 \end{pmatrix}$ E. $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$

36. The volume of water in a cuboid is 9m^3 . The length of the cuboid is 3m and the breadth is 2m. Calculate the depth of water in the cuboid.

- A) 0.15m B) 0.18m C) 1.5m D) 1.8m E) 6.0m

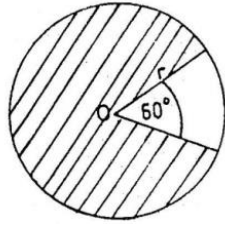
37.



In the diagram above, rectangle AEFG is an enlargement of the rectangle ABCD. If $|AB| = 5\text{cm}$ and $|AE| = 15\text{cm}$. What is the scale factor of the enlargement?

- A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) 2 D) 3 E) 10

38.



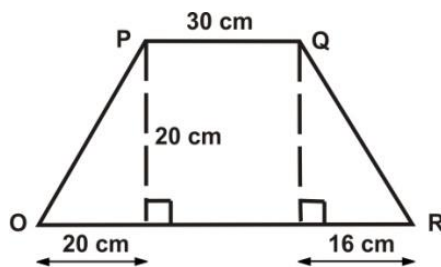
In the diagram, O is the centre of the circle and r is its radius. Calculate the area of the shaded region.

- A) $\frac{1}{6} \pi r^2$ B) $\frac{1}{5} \pi r^2$ C) $\frac{1}{3} \pi r^2$ D) $\frac{5}{6} \pi r^2$ E) $\frac{7}{12} \pi r^2$

39. Which of the following best describes the statement: “The locus of points 6cm from a fixed point O?”

- A) A parallel line 6cm from O
 B) A vertical line 6cm from point O
 C) A horizontal line 6 cm from point O
 D) An equilateral triangle of side 6cm
 E) A circle with centre O and radius 6cm.

40.



OPQR is a trapezium whose height is 20cm. What is the area?

- A) 460cm^2 B) 600cm^2 C) 920cm^2 D) 960cm^2 E) 1000cm^2

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. D) Disjoint sets
2. B. $\{2, 4\}$
3. C) 2.0
4. D) 35
5. D) 109
6. C) Distributive
7. A) 7
8. B) 0.049
9. C) $\frac{3}{4}$
10. E) $\frac{2}{3}, \frac{3}{5}, 0, -9$
11. B) 4
12. A) €1,500.00
13. D) 18.18%
14. E) 62km
15. C) $6a + 4b$

16. D) 62.5%
17. A) 19.66
18. E) $2^4 \times 3^2$
19. B) 20%
20. E) $6/_{11}$
21. D) 4.5
22. C) 16
23. C) 3
24. B) 2
25. B. (0,1)
26. D) ¢20,000.00
27. D) ¢4,000.00
28. E) 275°
29. D) 110°
30. A. $(2x+5)(y-4)$
31. E) 270°
32. D) 5cm
33. A) 2
34. E. $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$
35. B. $\begin{pmatrix} 12 \\ -1 \end{pmatrix}$
36. C) 1.5m
37. D) 3

38. D) $\frac{5}{6} \pi r^2$
39. E) A circle with centre O and radius 6cm
40. D) 960 cm^2

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MATHEMATICS

SECTION B

ESSAY

1 hour

1. (a) Simplify the expression $3x^2 + 6xy - 3y^2 + 4x^2 + 8xy + 2y^2$

(b) (i) Solve $3x - 9 \geq 12$ ($x - 3$)
(ii) Illustrate your answer on the number line

(c) If $P = 7$, $a = 16$, $b = 4$ and $c = 3$, evaluate $p^2 - \frac{(a-b)}{C}$

2. a) Using a ruler and a pair of compasses only,
(i) construct a triangle PQR such that $|PQ| = 8\text{cm}$, angle $RPQ = 90^\circ$ and angle $PQR = 30^\circ$.
Measure $|RQ|$

(ii) construct the perpendicular bisector (mediator) of RQ. Let it meet RQ at O.

b) With O as centre and radius OP, draw a circle. Measure $|OP|$.

c) What is the special name for the chord RQ?

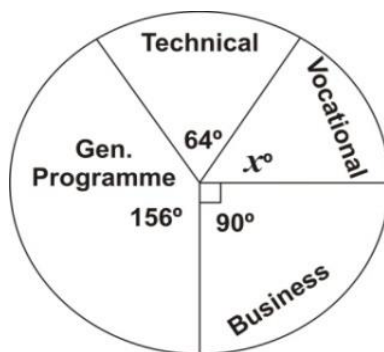
3. (a) A man travelled from Bakwa to Pabam. The distance between the two towns is 510km. At Pabam he covered additional 40km on official duties. He returned to Bakwa the next day.
(i) Find the total distance covered by the man

(ii) If the car used one litre of petrol to cover 20km, find the amount of petrol used for the whole journey.

(iii) If a litre of petrol cost ₦522.00, calculate the total cost of petrol used for the whole journey.

- (b) A woman sold an article for ₦200,000.00. She made a profit of 25%. Find the cost price of the article

4. (a) The pie chart shows angles representing the number of candidates who applied for admission into four programmes at a senior secondary school. The number of pupils who applied were 1080.



Find:

- the angle x° representing the Vocational programme.
 - the number of candidates who applied for Business programme.
 - correct to the nearest whole number the percentage of the number of applicants who applied for General Programme.
- (b) The data below shows the distribution of the masses of pupils in a school. On a graph paper, draw a bar chart for the distribution.

| | | | | | | |
|-------------------|----|----|----|----|----|----|
| Masses (in kg) | 19 | 20 | 21 | 22 | 23 | 24 |
| Frequency | 5 | 9 | 19 | 25 | 18 | 4 |

5. (a) Using a scale of 2cm to 2units on both axes, draw two perpendicular axes OX and OY on a graph sheet. On the same graph sheet, mark the x-axis from -8 to 8 and the y-axis from -8 to 8
- Plot P(-2, 3) and Q (6, 4). Join PQ
 - Draw the image P_1Q_1 of PQ under an anticlockwise rotation through 90° about the origin, where $P \rightarrow P_1$ and $Q \rightarrow Q_1$. Indicate clearly all the co-ordinates.

(iii) Draw the image P_2Q_2 of PQ under a clockwise rotation through 90° about the origin where $P \rightarrow P_2$ and $Q \rightarrow Q_2$. Indicate clearly all the co-ordinates

(b) The base radius of a closed cylinder is 4 m. The height of the cylinder is 7 m. Calculate its total surface area. [Take $\pi = \frac{22}{7}$]

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

$$\begin{aligned} 1 \text{ (a)} \quad & 3x^2 + 6xy - 3y^2 + 4x^2 + 8xy + 2y^2 \\ = & 3x^2 + 4x^2 + 6xy + 8xy - 3y^2 + 2y^2 \\ = & \underline{\underline{7x^2 + 14xy - y^2}} \end{aligned}$$

$$\begin{aligned} 1 \text{ (b) (i)} \quad & 3x - 9 \geq 12(x - 3) \\ \Rightarrow & 3x - 9 \geq 12x - 36 \end{aligned}$$

Approach 1

$$\begin{aligned} \Rightarrow & 36 - 9 \geq 12x - 3x \\ \Rightarrow & 27 \geq 9x \\ \Rightarrow & \frac{27}{9} \geq \frac{9x}{9} \\ \Rightarrow & 3 \geq x \\ \Rightarrow & \underline{\underline{x \leq 3}} \end{aligned}$$

Turning the ' $3 \geq x$ ' around
reverses the \geq

Approach 2

$$\Rightarrow 3x - 12x \geq 9 - 36$$

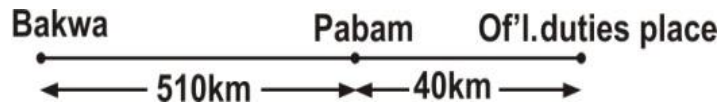
[NB: Division by a negative quantity reverses the \geq]

A horizontal number line with arrows at both ends. It is marked with integers from -3 to 4. A solid black dot is placed at the number 3. A thick black arrow points to the left from the dot at 3, indicating the solution set $x \leq 3$.

$$\Rightarrow 7^2 - \frac{(16-4)}{3} \Rightarrow 49 - \frac{12}{3}$$
$$\Rightarrow 49 - 4 = \underline{45}$$

(c) The special name for chord RQ is diameter

3(a) (i)



Total distance covered

$$\begin{aligned}
 &= 2 (510\text{km} + 40\text{km}) \\
 &= 2 \times 550\text{km} \\
 &= \underline{1100 \text{ km}}
 \end{aligned}$$

Alternatively, by expansion,

$$\begin{aligned}
 &2 (510\text{km} + 40\text{km}) \\
 &= 1020\text{km} + 80\text{km} \\
 &= \underline{1100 \text{ km}}
 \end{aligned}$$

(ii) **Method 1** (Simple logic)

$$1100 \div 20 = 55$$

⇒ The amount of petrol used for the whole journey = 55 litres

(ii) **Method 2** (Proportion)

| Distance (km) | Amount of petrol (ℓ) |
|---------------|----------------------|
| 20 | 1 |
| 1100 | ? |

From the table above, If 20 km → 1 litre

Then 1100 km → ? (more)

If more, less (20km) divides, hence we have

$$\frac{1100 \text{ km}}{20 \text{ km}} \times 1 \text{ litre} = 55 \text{ litres}$$

⇒ The amount of petrol used for the whole journey = 55 litres

(iii) **Method 1** (Simple logic)

$$522 \times 55 = 28,710$$

⇒ total cost of petrol for the whole journey = ₦28,710.00

(iii) **Method 2** (Proportion)

| Amount of petrol (litres) | Cost of petrol (₦) |
|---------------------------|--------------------|
| 1 | 522 |
| 55 | p |

From the table above,

Approach 1 (Equivalent Fraction)

$$p = \frac{522 \times 55}{1} = 28,710$$

⇒ total cost of petrol for the whole journey = ¢28,710.00

(iii) **Approach 2** (if more, less divides ...)

If 1 litre → ¢522

Then, 55 litres → ? (more)

If more, less (1 litre) divides, hence we have $\frac{55 \text{ litres}}{1 \text{ litre}} \times \text{¢}522$
 $= \text{¢}28,710.00$

3(b) **Method 1** (Formula / Equation)

$$\begin{aligned} \text{CP} &= \frac{\text{CP percentage}}{\text{SP percentage}} \times \text{SP} \\ &= \frac{100 \%}{125 \%} \times \text{¢}200,000 \\ &= \frac{100}{125} \times \text{¢}200,000 \\ &= \text{¢}160,000.00 \end{aligned}$$

3(b) **Method 2** (Equivalent fractions)

| | Percentage | Amount (¢) |
|----|-----------------------------|----------------|
| SP | 100% + 25% = 125% | 200,000 |
| CP | 100% | ? |

From the table above,

$$\begin{aligned} \frac{125\%}{100\%} &= \frac{\text{¢}200,000}{x} \\ \Rightarrow 125 \times x &= \text{¢}200,000 \times 100 \\ \Rightarrow x &= \frac{\text{¢}200,000 \times 100}{125} \\ &= \text{¢}160,000 \end{aligned}$$

The cost price of the article is ¢160,000.00

3(b)

Method 3 (If more, less divides ...)

If 125% → ₦200,000

Then 100% → ? (less)

If less, more divides, hence we have

$$\frac{100\%}{125\%} \times \text{₦}200,000 = \text{₦}160,000$$

The cost price of the article is ₦ 160,000.00

4 (a) (i) $x^\circ + 90^\circ + 156^\circ + 64^\circ = 360^\circ$

$$x^\circ + 310^\circ = 360^\circ$$

$$x^\circ = 360^\circ - 310^\circ$$

$$x^\circ = \underline{\underline{50^\circ}}$$

(ii) **Method 1** (Formula)

No. of candidates for business

= fraction of business \times Total no. of candidates

$$= \frac{90^\circ}{360^\circ} \times 1080$$

$$= 270$$

\Rightarrow 270 candidates applied for the business programme

(ii) **Method 2** (Simple Proportion)

| | Angle | Number |
|----------|-------------|--------|
| Total | 360° | 1080 |
| Business | 90° | x |

Approach 1 (Equivalent Fractions)

From the table above,

$$\frac{360}{90} = \frac{1080}{x}$$

Cross multiplying, we have

$$\Rightarrow 360 \times x = 1080 \times 90$$

$$\Rightarrow x = \frac{1080 \times 90}{360}$$

$$\Rightarrow x = 270$$

270 candidates applied for the business programme

(ii) Approach 2 (If more, less divides ...)

$$\text{If } 360^\circ \rightarrow 1080$$

$$\text{Then } 90^\circ \rightarrow ? \text{ (less)}$$

If less, more (i.e., 360°) divides; therefore we have

$$\frac{90^\circ}{360} \times 1080$$

$$= 270$$

270 candidates applied for the business programme

4 (a) (iii) Percentage of applicants who applied for Gen. Prog.

$$= \frac{\text{Angle for Gen. Prog}}{\text{Total angle}} \times 100\%$$

$$= \frac{156}{360} \times 100\%$$

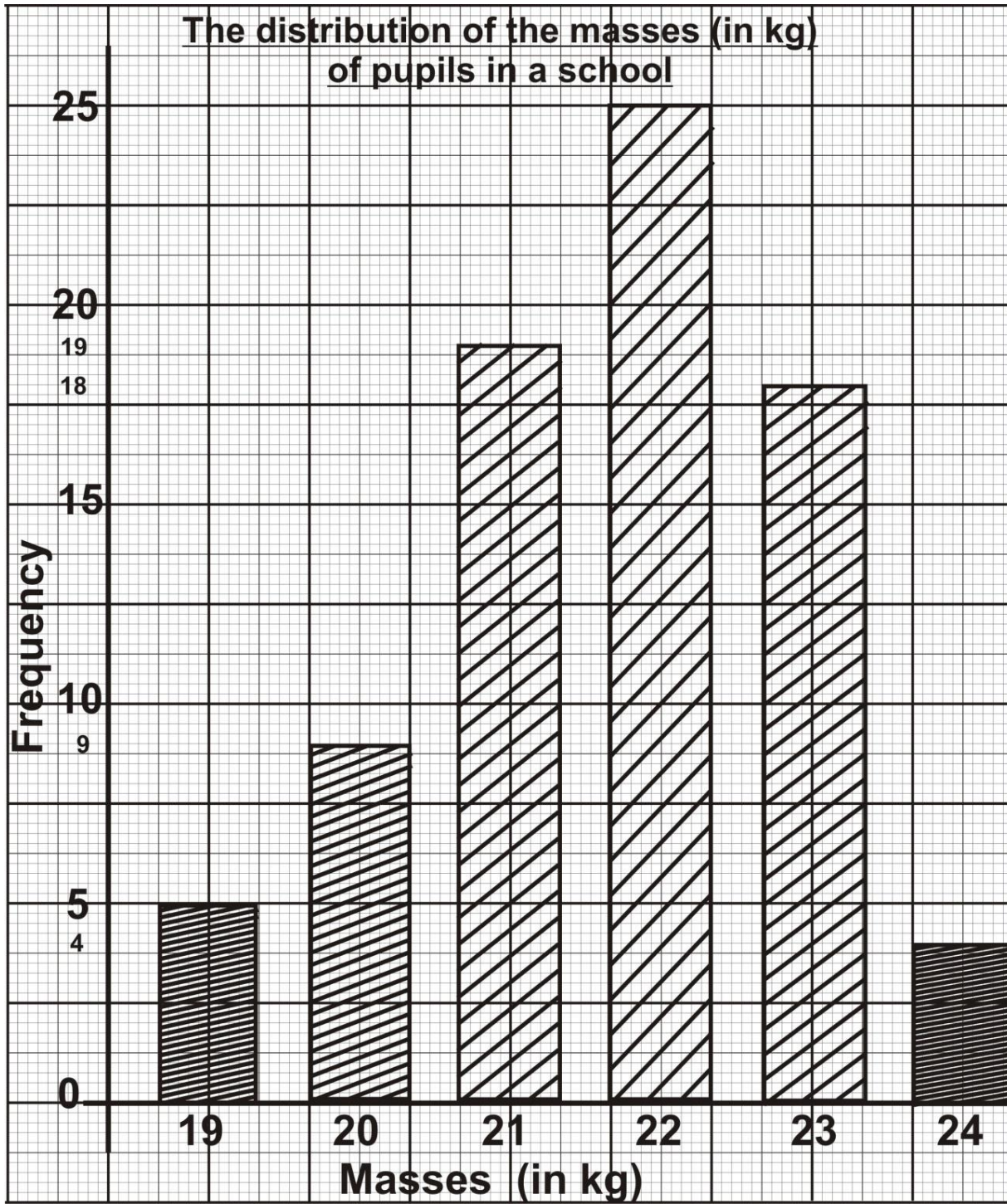
$$= \underline{43\frac{1}{3}\%} \quad \text{or} \quad \approx \underline{43.3\%}$$

$$\Rightarrow \underline{43\frac{1}{3}\% \text{ of the pupils applied for Gen. programme}}$$

4 (b)

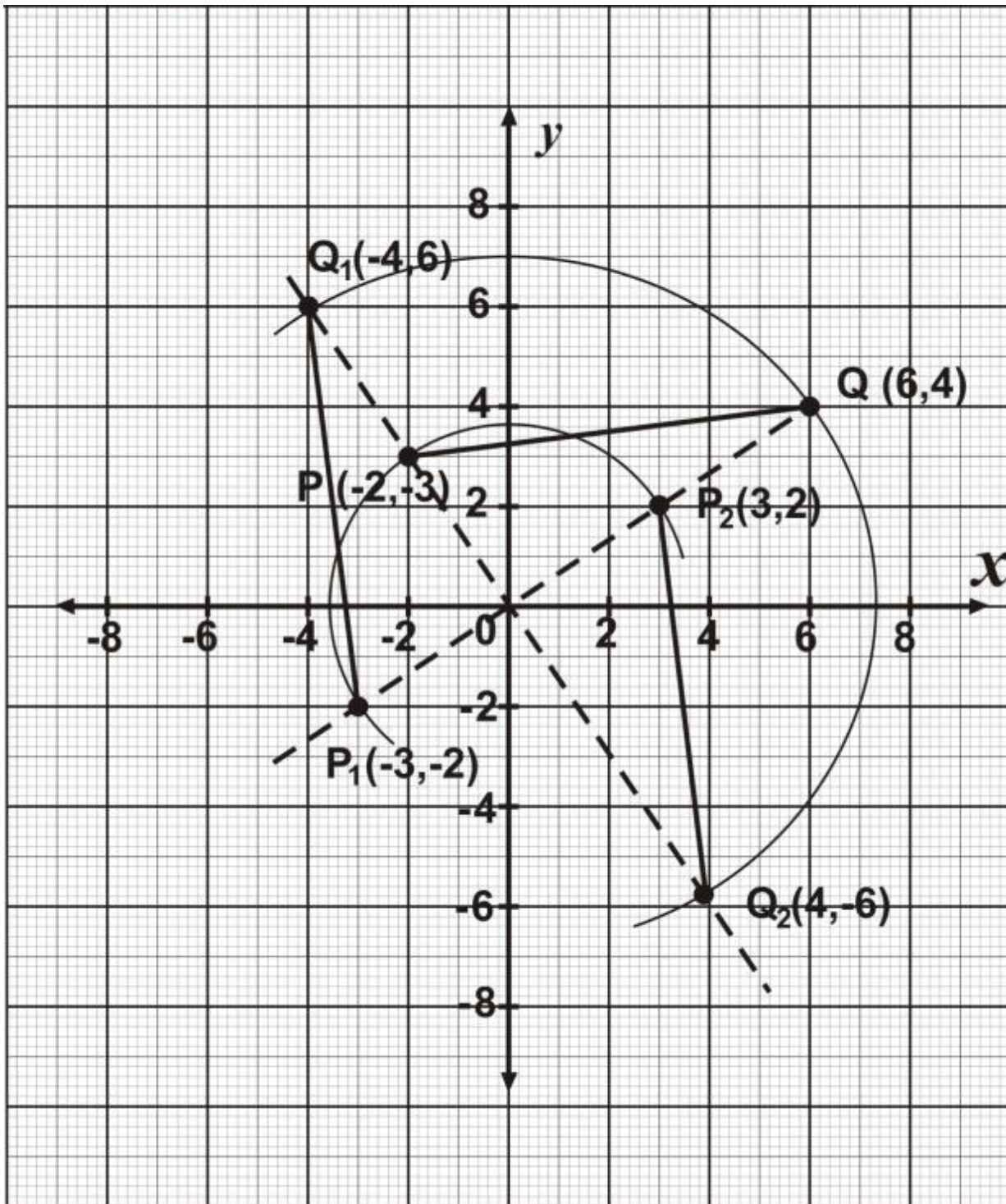
Vertical Axis Scale: 4 cm to 5 pupils

**The distribution of the masses (in kg)
of pupils in a school**



5 (a)

Approach 1 (By Inspection / Construction)



5 (a)

Approach 2 [\(The rule / formula\)](#)

- (ii) Rotating (x, y) about the origin through 90° anticlockwise

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -y \\ x \end{pmatrix}$$

$$OP \begin{pmatrix} -2 \\ 3 \end{pmatrix} \rightarrow OP_1 \begin{pmatrix} -3 \\ -2 \end{pmatrix}, \quad \therefore P_1(-3, -2)$$

$$OQ \begin{pmatrix} 6 \\ 4 \end{pmatrix} \rightarrow OQ_1 \begin{pmatrix} -4 \\ 6 \end{pmatrix}, \quad \therefore Q_1(-4, 6)$$

- \therefore Plot and join $P_1(-3, -2)$ and $Q_1(-4, 6)$ as the image of line segment PQ under a rotation about the origin through 90° anticlockwise

- (iii) Rotating (x, y) about the origin through 90° clockwise

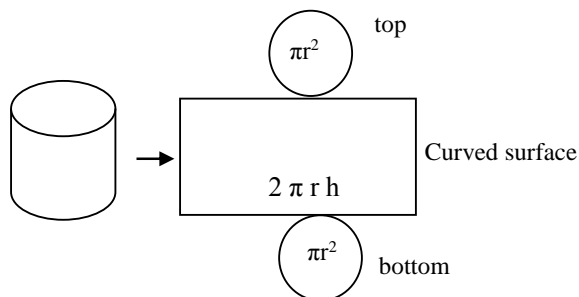
$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} y \\ -x \end{pmatrix}$$

$$OP \begin{pmatrix} -2 \\ 3 \end{pmatrix} \rightarrow OP_2 \begin{pmatrix} 3 \\ 2 \end{pmatrix}, \quad \therefore P_2(3, 2)$$

$$OQ \begin{pmatrix} 6 \\ 4 \end{pmatrix} \rightarrow OQ_2 \begin{pmatrix} 4 \\ -6 \end{pmatrix}, \quad \therefore Q_2(4, -6)$$

- \therefore Plot and join $P_2(3, 2)$ and $Q_2(4, -6)$ as the image of line segment PQ under a rotation about the origin through 90° clockwise
(as shown in the diagram above)

5 (b)



Total surface area of closed cylinder:

Approach 1

$$= \text{Area of (Curved surface + 2 circular surfaces)}$$

$$\begin{aligned}
&= 2 \pi r h + 2 (\pi r^2) \\
&= 2 \times \frac{22}{7} \times 4\text{cm} \times 7\text{cm} + 2 \times \frac{22}{7} \times (4\text{cm})^2 \\
&= 2 \times 22 \times 4\text{cm}^2 + 2 \times \frac{22}{7} \times 16\text{cm}^2 \\
&= 176 \text{ cm}^2 + \frac{704}{7} \text{ cm}^2 \\
&= 176 \text{ cm}^2 + 100\frac{4}{7} \text{ cm}^2 \\
&= \underline{\underline{276\frac{4}{7} \text{ cm}^2}} \quad \text{or} \quad \approx \underline{\underline{276.57 \text{ cm}^2}}
\end{aligned}$$

5 (b)

Approach 2

$$\begin{aligned}
&= \text{curved surface} + \text{top} + \text{bottom} \\
&= 2 \pi r h + \pi r^2 + \pi r^2 \\
&= [2 \times \frac{22}{7} \times 4\text{cm} \times 7\text{cm}] + [\frac{22}{7} \times (4\text{cm})^2] + [\frac{22}{7} \times (4\text{cm})^2] \\
&= 176\text{cm}^2 + \frac{352}{7} \text{ cm}^2 + \frac{352}{7} \text{ cm}^2 \\
&= 176 \text{ cm}^2 + 50\frac{2}{7} \text{ cm}^2 + 50\frac{2}{7} \text{ cm}^2 \\
&= \underline{\underline{276\frac{4}{7} \text{ cm}^2}} \quad \text{or} \quad \approx \underline{\underline{276.57 \text{ cm}^2}}
\end{aligned}$$

5 (b)

Approach 3

$$\begin{aligned}
&= \text{Areas of (Curved surface + 2 circular surfaces)} \\
&= 2 \pi r h + 2 \pi r^2 \\
&= 2 \pi r (h + r) \\
&= 2 \times \frac{22}{7} \times 4\text{cm} (11\text{cm} + 4\text{cm}) \\
&= \frac{176}{7} \text{ cm} \times (11\text{cm}) \\
&= \frac{176 \text{ cm} \times 11 \text{ cm}}{7} = \frac{1936 \text{ cm}^2}{7} \\
&= \underline{\underline{276\frac{4}{7} \text{ cm}^2}} \quad \text{or} \quad \approx \underline{\underline{276.57 \text{ cm}^2}}
\end{aligned}$$

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MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. Convert 320_{five} to a base ten numeral

A) 25 B) 77 C) 85 D) 86 E) 90

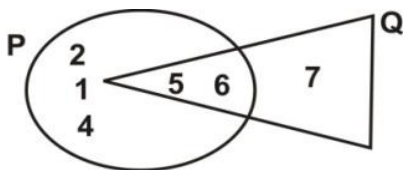
2. $P = \{2, 4, 6, 8\}$ and $Q = \{\text{even counting numbers less than } 12\}$.

What is the relationship between P and Q?

A) $P = Q$ B) $P \subset Q$ C) $P < Q$ D) $Q \subset P$ E) $P \in Q$

3. In the diagram below, P is the set of numbers in the circle and Q is the set of numbers in the triangle.

What is $P \cap Q$?



- A. $\{1, 2, 4\}$
B. $\{5, 6\}$
C. $\{7\}$
D. $\{1, 2, 4, 5, 6, 7\}$
E. $\{\}$

4. The product $6287 \times 543 = 3,413,841$. What is the value of 628.7×5.43 ?

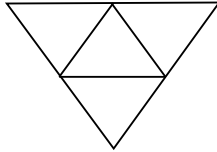
A) 3,413,841
B) 342,384.1

- C) 34,138.41
- D) 3,413.841
- E) 341.3841

5. Express 30cm as a percentage of 2m.

- A) 0.5%
- B) 1.5%
- C) 6.7%
- D) 15%
- E) 66.7%

6.



What solid can be made from this net ?

- A) triangle
- B) rectangular pyramid
- C) triangular prism
- D) rectangular prism
- E) triangular pyramid

7. Simplify $3(6b - 9a) + 7(6a - 5b)$

- A) $17b + 6a$
- B) $-17b + 6a$
- C) $17b + 48a$
- D) $15a - 17b$
- E) $17b - 15a$

8. Arrange the following fractions in descending order $\frac{9}{16}$, $\frac{5}{8}$, 0.62

- A) $\frac{9}{16}$, 0.62, $\frac{5}{8}$
- B) 0.62, $\frac{5}{8}$, $\frac{9}{16}$
- C) $\frac{5}{8}$, $\frac{9}{16}$, 0.62
- D) $\frac{5}{8}$, 0.62, $\frac{9}{16}$
- E) 0.62, $\frac{9}{16}$, $\frac{5}{8}$

9. Find the LCM of 18, 42 and 90.

- A) 2×3^2
- B) $2 \times 3 \times 7$

- C) $2 \times 3^2 \times 5$
 D) $2 \times 3 \times 5 \times 7$
 E) $2 \times 3^2 \times 5 \times 7$

10. What is the HCF of 18, 42 and 90 ?

- A) 21 B) 18 C) 9 D) 6 E) 3

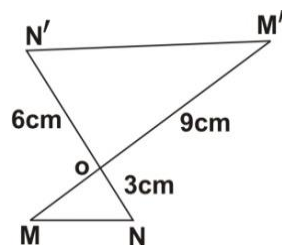
11. Simplify $\begin{pmatrix} 4 \\ 5 \end{pmatrix} + \begin{pmatrix} -2 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ 6 \end{pmatrix}$

- A. $\begin{pmatrix} 2 \\ 13 \end{pmatrix}$ B. $\begin{pmatrix} 3 \\ 13 \end{pmatrix}$ C. $\begin{pmatrix} 5 \\ 13 \end{pmatrix}$ D. $\begin{pmatrix} 6 \\ 13 \end{pmatrix}$ E. $\begin{pmatrix} 7 \\ 13 \end{pmatrix}$

12. If $R = \frac{1}{2}(a+b)k$, find k in terms of R , a and b .

- A) $\frac{a+b}{2R}$
 B) $\frac{2R}{a+b}$
 C) $\frac{2R-a}{b}$
 D) $\frac{2R-b}{a}$
 E) $\frac{R}{2(a+b)}$

In the figure below, triangle M'ON' is an enlargement of triangle MON, with centre O.



13. Find the scale factor of the enlargement

- A) 9 B) 3 C) 2 D) -2 E) -3

14. Find $|OM|$

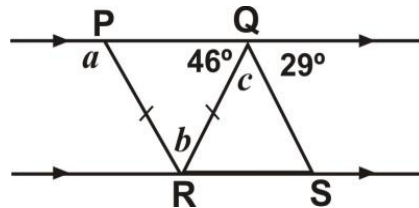
- A) 9 B) 6 C) 4.5 D) 3 E) 1.5

15. Find the image of the point $(6, 3)$ when translated by the vector $\begin{pmatrix} -4 \\ -1 \end{pmatrix}$

- A. $(-2, -2)$ B. $(2, -2)$ C. $(-2, 2)$ D. $(2, 2)$ E. $(10, 4)$

16. A student spends $\frac{17}{35}$ of his pocket money on transport and fruits. He spends $\frac{5}{6}$ of the remainder on sweets. What fraction of his pocket money does he spend on sweets?

- A) $\frac{4}{7}$ B) $\frac{3}{7}$ C) $\frac{17}{35}$ D) $\frac{18}{35}$ E) $\frac{17}{42}$



In the diagram above, PQ is parallel to RS and $|PR| = |QR|$.

Use the diagram to answer questions 17 to 19

17. What is a ?

- A) 29 B) 46 C) 75 D) 88 E) 134

18. Find b .

- A) 29 B) 46 C) 88 D) 92 E) 105

19. Find the value of c .

- A) 29 B) 46 C) 75 D) 88 E) 105

20. If $p = 7$, $q = 5$ and $r = 3$, find the value of $p^2 + q - r^3$

- A) 10 B) 27 C) 51 D) 57 E) 81

21. Simplify $35x^5y^3 \div 7xy^2$

- A) $5x^6y^5$ B) $5x^4y$ C) $5x^6y$ D) $5x^4y^5$ E) $5x^4y^2$

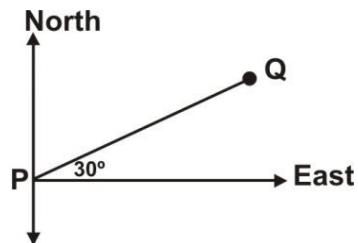
22. The sum of two numbers is 240. If one of them is y , find the other number.

- A) $120y$ B) $240 + y$ C) $240 - y$ D) $240y$ E) $240/y$

23. Make n the subject of the relation $2n + 5 = 7a$

- A) $n = \frac{1}{2}(7a+5)$
 B) $n = \frac{1}{2}(7a-5)$
 C) $n = 2(7a+5)$
 D) $n = 2(7a-5)$
 E) $n = 7a-5$

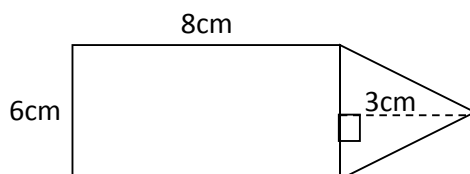
24.



Find the bearing of Q from P in the diagram above.

- A) 030° B) 060° C) 070° D) 090° E) 150°

25.



The figure above is made up of a rectangle and a triangle. The dimensions of the rectangle are 8cm and 6cm. The triangle has 6cm as its base and 3cm as its height.

Find the area of the figure.

- A) 33cm^2 B) 48cm^2 C) 51cm^2 D) 57cm^2 E) 66cm^2

26. The marks obtained by ten boys in a test are: 0, 1, 3, 3, 5, 7, 8, 9, 9 and 9.

Find the median score.

- A) 3 B) 5 C) 6 D) 7 E) 8

27. The marks obtained by ten boys in a test are: 0, 1, 3, 3, 5, 7, 8, 9, 9 and 9.

Calculate the mean score.

- A) 4.4 B) 5.4 C) 6.0 D) 6.4 E) 9.0

28. The marks obtained by ten boys in a test are: 0, 1, 3, 3, 5, 7, 8, 9, 9 and 9.

What is the probability that a boy chosen at random scored 3?

- A) $\frac{1}{27}$ B) $\frac{1}{18}$ C) $\frac{1}{10}$ D) $\frac{1}{5}$ E) $\frac{1}{3}$

29. Express 57_{ten} as a base two (binary) numeral.

- A) 101011_{two}
B) 100111_{two}
C) 11010_{two}
D) 110111_{two}
E) 111001_{two}

30. The scale of a map is 1: 100,000. What is the distance (in km) between two towns 4cm apart on the map?

- A) 0.04 B) 0.4 C) 4.0 D) 40 E) 400

31. If 22% of a rope is 55m long, find the full length of the rope.

- A) 12.1m B) 25m C) 121m D) 250m E) 2500m

32. Adwoa and Ama share an amount of ₵6,000.00 in the ratio 3:2. Find Adwoa's share.

- A) ₵2,000.00
- B) ₵2,400.00
- C) ₵3,000.00
- D) ₵3,600.00
- E) ₵4,000.00

33. Find the truth set of $5x - 8 \leq 2x + 4$

- A. $\{x \geq 4\}$ B. $\{x \geq -4\}$ C. $\{x \leq 4\}$ D. $\{x \leq -4\}$ E. $\{x = 4\}$

34. The diameter of a circular tray is 28cm. Find the area of the tray.

(Take $\pi = \frac{22}{7}$)

- A) 44 cm^2 B) 88 cm^2 C) 154 cm^2 D) 616 cm^2 E) 2464 cm^2

35. If $\mathbf{a} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 5 \\ -5 \end{pmatrix}$, find $\mathbf{a} + \mathbf{b}$

- A. $\begin{pmatrix} 2 \\ 8 \end{pmatrix}$ B. $\begin{pmatrix} 8 \\ 8 \end{pmatrix}$ C. $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ D. $\begin{pmatrix} 8 \\ -8 \end{pmatrix}$ E. $\begin{pmatrix} 8 \\ -2 \end{pmatrix}$

36.

| | | | | | |
|---|---|---|---|---|----|
| x | 0 | 1 | 2 | 3 | 4 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 0 | 1 | 4 | 9 | 16 |

What is the rule for the mapping above ?

- A) $x \rightarrow x+3$ B) $x \rightarrow x+1$ C) $x \rightarrow x-1$ D) $x \rightarrow x+2$ E) $x \rightarrow x^2$

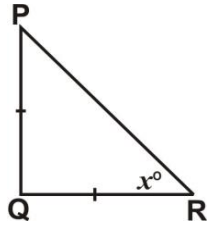
37. If 50 oranges cost ₵2,500.00 how many oranges can be bought for ₵15,000.00?

- A) 3 B) 30 C) 60 D) 300 E) 360

38. A farmer has 1853 pineapple suckers. He plants 17 pineapples in a row. How many rows can he plant?

- A) 17 B) 19 C) 91 D) 109 E) 190

39.



In triangle PQR, $|PQ| = |QR|$, and angle $PQR = 90^\circ$. Find x

- A) 30° B) 45° C) 60° D) 90° E) 180°

40. If $a \times b \times c = 1197$ and $a = 21$, $b = 3$, find c .

- A) 19 B) 49.9 C) 57 D) 63 E) 399

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. C) 85
2. B) $P \subset Q$
3. B. $\{5, 6\}$
4. D) 3,413.841
5. D) 15%
6. E) triangular pyramid
7. D) $15a - 17b$
8. D) $\frac{5}{8}, 0.62, \frac{9}{16}$
9. E) $2 \times 3^2 \times 5 \times 7$
10. D) 6
11. B. $\begin{pmatrix} 3 \\ 13 \end{pmatrix}$
12. B) $\frac{2R}{a+b}$
13. D) -2
14. C) 4.5

15. D. $(2, 2)$
16. B) $\frac{3}{7}$
17. E) 134
18. C) 88
19. E) 105
20. B) 27
21. B) $5x^4y$
22. C) $240 - y$
23. B) $n = \frac{1}{2}(7a-5)$
24. B) 060°
25. D) 57cm^2
26. C) 6
27. B) 5.4
28. D) $\frac{1}{5}$
29. E) 111001_{two}
30. C) 4.0
31. D) 250m
32. D) $\phi 3,600.00$
33. C. $\{x \leq 4\}$
34. D) 616 cm^2
35. E. $\begin{pmatrix} 8 \\ -2 \end{pmatrix}$
36. E) $x \rightarrow x^2$
37. D) 300

38. D) 109

39. B) 45°

40. A) 19

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) If $P = 4$, $a = 16$, $b = -5$ and $c = 3$, evaluate $p^2 - \frac{(a-b)}{C}$

(b) Solve the inequality $5x - 3(x - 1) \geq 39$. Illustrate your answer on the number line.

(c) If $x = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ and $y = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

Find (i) $x + 2y$ (ii) $3x - y$

2. Using a ruler and a pair of compasses only,

a) (i) construct a triangle ABC such that $|AB| = 8\text{cm}$, angle $ABC = 60^\circ$ and $|BC| = 8\text{cm}$.

(ii) What type of triangle is triangle ABC?

b) construct the bisector of angle BAC to meet $|BC|$ at D. Measure $|AD|$.

c) construct the perpendicular bisector of $|BA|$ to meet $|AD|$ at O.

d) Using O as centre and radius OD, draw a circle to touch the three sides of the triangle.

3. (a) If $2y - 5x + 10 = 0$, find:
- (i) y , when $x = 2$; (ii) x , when $y = 5$
- (b) (i) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular lines OX and OY on a graph sheet.
- (ii) On the same graph sheet, mark the x -axis from -5 to 5 and the y -axis from -6 to 6 .
- (iii) Plot on the same graph sheet, the points A (0,-5) and B(4, 5). Join AB using a ruler.
- (iv) Find the gradient of the line AB
- (v) Measure the acute angle that the line AB makes with the x -axis, using a protractor.

4. (a) The table below shows the distribution of the ages (in years) of children who were treated in a clinic in a day.

| | | | | | |
|----------------|---|---|---|---|---|
| Age (in years) | 1 | 2 | 3 | 4 | 5 |
| Frequency | 6 | 4 | 2 | 3 | 5 |

Find

- (i) the mean age
- (ii) the modal age
- (b) Draw a bar chart for the distribution.
5. (a) The volume of a cylinder is 220cm^3 . The radius of the cross-section is 2.5cm . Find the height of the cylinder. (Take $\pi = \frac{22}{7}$)
- (b) Each of the interior angles of a regular polygon is 140° . How many sides does it have?

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

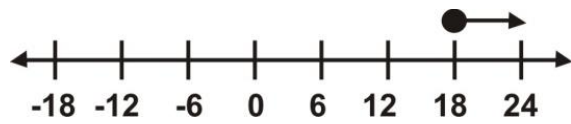
1 (a)

$$\begin{aligned} & p^2 - \frac{(a-b)}{C}, \quad \text{if } P = 4, a = 16, b = -5 \text{ and } c = 3 \\ \Rightarrow & 4^2 - \frac{[16 - (-5)]}{3} \qquad \Rightarrow \qquad 4^2 - \frac{(16 + 5)}{3} \\ \Rightarrow & 16 - \frac{21}{3} \qquad \Rightarrow \qquad 16 - 7 \\ & = \qquad \underline{\underline{9}} \end{aligned}$$

(b)

$$\begin{aligned} & 5x - 3(x-1) \geq 39 \\ \Rightarrow & 5x - 3x + 3 \geq 39 \\ \Rightarrow & 2x + 3 \geq 39 \\ \Rightarrow & 2x \geq 39 - 3 \\ \Rightarrow & 2x \geq 36 \\ \Rightarrow & \frac{2x}{2} \geq \frac{36}{2} \\ \Rightarrow & \underline{\underline{x \geq 18}} \end{aligned}$$

The number line illustration is shown below:



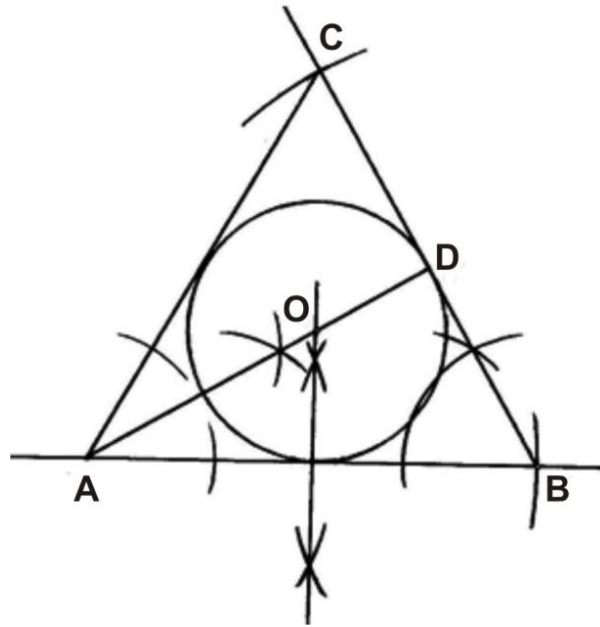
(c) (i)

$$\begin{aligned}
 & x + 2y \\
 = & \begin{pmatrix} -3 \\ 2 \end{pmatrix} + 2 \begin{pmatrix} 4 \\ -1 \end{pmatrix} \\
 = & \begin{pmatrix} -3 \\ 2 \end{pmatrix} + \begin{pmatrix} 2 \times 4 \\ 2 \times -1 \end{pmatrix} \\
 = & \begin{pmatrix} -3 \\ 2 \end{pmatrix} + \begin{pmatrix} 8 \\ -2 \end{pmatrix} \\
 = & \begin{pmatrix} -3 + 8 \\ 2 + (-2) \end{pmatrix} \\
 = & \begin{pmatrix} -3 + 8 \\ 2 - 2 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 5 \\ 0 \end{pmatrix}}}
 \end{aligned}$$

(ii)

$$\begin{aligned}
 & 3x - y \\
 = & 3 \begin{pmatrix} -3 \\ 2 \end{pmatrix} - \begin{pmatrix} 4 \\ -1 \end{pmatrix} \\
 = & \begin{pmatrix} 3 \times -3 \\ 3 \times 2 \end{pmatrix} - \begin{pmatrix} 4 \\ -1 \end{pmatrix} \\
 = & \begin{pmatrix} -9 \\ 6 \end{pmatrix} - \begin{pmatrix} 4 \\ -1 \end{pmatrix} \\
 = & \begin{pmatrix} -9 - 4 \\ 6 - (-1) \end{pmatrix} \\
 = & \begin{pmatrix} -9 - 4 \\ 6 + 1 \end{pmatrix} = \underline{\underline{\begin{pmatrix} -13 \\ 7 \end{pmatrix}}}
 \end{aligned}$$

2.



a) (ii) ABC is an equilateral triangle

b) $|AD| \approx \underline{\underline{6.9 \text{ cm}}}$

3 (a) (i)

When $x = 2$, we have

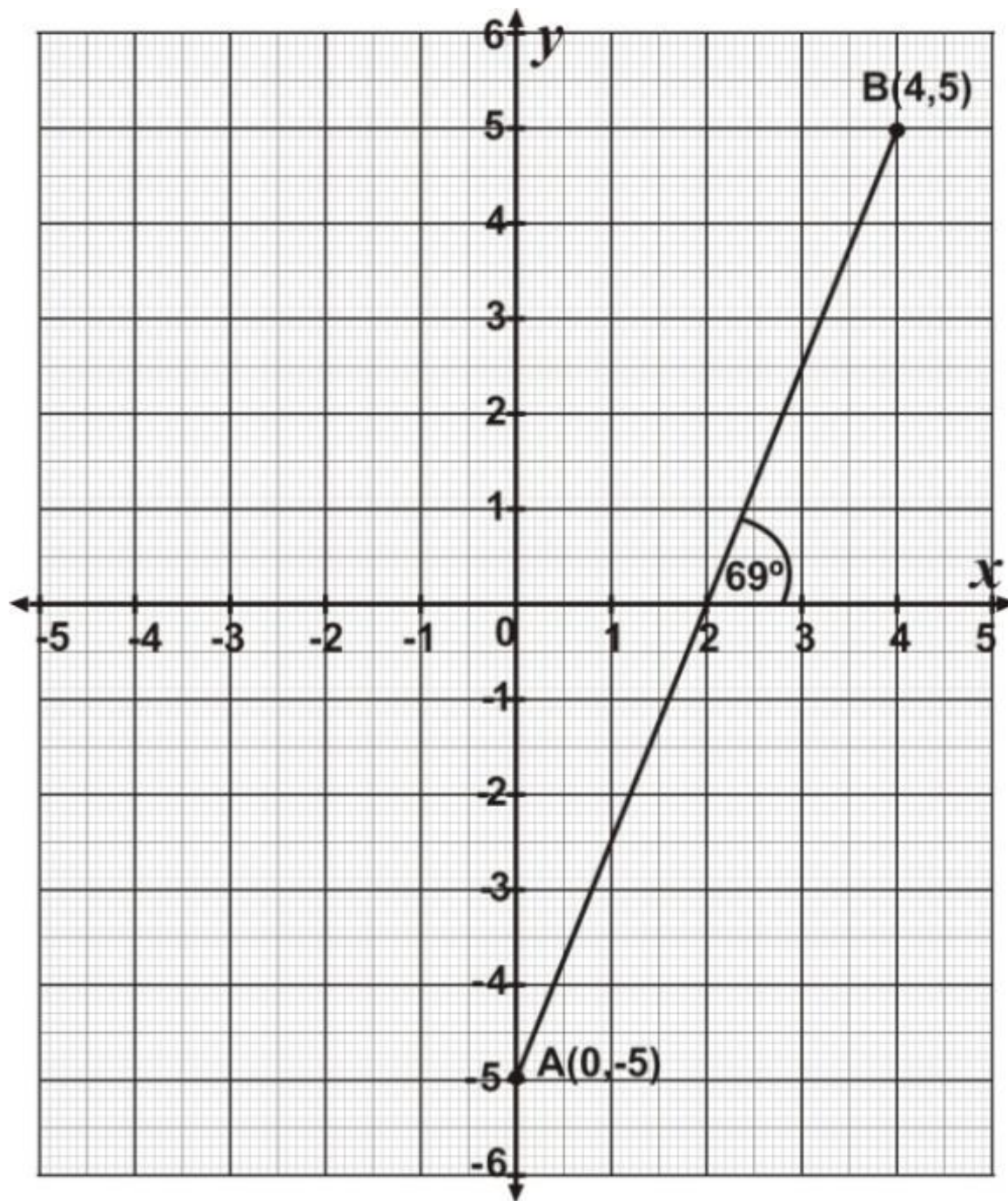
$$\begin{aligned}
 2y - 5(2) + 10 &= 0 \\
 \Rightarrow 2y - 10 + 10 &= 0 \\
 \Rightarrow 2y + 0 &= 0 \\
 \Rightarrow 2y &= 0 \\
 \Rightarrow y &= 0/2 \\
 \Rightarrow \underline{\underline{y}} &= \underline{\underline{0}}
 \end{aligned}$$

(ii)

When $y = 5$, we have

$$\begin{aligned}
 2(5) - 5x + 10 &= 0 \\
 \Rightarrow 10 - 5x + 10 &= 0 \\
 \Rightarrow 20 - 5x &= 0 \\
 \Rightarrow 20 &= 5x \\
 \Rightarrow \frac{20}{5} &= x \\
 \Rightarrow 4 &= x \\
 \Rightarrow \underline{\underline{x}} &= \underline{\underline{4}}
 \end{aligned}$$

3 (b)



(iv) The gradient of line AB

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-5)}{4 - 0} = \frac{10}{4} = \underline{\underline{2.5}}$$

or

$$= \frac{y_1 - y_2}{x_1 - x_2} = \frac{-5 - 5}{0 - 4} = \frac{-10}{-4} = \underline{\underline{2.5}}$$

(v) The acute angle that the line AB makes with the x -axis $\approx \underline{\underline{69^\circ}}$

4 (a) (i)

Approach 1

$$\begin{aligned}\text{The mean age} &= \frac{\text{The sum of ages}}{\text{The total number of children}} \\&= \frac{(1 \times 6) + (2 \times 4) + (3 \times 2) + (4 \times 3) + (5 \times 5)}{6 + 4 + 2 + 3 + 5} \\&= \frac{6 + 8 + 6 + 12 + 25}{6 + 4 + 2 + 3 + 5} \\&= \frac{57}{20} = \underline{\underline{2\frac{17}{20} \text{ years}}} \text{ or } \underline{\underline{2.85 \text{ years}}}\end{aligned}$$

4 (a) (i)

Approach 2

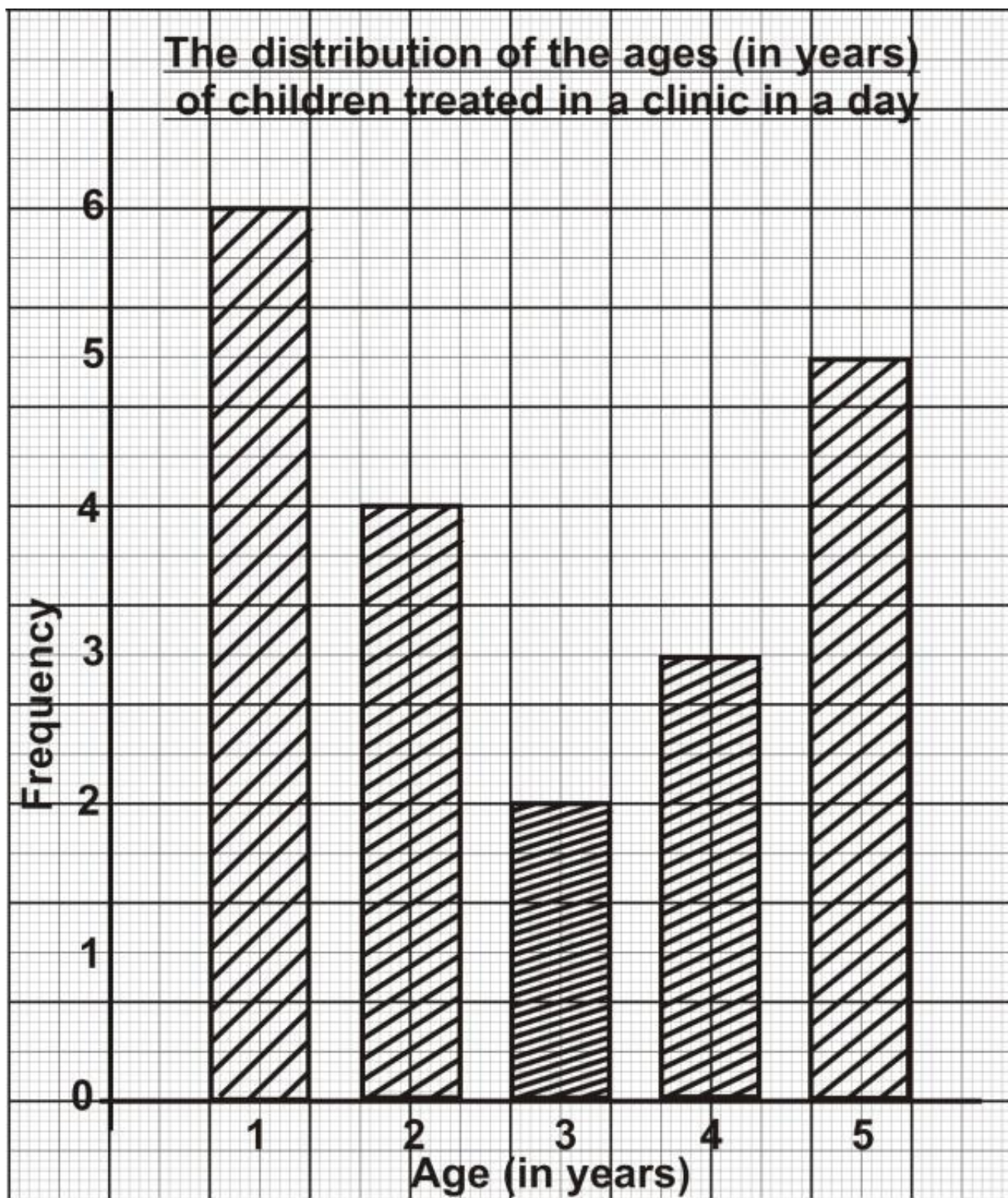
| Age (years) (x) | Frequency (f) | f x |
|--------------------|-----------------------------------|------------------------------------|
| 1 | 6 | 6 |
| 2 | 4 | 8 |
| 3 | 2 | 6 |
| 4 | 3 | 12 |
| 5 | 5 | 25 |
| | $\Sigma f = 20$ | $\Sigma fx = 57$ |

$$\begin{aligned}\text{The mean age} &= \frac{\Sigma f x}{\Sigma f} = \frac{57}{20} \\&= \underline{\underline{2\frac{17}{20} \text{ years}}} \text{ or } \underline{\underline{2.85 \text{ years}}}\end{aligned}$$

(ii) The modal age = the most-occurring age
= 1 year

4 (b)

Vertical Axis Scale: 3 cm to 1 child



5 (a) Volume of cylinder = Area of base \times height

Approach 1 [\(Substitution first\)](#)

$$\begin{aligned}
 V &= \pi r^2 \times h \\
 \Rightarrow 220\text{cm}^3 &= \frac{22}{7} \times (2.5\text{cm})^2 \times h \\
 \Rightarrow 220\text{cm}^3 &= \frac{22}{7} \times 2.5\text{cm} \times 2.5\text{cm} \times h \\
 \Rightarrow \frac{220\text{cm}^3 \times 7}{22 \times 2.5\text{cm} \times 2.5\text{cm}} &= h \\
 \Rightarrow \frac{10\text{cm}^3 \times 7}{2.5\text{cm} \times 2.5\text{cm}} &= h \\
 \Rightarrow \frac{70\text{cm}^3}{6.25\text{cm}^2} &= h \\
 \Rightarrow \frac{70\text{cm}^3}{6\frac{1}{4}\text{cm}^2} &= h \\
 \Rightarrow \frac{70\text{cm}^3}{25/4\text{cm}^2} &= h \\
 \Rightarrow \frac{4 \times 70\text{cm}^3}{25\text{cm}^2} &= h \\
 \Rightarrow \frac{4 \times 14\text{cm}^3}{5\text{cm}^2} &= h \\
 \Rightarrow \frac{56\text{cm}^3}{5\text{cm}^2} &= h \\
 \Rightarrow 11\frac{1}{5}\text{cm} &= 11.2\text{cm} = h \\
 \Rightarrow \text{The height of the cylinder} &= \underline{\underline{11\frac{1}{5}\text{cm} \text{ or } 11.2\text{cm}}}
 \end{aligned}$$

Alternatively, from the 5th step

$$\begin{aligned}
 \frac{70\text{cm}^3}{6.25\text{cm}^2} &= h \\
 \Rightarrow \frac{7000\text{cm}^3}{625\text{cm}^2} &= h \\
 \Rightarrow \frac{56\text{cm}^3}{5\text{cm}^2} &= h \\
 \Rightarrow 11\frac{1}{5}\text{cm} &= 11.2\text{cm} = h
 \end{aligned}$$

$$\Rightarrow \text{The height of the cylinder} = \underline{11\frac{1}{5} \text{ cm}} \text{ or } \underline{11.2 \text{ cm}}$$

5 (a) **Approach 2** [\(making \$h\$ the subject first\)](#)

$$V = \pi r^2 \times h$$

$$\Rightarrow \frac{V}{\pi r^2} = h$$

$$\Rightarrow \frac{220 \text{ cm}^3}{\frac{22}{7} \times (2.5 \text{ cm})^2} = h$$

$$\Rightarrow \frac{7 \times 220 \text{ cm}^3}{22 \times 2.5 \text{ cm} \times 2.5 \text{ cm}} = h$$

$$\Rightarrow \frac{7 \times 10 \text{ cm}^3}{2.5 \text{ cm} \times 2.5 \text{ cm}} = h$$

$$\Rightarrow \frac{70 \text{ cm}^3}{6.25 \text{ cm}^2} = h$$

$$\Rightarrow \frac{7000 \text{ cm}^3}{625 \text{ cm}^2} = h$$

$$\Rightarrow \frac{56 \text{ cm}^3}{5 \text{ cm}^2} = h$$

$$\Rightarrow 11\frac{1}{5} \text{ cm} = h \quad \text{or}$$

$$\Rightarrow 11.2 \text{ cm} = h$$

$$\Rightarrow \text{The height of the cylinder} = \underline{11\frac{1}{5} \text{ cm}} \text{ or } \underline{11.2 \text{ cm}}$$

5 (b) **METHOD 1** [\(Using relation between exterior angle and no. of sides\)](#)

$$\text{Since interior angle} = 140^\circ,$$

$$\Rightarrow \text{Exterior angle} = 180^\circ - 140^\circ = 40^\circ$$

$$\text{Therefore Number of sides (n)} = \frac{360^\circ}{40^\circ}$$

$$= \underline{9 \text{ sides.}}$$

5 (b) **METHOD 2** [\(Using relation between interior angle and no. of sides\)](#)

For a regular polygon, each interior angle = $\frac{180^0(n-2)}{n}$, where n = no. of sides

$$\Rightarrow 140^\circ = \frac{180^0(n-2)}{n}$$

$$\Rightarrow 140^\circ n = 180^\circ (n - 2)$$

$$\Rightarrow 140^\circ n = 180^\circ n - 360^\circ$$

$$\Rightarrow 360^\circ = 180^\circ n - 140^\circ n$$

$$\Rightarrow 360^\circ = 40^\circ n$$

$$\Rightarrow \frac{360^\circ}{40^0} = n$$

$$\Rightarrow \underline{9} = n$$

\therefore The polygon has 9 sides

August 1996

MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. $U = \{0, 1\}$. How many subsets have U ?
A) 1 B) 2 C) 3 D) 4 E) 5
2. The following addition is done in base ten. What number represents ABC?

$$\begin{array}{r} 225 \\ 343 \\ \hline ABC \\ \hline 1000 \end{array}$$

- A) 324 B) 242 C) 423 D) 432 E) 234

Use the mapping below to answer questions 3 and 4

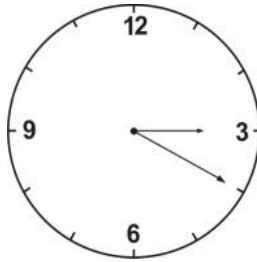
| | | |
|----------|-------------------|----------|
| 2^3 | \longrightarrow | 8 |
| 2^2 | \longrightarrow | 4 |
| 2^1 | \longrightarrow | 2 |
| 2^0 | \longrightarrow | a |
| 2^{-1} | \longrightarrow | b |

3. The value of **a** is
A) 0 B) $\frac{1}{2}$ C) 1 D) 16 E) 32
4. What is the value of **b** ?
A) -2 B) $\frac{1}{4}$ C) $\frac{1}{2}$ D) 1 E) 2

5. Write two hundred thousand and fifty seven in figures

- A) 20,057
- B) 200,057
- C) 2,000,057
- D) 20,000,057
- E) 200,570

6.



What time is the clock above showing?

- A) 4:30 B) 4:15 C) 3:40 D) 3:20 E) 3:04

7. Kojo, Ebo and Ama share ¢14,000.00 among themselves. Kojo had twice as much as Ebo and Ebo also had twice as much as Ama. How much did Ebo get?

- A) ¢8,000.00
- B) ¢6,000.00
- C) ¢4,000.00
- D) ¢3,000.00
- E) ¢2,000.00

8. At what rate of simple interest will ¢5,000.00 amount to ¢ 7,500 if saved for 5 years ?

- A) 5% B) $6\frac{2}{3}\%$ C) $7\frac{1}{2}\%$ D) 10% E) $12\frac{1}{2}\%$

9. Simplify $\frac{1}{3} - \frac{1}{2} + \frac{2}{5}$

- A) $\frac{17}{30}$ B) $\frac{13}{30}$ C) $\frac{7}{30}$ D) $-\frac{7}{30}$ E) $-\frac{17}{30}$

10. If $2^x = 8$, what is the value of x ?

- A) 0 B) 1 C) 2 D) 3 E) 4

The relation between the Celsius (C) and Fahrenheit (F) scale of temperature is given by:

$$C = \frac{5}{9}(F - 32)$$

11. If C is 40, F will be

A) 104.0 B) 78.4 C) 72.0 D) 65.6 E) 40.0

12. If C is -40 , find the value of F

A) -104.0 B) -78.4 C) -72.0 D) -65.6 E) -40.0

13. The ages in years of 9 children at a birthday party are: 2, 3, 3, 3, 4, 5, 5, 5 and 6.

What is the mean age?

A) 3.0 B) 3.5 C) 4.0 D) 4.5 E) 5.0

14. The ages in years of 9 children at a birthday party are:

2, 3, 3, 3, 4, 5, 5, 5 and 6. What is the median age?

A) 2.0 B) 3.0 C) 3.5 D) 4.0 E) 5.0

15. The ages in years of 9 children at a birthday party are: 2, 3, 3, 3, 4, 5, 5, 5 and 6.

If a child is picked at random, what is the probability that he is 5 years old?

A) $\frac{2}{9}$ B) $\frac{1}{3}$ C) $\frac{4}{9}$ D) $\frac{5}{9}$ E) $\frac{2}{3}$

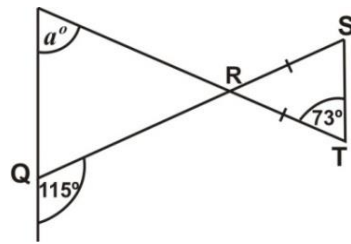
16. P (2, 5) and Q (-2, 3) are points in the Cartesian plane, find the vector PQ

A. $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ B. $\begin{pmatrix} -4 \\ -2 \end{pmatrix}$ C. $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$ D. $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$ E. $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

17. Find K in the vector equation $\begin{pmatrix} 3 \\ 4 \end{pmatrix} + K\begin{pmatrix} 3 \\ 4 \end{pmatrix} = -\begin{pmatrix} 3 \\ 4 \end{pmatrix}$

A) -3 B) -2 C) -1 D) $-\frac{3}{4}$ E) 2

- 18.



In the above diagram, $|RS| = |RT|$. Find a

- A) 146° B) 81° C) 73° D) 65° E) 34°

19. If $a^2 - b^2 = (a + b)(a - b)$, evaluate $9.32^2 - 0.68^2$

- A) 87.32 B) 86.4 C) 74.65 D) 10.0 E) 8.64

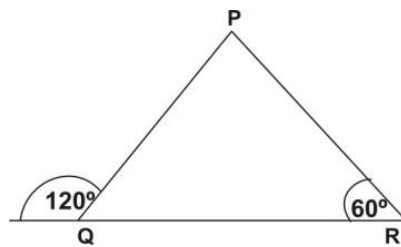
20. Simplify $\frac{6^2}{2^2 \times 3}$

- A) 1 B) 2 C) 3 D) 6 E) 9

21. The sum of the ages of Kwaku and Kojo is 30 years. Kwaku is 4 years older than Kojo. How old is Kojo?

- A) 19 B) 17 C) 13 D) 11 E) 9

22. What type of triangle is PQR?



- A) Equilateral
B) Isosceles
C) scalene
D) right-angled
E) obtuse-angled

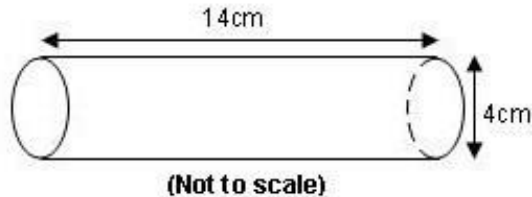
Use the equation $y = (x + 2)(x - 2)$ to answer questions 23 and 24.

23. If $x = -1$, find y .

- A) -4 B) -3 C) 3 D) 4 E) 9

24. Find the set of values of x for which y is zero.
- A. $\{0\}$ B. $\{0,2\}$ C. $\{0,-2\}$ D. $\{-2,2\}$ E. $\{2\}$

Use the information below to answer questions 25 to 27



In the diagram above, the cylinder has diameter 4cm and length 14cm.

(Take $\pi = \frac{22}{7}$)

25. Find the circumference of the base.
- A) $\frac{44}{7}$ cm B) $\frac{88}{7}$ cm C) $\frac{176}{7}$ cm D) 44 cm E) 176 cm
26. The area of the base is
- A) 176cm^2 B) 44cm^2 C) $\frac{176}{7}\text{cm}^2$ D) $\frac{88}{7}\text{cm}^2$ E) $\frac{44}{7}\text{cm}^2$
27. What is the volume of the cylinder?
- A) 176cm^3 B) 44cm^3 C) $\frac{176}{7}\text{cm}^3$ D) $\frac{88}{7}\text{cm}^3$ E) $\frac{44}{7}\text{cm}^3$
28. A woman bought 210 oranges for ₦650.00. She sold all of them at 3 for ₦20.00. How much profit did she make?
- A) ₦350.00
B) ₦450.00
C) ₦550.00
D) ₦650.00
E) ₦750.00
29. The ratio of boys to girls in a school is 9:11. If there are 400 pupils in the school, how many boys are there?

- A) 80 B) 120 C) 180 D) 220 E) 280

30. Express the product of 162.5×0.5 in standard form.

- A) 81.25×10^{-1}
B) 81.25×10
C) 8.125×10^{-1}
D) 8.125×10
E) 0.8125×10^{-2}

31. What is 16% of ₦500,000.00?

- A) ₦80 B) ₦8,000 C) ₦80,000 D) ₦420,000 E) ₦492,000

32. Simplify $\frac{0.24 \times 14.3}{5.2}$

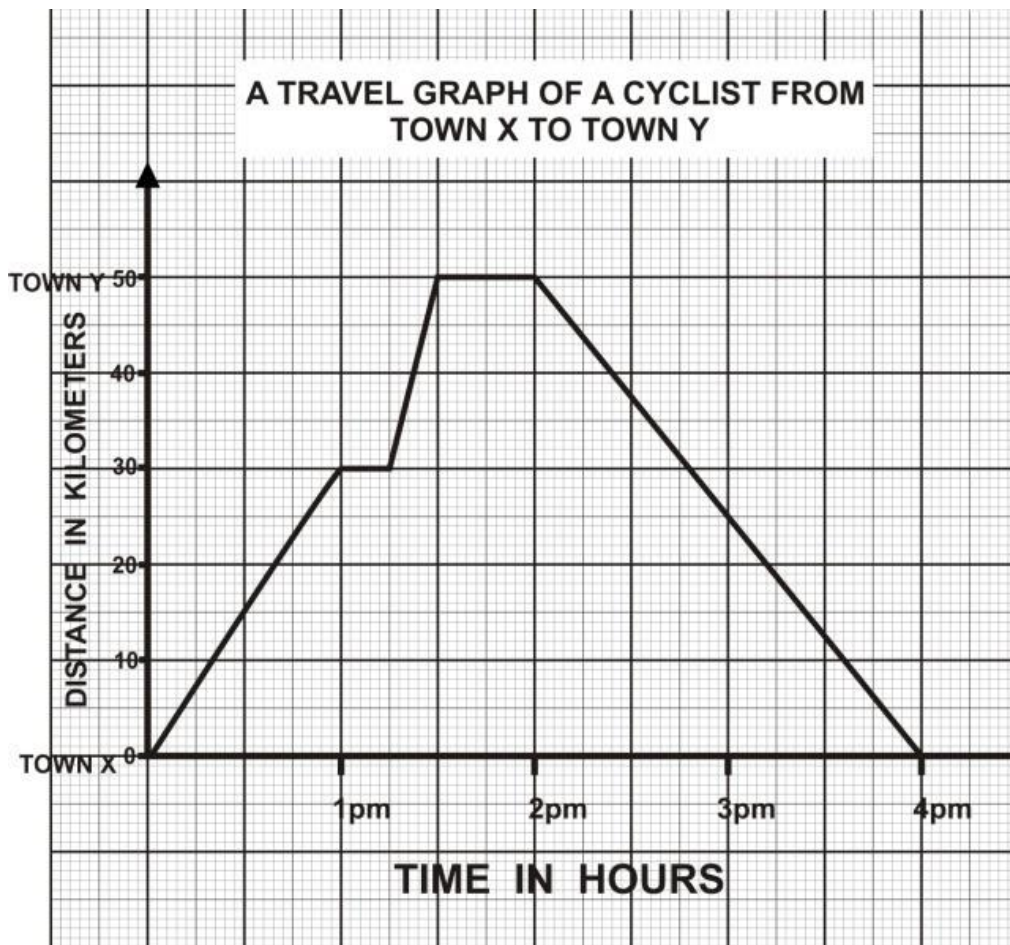
- A) 66 B) 6.60 C) 0.70 D) 0.66 E) 0.60

33. The product of $2x$ and 3 is 138. Find x

- A) 23 B) 33 C) 68 D) 69 E) 138

Use the graph below to answer questions 34 to 36

The travel graph describes the journey of a cyclist from town **X** to town **Y**



34. What was the average speed for the return journey from town Y to town X
- 100 km h⁻¹
 - 50 km h⁻¹
 - 33.33 kmh⁻¹
 - 25 km h⁻¹
 - 20 km h⁻¹
35. State the period within which he travelled to town Y after his first rest?
- 1:00 – 2:00 pm
 - 1:00 – 4:00 pm
 - 1:15 – 1:30 pm
 - 1:30 – 2:00 pm
 - 2:00 – 4:00 pm
36. How many minutes did the cyclist spend at town Y?
- 15 min
 - 20 min
 - 30 min
 - 45 min
 - 60 min
37. 200 bottles of equal capacity hold 350 litres of water. How much water does each bottle hold ?
- 1750 litres

- B) 175 litres
- C) 17.5 litres
- D) 1.75 litres
- E) 0.17 litres

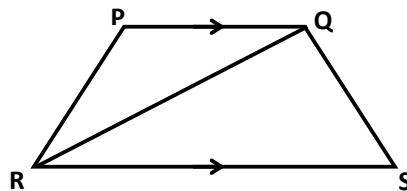
38. Find the solution set of $2x + 4 > -6$

- A. $\{x = -5\}$ B. $\{x < 5\}$ C. $\{x > 5\}$ D. $\{x < -5\}$ E. $\{x > -5\}$

39. A rectangular field 50 meters wide and x metres long requires 260 meters of fencing. Which of the following statements is true?

- A) $x + 100 = 260$
- B) $2x + 50 = 260$
- C) $4x + 200 = 260$
- D) $2x + 100 = 260$
- E) $4x + 100 = 260$

40.



In the diagram above, PQSR is a trapezium. PQ is parallel to RS. $\angle PQR = \angle QRS$. What type of triangle is triangle RQS?

- A) Isosceles
- B) scalene
- C) equilateral
- D) Right-angled
- E) obtuse-angled

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. D) 4
2. D) 432
3. C) 1
4. C) $\frac{1}{2}$
5. B) 200,057
6. D) 3:20
7. C) ₦4,000.00
8. D) 10%
9. C) $\frac{7}{30}$
10. D) 3
11. A) 104.0
12. E) -40.0
13. C) 4.0
14. D) 4.0
15. B) $\frac{1}{3}$

16. B. $\begin{pmatrix} -4 \\ -2 \end{pmatrix}$
17. B) -2
18. B) 81°
19. B) 86.4
20. C) 3
21. C) 13
22. A) Equilateral
23. B) -3
24. D. $\{-2, 2\}$
25. B) $88/7$ cm
26. D) $88/7$ cm²
27. A) 176 cm³
28. E) ¢750.00
29. C) 180
30. D) 8.125×10
31. C) ¢80,000
32. D) 0.66
33. A) 23
34. D) 25 km h⁻¹
35. C) 1:15 – 1:30 pm
36. C) 30 min
37. D) 1.75 litres
38. E. $\{x > -5\}$

39. D) $2x + 100 = 260$

40. B) scalene

August 1996

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Kofi is n years old now
 - (i) How old was he 5 years ago?
 - (ii) How old will he be 10 years from now?
 - (ii) If his age in 10 years time will be four times his age 5 years ago, how old is he now?
 - (b) Convert 2342_{five} to a base ten numeral
 - (c) Given that $f = \frac{vu}{v+u}$, find v , if $f = 20$ and $u = 5$
-
2. (a) A man deposited ₦350,000.00 in his account in a bank. A simple interest of 4% per annum was paid on his deposit. Calculate the total amount at the end of 4 years.
 - (b) The cost of sending a telegram is ₦500 for the first 12 words and ₦25.00 for every extra word.

Find the cost of sending a telegram containing 20 words.

3. The table below shows the distribution of pupils in a JSS form one (1) class who speak some of the Ghanaian languages.

| Ghanaian Language | No. of students who speak the language |
|-------------------|--|
| Nzema | 5 |
| Ga | 20 |
| Twi | 30 |
| Ewe | 25 |
| Fante | 10 |

- (a) (i) Draw a pie chart for the distribution.
- (ii) What is the modal Ghanaian language?
- (b) If a pupil is selected at random from the form, what is the probability that he speaks Ga?
4. Using a ruler and a pair of compasses only,
- a) Construct triangle ABC such that $|AB| = 6\text{cm}$, $|AC| = 10\text{cm}$ and $|BC| = 8\text{cm}$.
Measure angle ABC.
- b) Construct the perpendicular bisectors (mediators) of $|AB|$ and $|BC|$. Let the bisectors meet at O.
- c) Construct a circle with centre O and radius OA. Measure the radius of the circle.
5. a) Using a scale of 2cm to 2 units on both axes draw two perpendicular axis, OX and OY on a graph sheet.
- b) On this graph sheet, mark the x-axis from -4 to 10 and the y-axis from -6 to 12
- c) Plot on the same graph sheet the points A (2, 1), B(3, 4) and C(4, 2). Join the points to form a triangle ABC.

- d) Draw an enlargement $A_1B_1C_1$ of triangle ABC with scale factor 2 from the origin $O(0, 0)$, such that $A \rightarrow A_1$, $B \rightarrow B_1$ and $C \rightarrow C_1$. Indicate the co-ordinates of triangle $A_1B_1C_1$. Show all lines of transformation.
- e) Using the x-axis as mirror line, draw the image $A_2B_2C_2$ of triangle ABC , where $A \rightarrow A_2$, $B \rightarrow B_2$ and $C \rightarrow C_2$. Indicate the co-ordinates of triangle $A_2B_2C_2$.

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1 (a)

(i) Kofi's age 5 years ago $= n - 5$

(ii) Kofi's age in 10 years' time $= n + 10$

Kofi's age in 10 years' time $= 4 \times (\text{Kofi's age 5 years ago})$

$$\Rightarrow n + 10 = 4 \times (n - 5)$$

$$\Rightarrow n + 10 = 4n - 20$$

$$\Rightarrow 20 + 10 = 4n - n$$

$$\Rightarrow 30 = 3n$$

$$\Rightarrow 30 \div 3 = n$$

$$\Rightarrow 10 = n$$

Therefore Kofi is 10 years old now

(b)

Converting 2342_{five} to a base ten numeral

| | | | |
|-------|-------|-------|-------|
| 2 | 3 | 4 | 2 |
| 5^3 | 5^2 | 5^1 | 5^0 |

$$\Rightarrow (2 \times 5^3) + (3 \times 5^2) + (4 \times 5^1) + (2 \times 5^0)$$

$$= (2 \times 125) + (3 \times 25) + (4 \times 5) + (2 \times 1)$$

$$= 250 + 75 + 20 + 2$$

$$= \underline{\underline{347}}$$

(c)

If $f = 20$ and $u = 5$, we have

$$\begin{aligned}20 &= \frac{v(5)}{v+5} \\ \Rightarrow 20(v+5) &= 5v \\ \Rightarrow 20v+100 &= 5v \\ \Rightarrow 20v-5v &= -100 \\ \Rightarrow 15v &= -100 \\ \Rightarrow \frac{15v}{15} &= \frac{-100}{15} \\ \Rightarrow v &= \frac{-20}{3} \\ \Rightarrow v &= \underline{\underline{-6\frac{2}{3}}}\end{aligned}$$

2 (a)

Total amount = Principal + S. Interest

$$\begin{aligned}&= P + P \times R \times T \\&= 350,000 + (350,000 \times 4\% \times 4) \\&= 350,000 + (350,000 \times \frac{4}{100} \times 4) \\&= 350,000 + (3,500 \times 4 \times 4) \\&= 350,000 + 56,000 \\&= \underline{\underline{\text{¢ } 406,000}}\end{aligned}$$

(b)

Cost of the first 12 words = ¢500

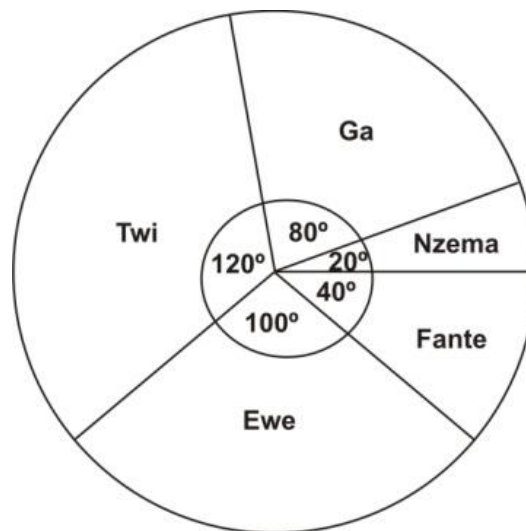
Remaining 8 words = $8 \times \text{¢}25$ = ¢200

Cost of sending 20 words = ¢500 + ¢200 = ¢700

3(a) (i)

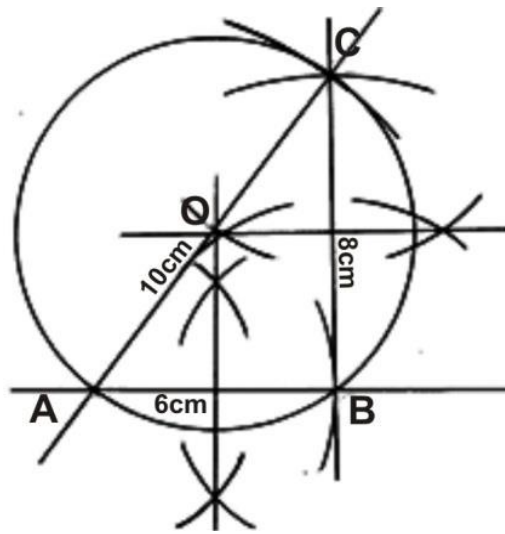
| Ghanaian Language | No. of students | Angle of sector |
|-------------------|-----------------|--|
| Nzema | 5 | $\frac{5}{90} \times 360^\circ = 20^\circ$ |
| Ga | 20 | $\frac{20}{90} \times 360^\circ = 80^\circ$ |
| Twi | 30 | $\frac{30}{90} \times 360^\circ = 120^\circ$ |
| Ewe | 25 | $\frac{25}{90} \times 360^\circ = 100^\circ$ |
| Fante | 10 | $\frac{10}{90} \times 360^\circ = 40^\circ$ |
| TOTAL | 90 | 360° |

Pie chart showing the distribution of pupils in JSS form 1 who speak some of the Ghanaian Languages



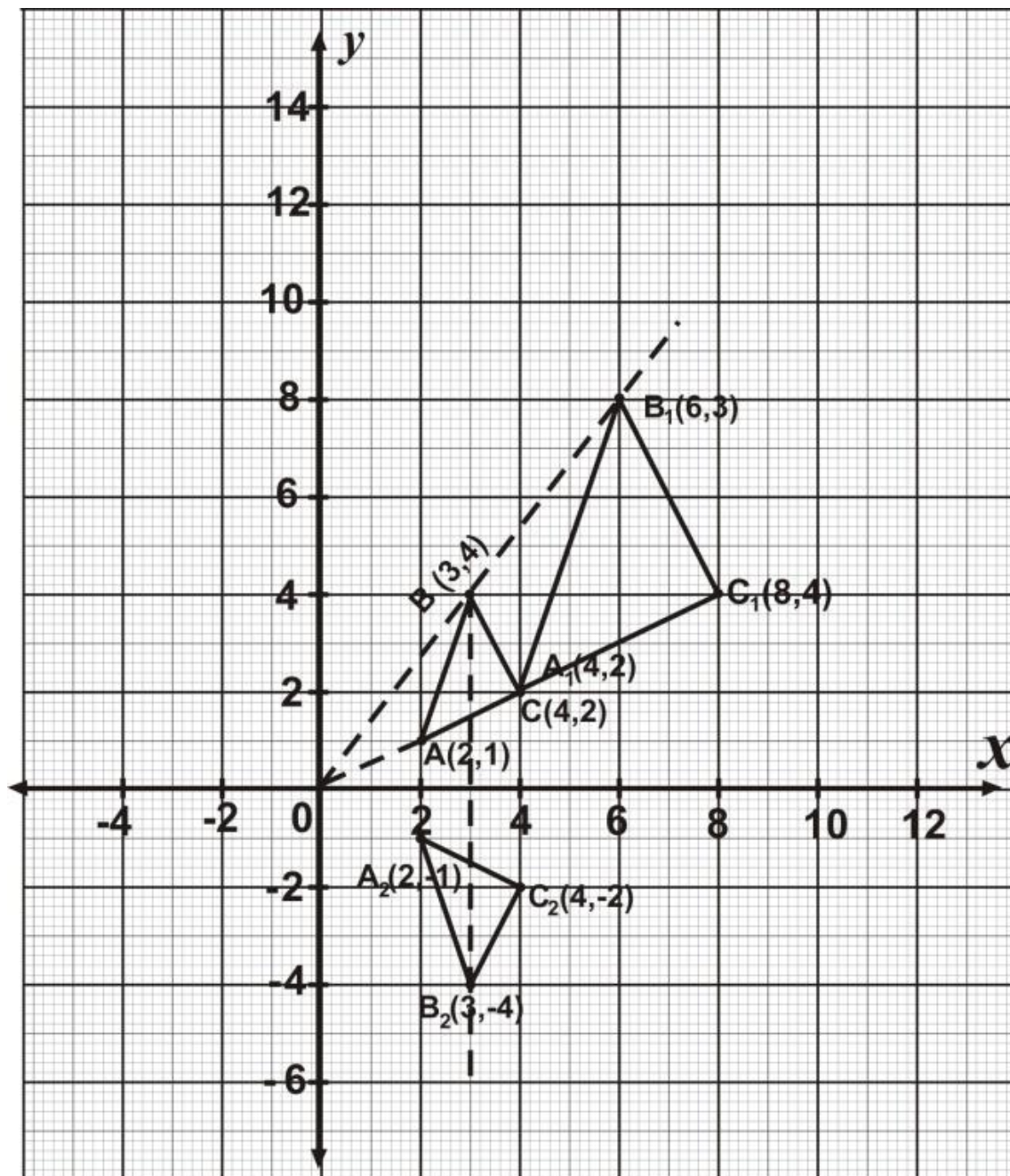
(a) (ii) The modal Ghanaian Language is **Twi**

$$\begin{aligned}
 \text{(b)} \quad P(\text{student speaks Ga}) &= \frac{\text{Number of students who speak Ga}}{\text{Total number of students}} \\
 &= \frac{20}{5+20+30+25+10} \\
 &= \frac{20}{90} = \frac{2}{9}
 \end{aligned}$$



- (a) Angle ABC $\approx 90^\circ$
- (c) Radius of circle ≈ 5 cm

5. Approach 1 ([By Inspection / Construction](#))



Approach 2 [\(The rule / formula\)](#)

(d) Enlarging (x, y) from $(0,0)$ by scale factor k

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow k \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} kx \\ ky \end{pmatrix}$$

$$OA \begin{pmatrix} 2 \\ 1 \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} 2 \times 2 \\ 2 \times 1 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}, \quad \therefore A_1(4, 2)$$

$$OB \begin{pmatrix} 3 \\ 4 \end{pmatrix} \rightarrow OB_1 \begin{pmatrix} 2 \times 3 \\ 2 \times 4 \end{pmatrix} = \begin{pmatrix} 6 \\ 8 \end{pmatrix}, \quad \therefore B_1(6, 8)$$

$$OC\begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OC_1\begin{pmatrix} 2 \times 4 \\ 2 \times 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}, \quad \therefore C_1(8,4)$$

\therefore Plot and join $A_1(4,2)$, $B_1(6,8)$ and $C_1(8,4)$ as the image of triangle ABC under an enlargement by scale factor 2 from the origin (0,0)

(e) Reflecting (x, y) in the x -axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x \\ -y \end{pmatrix}$$

$$OA\begin{pmatrix} 2 \\ 1 \end{pmatrix} \rightarrow OA_2\begin{pmatrix} 2 \\ -1 \end{pmatrix}, \quad \therefore A_2(2,-1)$$

$$OB\begin{pmatrix} 3 \\ 4 \end{pmatrix} \rightarrow OB_2\begin{pmatrix} 3 \\ -4 \end{pmatrix}, \quad \therefore B_2(3,-4)$$

$$OC\begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OC_2\begin{pmatrix} 4 \\ -2 \end{pmatrix}, \quad \therefore C_2(4,-2)$$

\therefore Plot and join $A_2(2,-1)$, $B_2(3,-4)$ and $C_2(4,-2)$ as the image of triangle ABC under a reflection in the x -axis

August 1995

MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. $P = \{\text{prime numbers less than } 20\}$ and $Q = \{\text{odd numbers less than } 10\}$.

Find $P \cap Q$

- A. $\{2, 3\}$
- B. $\{1, 3, 5, 7, 11\}$
- C. $\{3, 5, 7, 9\}$
- D. $\{3, 5, 7\}$
- E. $\{3, 5, 7, 11\}$

2. Convert 104_{ten} to a binary numeral

- A) 1101000
- B) 1010100
- C) 1101100
- D) 1011010
- E) 1110100

3. What is the HCF of 48, 30 and 18 ?

- A) 2 B) 3 C) 5 D) 6 E) 9

4. Express 34m 5cm 6mm in millimetres

- A) 340506 mm
- B) 342506 mm
- C) 34056 mm
- D) 30456 mm
- E) 34565 mm

5. Write 356.07 in standard form

- A) 35.607×10
- B) 35.607×10^2
- C) 3.5607×10^2
- D) 3.5607×10^{-2}
- E) 0.35607×10^3

6. Divide $(1\frac{1}{2} + \frac{1}{4})$ by $(1\frac{1}{2} - \frac{1}{4})$

- A) $\frac{5}{7}$ B) 1 C) $1\frac{2}{5}$ D) $1\frac{3}{4}$ E) 3

7. Which property is illustrated by the statement $a \times (b+c) = a \times b + a \times c$

- A) Inverse
- B) Identity
- C) Commutative
- D) Distributive
- E) Associative

8. How many edges has a cube?

- A) 4 B) 6 C) 8 D) 12 E) 18

9. What is the mode of the following numbers:

4, 5, 3, 3, 4, 2, 7, 6, 5, 4, 4 and 1 ?

- A) 3 B) 4 C) 5 D) 6 E) 7

10. What is the rule for the mapping below ?

| | | | | | |
|---|---|---|---|----|----|
| x | 1 | 2 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 2 | 4 | 8 | 16 | 32 |

- A) $y = 2x+2$ B) $y = 2^x$ C) $y = x+2$ D) $y = x+1$ E) $y = 2x$

11. Solve $4x - 6 < -2$

- A) $x < 1$ B) $x > 1$ C) $x < -1$ D) $x > -1$ E) $x < 4$

12. In a school, 80 pupils wrote an examination and 64 of them passed. What is the percentage of pupils who passed?

- A) 8% B) 16% C) 20% D) 64% E) 80%

13. The interior angle of a regular polygon is 120° . How many sides has the polygon?

- A) 3 B) 4 C) 5 D) 6 E) 8

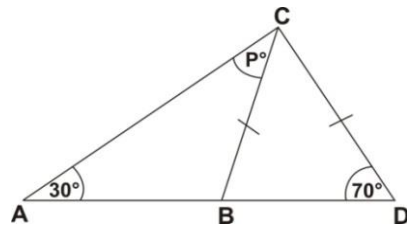
14. Kofi throws a die. What is the probability that he throws the number 2?

- A) 1 B) $\frac{2}{3}$ C) $\frac{1}{2}$ D) $\frac{1}{3}$ E) $\frac{1}{6}$

15. What is the image of - 4 under the mapping $x \rightarrow \frac{1}{2}x - 2$?

- A) 4 B) 2 C) 0 D) -2 E) -4

16.



Find the value of P in the diagram above

- A) 110 B) 90 C) 70 D) 50 E) 40

17. Make a subject of the relation $P = 2(a + b)$

A) $a = \frac{P - 2b}{2}$

B) $a = \frac{P + 2b}{2}$

C) $a = \frac{2b - P}{2}$

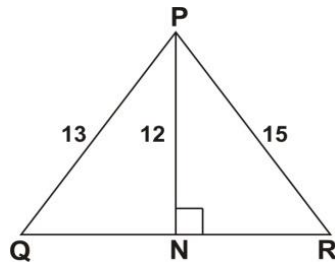
D) $a = \frac{P-b}{2}$

E) $a = \frac{P-2}{b}$

18. What is the value of x in the relation $5^x = 125$?

- A) 2 B) 3 C) 4 D) 5 E) 6

19. Calculate the length of QR in triangle PQR.



- A) 11 B) 14 C) 16 D) 17 E) 25

20. Five cards are numbered 1 to 5. A card is picked at random. What is the probability that it has an even number?

- A) 1 B) $\frac{4}{5}$ C) $\frac{3}{5}$ D) $\frac{2}{5}$ E) $\frac{1}{5}$

21. If $\mathbf{u} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$, find $3\mathbf{u} + 2\mathbf{v}$

- A. $\begin{pmatrix} 8 \\ 9 \end{pmatrix}$ B. $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$ C. $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$ D. $\begin{pmatrix} 4 \\ 9 \end{pmatrix}$ E. $\begin{pmatrix} -4 \\ -9 \end{pmatrix}$

22. Arrange the following fractions in descending order $\frac{3}{4}$, $\frac{5}{8}$, $\frac{4}{5}$, $\frac{13}{20}$

- A) $\frac{4}{5}$, $\frac{3}{4}$, $\frac{13}{20}$, $\frac{5}{8}$
 B) $\frac{4}{5}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{13}{20}$
 C) $\frac{5}{8}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{13}{20}$
 D) $\frac{4}{5}$, $\frac{5}{8}$, $\frac{13}{20}$, $\frac{3}{4}$
 E) $\frac{13}{20}$, $\frac{5}{8}$, $\frac{4}{5}$, $\frac{3}{4}$

23. How many lines of symmetry has a square?

- A) 0 B) 1 C) 2 D) 3 E) 4

24. If $(x, y) \rightarrow (x, 2y)$, find the image of $(2\frac{1}{2}, -\frac{1}{4})$ under the same mapping.

- A. $(2\frac{1}{2}, -2)$
B. $(2\frac{1}{2}, -\frac{1}{2})$
C. $(2, 2)$
D. $(2, -\frac{1}{4})$
E. $(2, 2\frac{1}{2})$

25. The ages (in years) of eight boys are:

14, 14.5, 15, 12, 11.5, 13, 10.5 and 13.5.

What is their average age?

- A) 14 B) 13 C) 12 D) 11 E) 10

26. Convert 133_{five} to a base ten numeral.

- A) 23 B) 25 C) 31 D) 40 E) 43

27. Find the simple interest on ₦15,000.00 at rate of 20% per annum for 5 years.

- A) ₦10,000.00
B) ₦15,000.00
C) ₦30,000.00
D) ₦50,000.00
E) ₦90,000.00

28. List all members of the set $\{x: 2 < x < 8, x \text{ is an integer}\}$

- A. $\{3, 4, 5\}$
B. $\{2, 3, 4, 5, 6, 7, 8\}$
C. $\{2, 2\frac{1}{2}, 3, 4, 5, 6, 7, 8\}$
D. $\{3, 3\frac{1}{2}, 3, 4, 5, 6, 7, 8\}$
E. $\{3, 4, 5, 6, 7\}$

29. Simplify $348.94 - 188.34$

A) 60.60 B) 60.68 C) 160.60 D) 200.60 E) 206.60

30. Find the difference between the values of $(2d)^2$ and $2d^2$ when $d=3$

A) 16 B) 18 C) 24 D) 28 E) 54

31. The heights of two boys are in the ratio 4:5. The shorter boy is 80cm. What is the height of the taller boy?

A) 100cm B) 150cm C) 164cm D) 180cm E) 200cm

32. Factorize completely $5xy + 10ny$

- A. $5y(x + n)$
- B. $5y(x + 2n)$
- C. $5xy(1 + 2n)$
- D. $5(xy + 2ny)$
- E. $x(5x + 10n)$

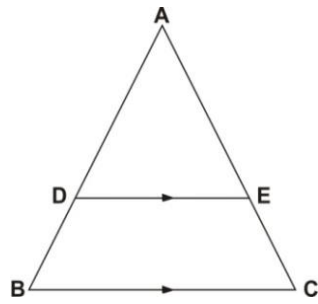
33. If $13x - 12 = 5x + 60$, find x

A) -9 B) -6 C) 4 D) 6 E) 9

34. The length of a spring when a mass of n kg is hung on it is $L = (74+15n)$ mm. What is the length of the spring when a mass of 1.20kg is hanged on it?

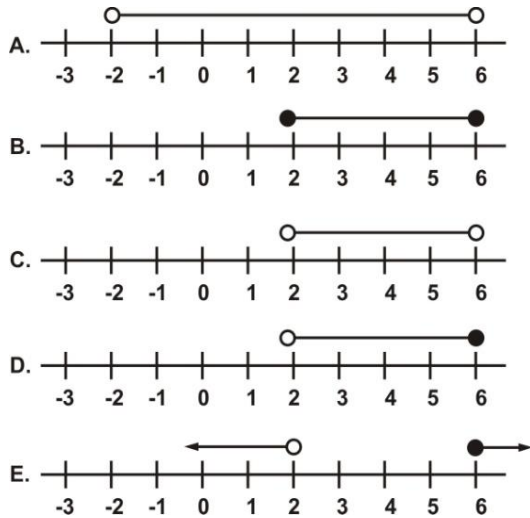
- A) 75.20 mm
- B) 89.00 mm
- C) 92.00mm
- D) 97.00 mm
- E) 104.00mm

35. In the figure below, triangle ABC is an enlargement of triangle ADE. If $|AE| = 20\text{cm}$ and $|EC| = 10\text{cm}$. What is the scale factor of the enlargement?



- A) $\frac{1}{2}$ B) $\frac{3}{2}$ C) 2 D) $\frac{5}{2}$ E) 3

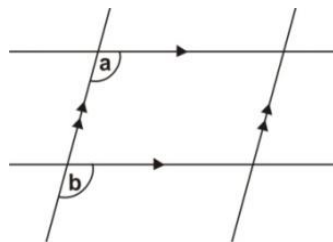
36. Which of the number lines below represents the inequality $2 < x \leq 6$?



37. A cylinder has a radius 6cm and height 7cm. Find its volume. (Take $\pi = \frac{22}{7}$)

- A) 132cm^3 B) 264cm^3 C) 294cm^3 D) 792cm^3 E) 924cm^3

38.



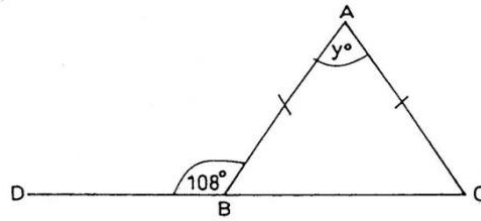
The angles a and b in the figure above are

- A) interior opposite
B) corresponding
C) vertically opposite
D) acute
E) alternate

39. A man travelled a distance of 1.2km in 30 minutes. What distance can he cover in 55 minutes travelling at the same speed?

- A) 1.375km B) 2.02km C) 2.2km D) 12.02km E) 13.25km

40.



In the diagram above, $\triangle ABC$ is an isosceles triangle. $\angle ABD$ is 108° . Find the value of y .

- A) 72 B) 60 C) 48 D) 36 E) 24

August 1995

MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. D. $\{3, 5, 7\}$
2. A) 1101000
3. D) 6
4. C) 34056 mm
5. C) 3.5607×10^2
6. C) $1 \frac{2}{5}$
7. D) Distributive
8. D) 12
9. B) 4
10. B) $y = 2^x$
11. A) $x < 1$
12. E) 80%
13. D) 6
14. E) $\frac{1}{6}$
15. E) -4

16. E) 40

17. A) $a = \frac{P - 2b}{2}$

18. B) 3

19. B) 14

20. D) $\frac{2}{5}$

21. D. $\binom{4}{9}$

22. A) $\frac{4}{5}, \frac{3}{4}, \frac{13}{20}, \frac{5}{8}$

23. E) 4

24. B. $(2\frac{1}{2}, -\frac{1}{2})$

25. B) 13

26. E) 43

27. B) $\phi 15,000.00$

28. E. $\{3,4,5,6,7\}$

29. C) 160.60

30. B) 18

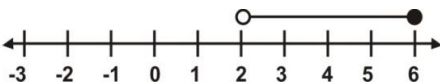
31. A) 100cm

32. B. $5y(x + 2n)$

33. E) 9

34. C) 92.00 mm

35. B) $\frac{3}{2}$

36. D. 

37. D) 792 cm^3

38. B) corresponding
39. C) 2.2km
40. D) 36

August 1995

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

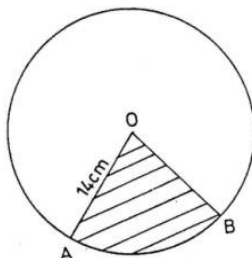
All questions carry equal

1. (a) There are 20 students in a hostel. 16 of them are fluent in French and 10 of them are fluent in English. Each student is fluent in at least one of the two languages
 - (i) Illustrate this information on a Venn diagram
 - (ii) How many students are fluent in both English and French?
 - (b) The sum of the ages of two brothers: Kofi and Kwaku is 35. Kofi's age is two-thirds of Kwaku's age. Find their ages.
-
2. (a) Using a ruler and a pair of compasses only
 - (i) construct triangle ABC such that $|AB| = 9\text{cm}$, angle $BAC = 60^\circ$ and angle $ABC = 45^\circ$.
 - (ii) construct a line from the point C perpendicular to line AB and let it meet AB at P. Measure $|CP|$ and $|AP|$
 - (b) What is the value of angle ACP?

3. (a) Mansah earns a salary of ₦10,000.00 per month as a sales girl. In addition to the salary, she is given a commission of 1.5% of whatever sales she makes in a month.

In January this year, she made sales of ₦7,500,000.00. What was the total amount Mansah earned at the end of January?

- (b) The diagram below shows a circle with centre O and radius 14cm. The shaded region AOB is a sector with angle $\text{AOB} = 72^\circ$.



Find:

- (i) The length of the minor arc AB
- (ii) The area of the shaded sector AOB [Take $\pi = \frac{22}{7}$]

4. (a) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular axes, OX and OY on a graph sheet.
- (b) On the graph sheet, mark the x-axis from -5 to 5 and the y-axis from -6 to 6
- (c) Plot on the same graph sheet the points A(1, 1 ½), B(4, 1 ½) and C (1, 4). Join the points to form a triangle. What type of triangle have you drawn ?
- (d) Draw the image triangle A₁B₁C₁ of ABC under a reflection in the y-axis, where A→A₁, B→B₁ and C→C₁. Label the vertices and the co-ordinates clearly.
- (e) Draw the image triangle A₂B₂C₂ of triangle ABC under an enlargement with scale factor -1 with the centre of enlargement as the origin (0,0), where A→A₂, B→B₂ and C→C₂. Show all lines of enlargement. Label the vertices and co-ordinates clearly
- (f) What single transformation maps A₁B₁C₁ onto A₂B₂C₂ where A₁→A₂, B₁→ B₂ and C₁→C₂ ?

5. (a) The data below shows the distribution of the ages of workers in a factory.

| Age (in years) | No. of workers |
|----------------|----------------|
| 19 | 3 |
| 24 | 7 |
| 29 | 8 |
| 34 | 4 |
| 39 | 5 |
| 44 | 3 |

- (i) How many workers are there in the factory?
- (ii) What is the modal age of the distribution?
- (iii) Calculate the mean age of the workers, correct to one decimal place.

(b) (i) Make T the subject of the relation
$$I = \frac{P \times T \times R}{100}$$

- (ii) If $I = \text{¢}40,000.00$, $P = \text{¢}64,000.00$ and $R = 25\%$, find the value of T in years

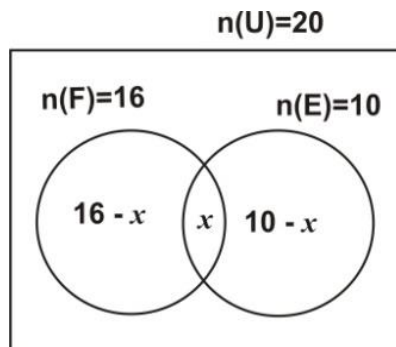
August 1995

MATHEMATICS

SECTION B ESSAY

SOLUTIONS

- 1(a) (i)** Let $n(U)$ = No. of students in the hostel
 $n(F)$ = No. of students who are fluent in French
 $n(E)$ = No. of students who are fluent in English
 x = No. of students who are fluent in both French and English



- (ii)** From the Venn diagram in (i) above,

$$\begin{aligned}16 - x + x + 10 - x + 0 &= 20 \\ \Rightarrow 16 + 0 + 10 - x + 0 &= 20 \\ \Rightarrow 26 - x &= 20 \\ \Rightarrow 26 - 20 &= x \\ \Rightarrow x &= 26 - 20 \\ \Rightarrow \underline{\underline{x}} &= \underline{\underline{6}} \\ \therefore \underline{\underline{6 \text{ students are fluent in both English and French}}}\end{aligned}$$

1(b)

$$\text{Kofi's} + \text{Kweku's} = 35 \quad \text{-----}[1]$$

$$\text{And Kofi's} = \frac{2}{3} \times \text{Kweku's} \quad \text{-----[2]}$$

\Rightarrow Putting [2] in [1], we have

$$\Rightarrow \left(\frac{2}{3} \times \text{Kweku's}\right) + \text{Kweku's} = 35 \quad \text{-----[3]}$$

Letting Kweku's age = w , [3] becomes

$$\frac{2}{3} \times w + w = 35$$

Approach 1 [\(Multiplying through by 3 to clear fractions first\)](#)

$$\Rightarrow 3 \times \left(\frac{2}{3} w\right) + 3(w) = 3(35)$$

$$\Rightarrow 2w + 3w = 105$$

$$\Rightarrow 5w = 105$$

$$\Rightarrow w = 105 \div 5$$

$$\Rightarrow \underline{\underline{w = 21}}$$

Therefore Kweku is 21 years old

and Kofi's age = two-thirds of 21 years

$$= \frac{2}{3} \times 21 \text{ years}$$

$$= 2 \times 7 \text{ years}$$

$$= \underline{\underline{14 \text{ years}}}$$

1(b)

Approach 2 [\(Simplifying the LHS first\)](#)

$$\frac{2}{3} \times w + w = 35$$

$$\Rightarrow \frac{2w}{3} + \frac{w}{1} = 35$$

$$\Rightarrow \frac{2w + 3w}{3} = 35$$

$$\Rightarrow \frac{5w}{3} = 35$$

$$\Rightarrow 5w = 35 \times 3$$

$$\Rightarrow 5w = 105$$

$$\Rightarrow \frac{5w}{5} = \frac{105}{5}$$

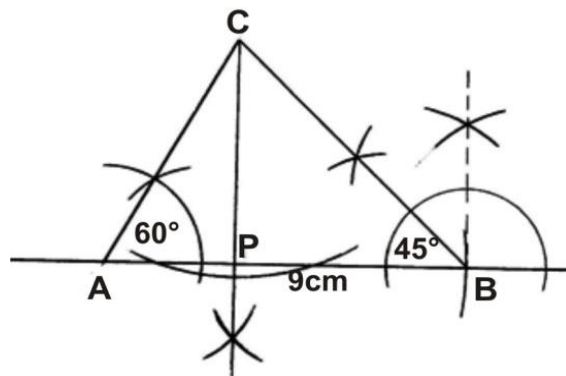
$$\Rightarrow \underline{\underline{w = 21}}$$

Therefore Kweku is 21 years old

and Kofi's age = two-thirds of 21 years

$$\begin{aligned}
 &= \frac{2}{3} \times 21 \text{ years} \\
 &= 2 \times 7 \text{ years} \\
 &= \underline{14 \text{ years}}
 \end{aligned}$$

2 (a)



$$\begin{aligned}
 \text{(a) (ii)} \quad |CP| &\approx \underline{5.7 \text{ cm}} \\
 |AP| &\approx \underline{3.3 \text{ cm}} \\
 \text{(b)} \quad \text{angle ACP} &\approx \underline{30^\circ}
 \end{aligned}$$

$$\begin{aligned}
 \text{3 (a)} \quad \text{Total amount earned} &= \text{Salary} + \text{Commission} \\
 &= \text{¢}10,000 + 1.5\% \text{ of Sales} \\
 &= \text{¢}10,000 + \left(\frac{1.5}{100} \times \text{¢}7,500,000 \right) \\
 &= \text{¢}10,000 + \text{¢}112,500 \\
 &= \underline{\text{¢} 122,500}
 \end{aligned}$$

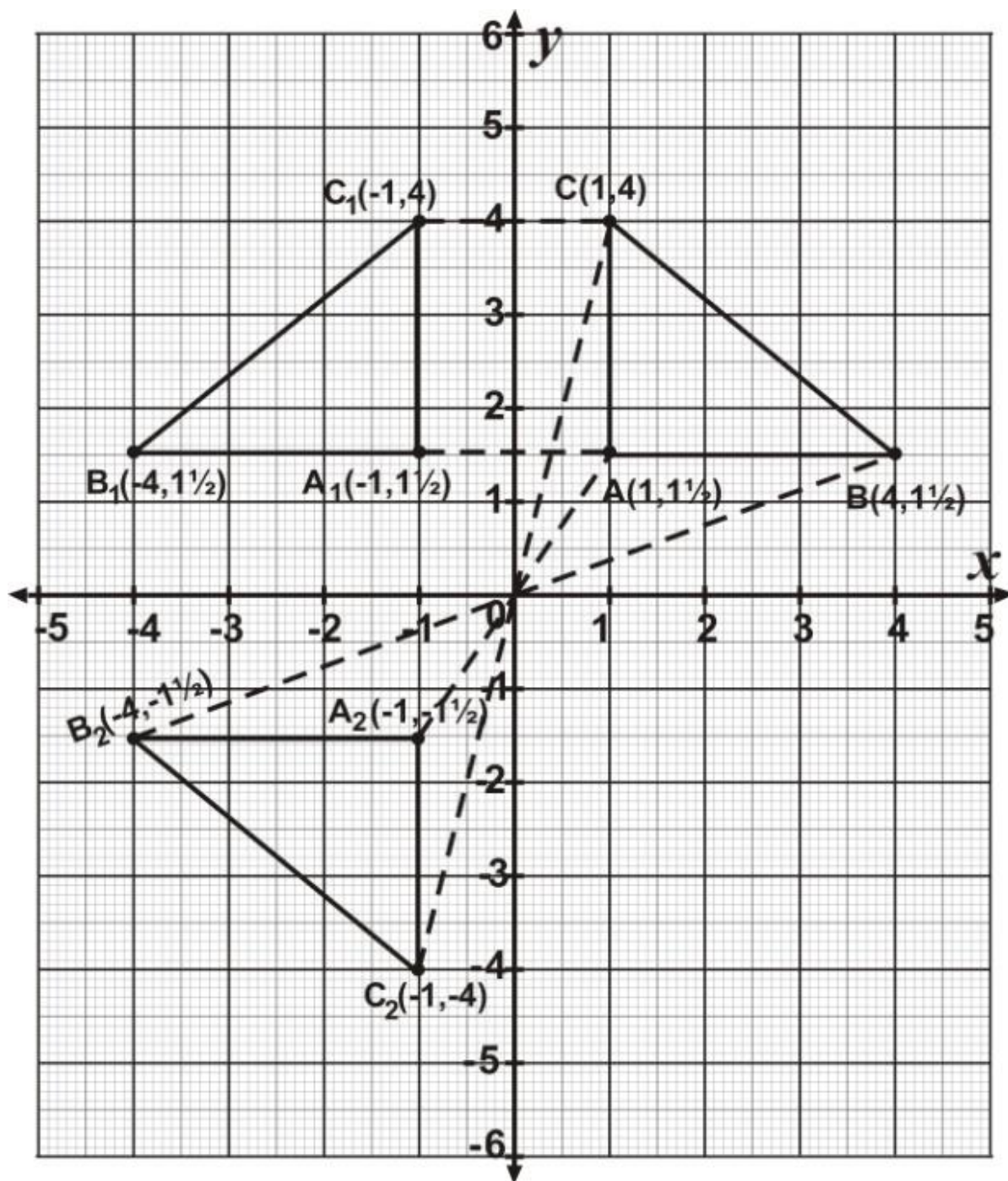
$$\begin{aligned}
 \text{3 (b) (i)} \quad \text{Length of minor arc} &= \text{fraction of circumference} \\
 &= \text{Minor arc AB fraction} \times \text{Circumference.} \\
 &= \frac{\theta}{360^\circ} \times 2 \pi r \\
 &= \frac{72^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 14 \text{ cm} \\
 &= \frac{1}{5} \times 2 \times 22 \times 2 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 &= \frac{88}{5} \text{ cm} \\
 &= \underline{\underline{17\frac{3}{5} \text{ cm}}} \quad \text{or} \quad \underline{\underline{17.6 \text{ cm}}}
 \end{aligned}$$

(ii) Area of the shaded sector AOB = fraction of area

$$\begin{aligned}
 &= \text{Minor area AOB fraction} \times \text{area} \\
 &= \frac{\theta}{360^\circ} \times \pi r^2 \\
 &= \frac{72^\circ}{360^\circ} \times \frac{22}{7} \times (14\text{cm})^2 \\
 &= \frac{72^\circ}{360^\circ} \times \frac{22}{7} \times 14\text{cm} \times 14\text{cm} \\
 &= \frac{1}{5} \times 22 \times 2\text{cm} \times 14\text{cm} \\
 &= \frac{616\text{cm}^2}{5} \\
 &= \underline{\underline{123\frac{1}{5} \text{ cm}^2}} \quad \text{or} \quad \underline{\underline{123.2 \text{ cm}^2}}
 \end{aligned}$$

4 (a) **Approach 1** ([By Inspection / Construction](#))



Approach 2 [\(The rule / formula\)](#)

4 (d)

Reflecting (x, y) in the y-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$OA \begin{pmatrix} 1 \\ 1\frac{1}{2} \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} -1 \\ 1\frac{1}{2} \end{pmatrix}, \quad \therefore A_1(-1, 1\frac{1}{2})$$

$$OB \begin{pmatrix} 4 \\ 1\frac{1}{2} \end{pmatrix} \rightarrow OB_1 \begin{pmatrix} -4 \\ 1\frac{1}{2} \end{pmatrix}, \quad \therefore B_1(-4, 1\frac{1}{2})$$

$$OC\begin{pmatrix} 1 \\ 4 \end{pmatrix} \rightarrow OC_1\begin{pmatrix} -1 \\ 4 \end{pmatrix}, \quad \therefore C_1(-1,4)$$

\therefore Plot and join $A_1(-1,1\frac{1}{2})$, $B_1(-4,1\frac{1}{2})$ and $C_1(-1,4)$ as the image of triangle ABC under a reflection in the y axis.

4 (e) Enlarging (x, y) from $(0,0)$ by scale factor k

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow k \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} kx \\ ky \end{pmatrix}$$

$$OA\begin{pmatrix} 1 \\ 1\frac{1}{2} \end{pmatrix} \rightarrow OA_2\begin{pmatrix} -1 \times 1 \\ -1 \times 1\frac{1}{2} \end{pmatrix} = \begin{pmatrix} -1 \\ -1\frac{1}{2} \end{pmatrix}, \quad \therefore A_2(-1, -1\frac{1}{2})$$

$$OB\begin{pmatrix} 1 \\ 1\frac{1}{2} \end{pmatrix} \rightarrow OB_2\begin{pmatrix} -1 \times 4 \\ -1 \times 1\frac{1}{2} \end{pmatrix} = \begin{pmatrix} -4 \\ -1\frac{1}{2} \end{pmatrix}, \quad \therefore B_2(-4, -1\frac{1}{2})$$

$$OC\begin{pmatrix} 1 \\ 4 \end{pmatrix} \rightarrow OC_2\begin{pmatrix} -1 \times 1 \\ -1 \times 4 \end{pmatrix} = \begin{pmatrix} -1 \\ -4 \end{pmatrix}, \quad \therefore C_2(-1, -4)$$

\therefore Plot and join $A_2(-1, -1\frac{1}{2})$, $B_2(-4, -1\frac{1}{2})$ and $C_2(-1, -4)$ as the image of triangle ABC under an enlargement by scale factor -1 from the origin $(0,0)$

4(f) The single transformation that maps $A_1B_1C_1$ onto $A_2B_2C_2$ is reflection in the x-axis

$$\begin{aligned} \text{5 (a) (i)} \quad \text{Total no. of workers} &= 3 + 7 + 8 + 4 + 5 + 3 \\ &= \underline{\underline{30}} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad \text{Modal age} &= \text{the most occurring age} \\ &= \underline{\underline{29 \text{ years}}} \end{aligned}$$

(iii) Finding Mean age using the table,

| Age in years (x) | No. of workers (f) | f x |
|---------------------|-----------------------------------|-------------------------------------|
| 19 | 3 | 57 |
| 24 | 7 | 168 |
| 29 | 8 | 232 |
| 34 | 4 | 136 |
| 39 | 5 | 195 |
| 44 | 3 | 132 |
| | $\Sigma f = 30$ | $\Sigma fx = 920$ |

$$\begin{aligned}
 \text{The mean age} &= \frac{\Sigma f x}{\Sigma f} = \frac{920}{30} \\
 &= \underline{\underline{30\frac{2}{3} \text{ years}}} \approx \underline{\underline{30.67 \text{ years}}}
 \end{aligned}$$

5 (b) (i)

$$I = \frac{P \times T \times R}{100}, \quad \text{making } T \text{ the subject}$$

$$\Rightarrow 100 I = P T R \quad \text{Cross-multiplying}$$

$$\Rightarrow \frac{100 I}{P R} = \frac{P T R}{P R}$$

$$\Rightarrow \frac{100 I}{P R} = T$$

$$\Rightarrow \underline{\underline{T = \frac{100 I}{P R}}}$$

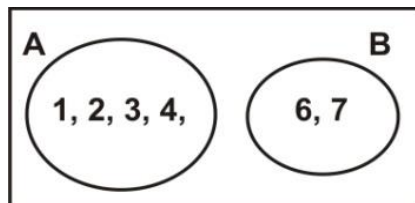
$$\begin{aligned}
 \text{(ii)} \quad T &= \frac{100 I}{P R} \\
 &= \frac{100 \times 40,000}{64,000 \times 25} \\
 &= \frac{5}{2} \\
 &= \underline{\underline{2\frac{1}{2} \text{ years}}}
 \end{aligned}$$

August 1994

MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. Which of the following is the set of factors of 12?
- A. {12, 6, 4, 3, 2, 1}
 - B. {12, 6, 4, 3, 2}
 - C. {12, 6, 4, 2}
 - D. {6, 4, 2, 1}
 - E. {6, 4, 3, 2}
2. Which of the following describes the relationship between the sets A and B in the Venn diagram below?



- A) $A \subset B$
 - B) $A \cap B = 5$
 - C) $A \cap B = \phi$
 - D) $A \cup B = \{1, 2, 3, 4, 5, 6, 7\}$
 - E) $B \subset A$
3. Mark is 30 years old. Yaw is half as old as Mark. Paul is 10 years older than Yaw. How old is Paul?
- A) 30 years
 - B) 25 years
 - C) 20 years
 - D) 15 years
 - E) 10 years

4. How many lines of symmetry does a rectangle have ?

- A) 1 B) 2 C) 3 D) 9 E) 11

5. Which of the following is not a prime number ?

- A) 3 B) 5 C) 7 D) 9 E) 11

6. If $x = \{1, 2, 3, 4, 5\}$, find the truth set of $2x + 1 < 7$

- A. $\{1, 2\}$ B. $\{2, 3\}$ C. $\{1, 2, 3\}$ D. $\{3\}$ E. $\{2\}$

7. In how many years will ₺5,000.00 yield a simple interest of ₺1,000.00 at a rate of 5% per annum.

- A) 4 years
B) 5 years
C) 10 years
D) 25 years
E) 30 years

8. Make m the subject of the relation $f = \frac{t}{s} - m$

A) $m = \frac{t}{s} + f$

B) $m = \frac{t}{s} - f$

C) $m = \frac{fs - t}{s}$

D) $m = f - \frac{t}{s}$

E) $m = -f - \frac{t}{s}$

9. Which property of arithmetic operation is illustrated by the statement:

$$a \times (b+c) = ab + ac ?$$

- A) Addition
- B) Association
- C) Commutative
- D) Multiplication
- E) Distributive

10. Simplify $15^9 \div 15^7$

- A) 30 B) 63 C) 225 D) 240 E) 625

11. If $\frac{1}{x} = 1\frac{1}{2}$, find x.

- A) $3\frac{1}{2}$ B) $\frac{3}{2}$ C) $\frac{4}{3}$ D) $\frac{2}{3}$ E) $\frac{1}{3}$

12. Calculate the size of an exterior angle of a regular pentagon.

- A) 72° B) 90° C) 108° D) 360° E) 540°

13. Factorize $x^2 - 5x + 6$

- A. $(x + 3)(x - 2)$
- B. $(x - 2)(x - 3)$
- C. $(x + 1)(x - 6)$
- D. $(x + 2)(x + 3)$
- E. $(x + 6)(x - 1)$

14. Kwame, Atsu and Kojo shared a profit of ₵500,000.00 in the ratio 1:4:3 respectively. How much did Atsu get?

- A) ₵62,500.00
- B) ₵125,000.00
- C) ₵187,500.00
- D) ₵250,000.00
- E) ₵312,500.00

15. Use the identity $a^2 - b^2 = (a + b)(a - b)$ to evaluate $83^2 - 17^2$

- A) 660 B) 6,600 C) 7,178 D) 7,600 E) 8,317

16. What is the probability of obtaining a prime number when a fair die is thrown once?

- A) $\frac{2}{3}$ B) $\frac{1}{2}$ C) $\frac{1}{3}$ D) $\frac{1}{6}$ E) $\frac{5}{6}$

17. The following are the scores obtained by girls in a beauty contest:

12, 16, 19, 14, 17, 8, 11, 19.

What is the probability of obtaining a score of 19?

- A) $\frac{1}{9}$ B) $\frac{1}{8}$ C) $\frac{1}{4}$ D) $\frac{19}{53}$ E) $\frac{19}{108}$

18. Express 25 as a percentage of 75.

- A) 300% B) 100% C) 50% D) 33.3% E) 25%

19. Find the value of m given that $m = (3^6 \div 3^4) \times 27$

- A) 3^1 B) 3^2 C) 3^5 D) 3^6 E) 3^{13}

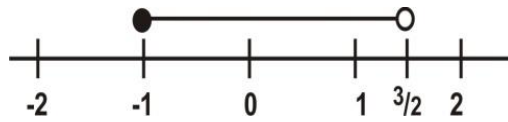
20. Express 0.0043216 in standard form

- A) 4.3216×10^{-4}
B) 4.3216×10^{-3}
C) 4.3216×10
D) 4.3216×10^3
E) 4.3216×10^4

21. Given that $a = 2$ and $b = 3$, evaluate $(2a + b)(a - 2b)$

- A) 28 B) 8 C) -7 D) -8 E) -28

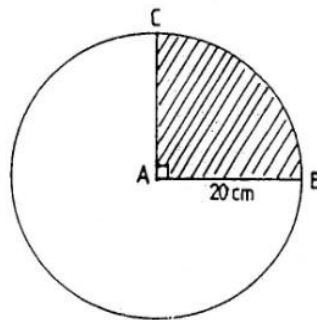
22.



Which of the following is illustrated on the number line above?

- A) $-1 < x < \frac{3}{2}$
- B) $-1 \leq x < \frac{3}{2}$
- C) $-1 \leq x \leq \frac{3}{2}$
- D) $-1 < x \leq \frac{3}{2}$
- E) $\frac{3}{2} \leq x \leq -1$

23.



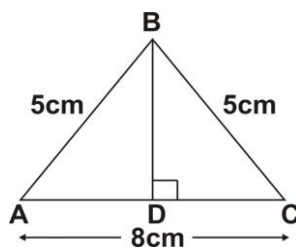
In the diagram above, A is the centre of the circle with radius 20cm. If angle BAC is 90° , find the perimeter of the shaded sector.

[Take $\pi = 3.14$]

- A) 31.4cm B) 31.8cm C) 40.0cm D) 51.4cm E) 71.4

24. In triangle ABC, $|AB| = |BC| = 5\text{cm}$, and $|AC| = 8\text{cm}$.

Find $|BD|$.



- A) 3cm B) 4cm C) 9cm D) 33cm E) 41cm

25. Write ¢35,632.00 correct to the nearest thousand cedis.

- A. ¢40,000.00
- B. ¢36,000.00
- C. ¢35,600.00
- D. ¢35,000.00
- E. ¢30,000.00

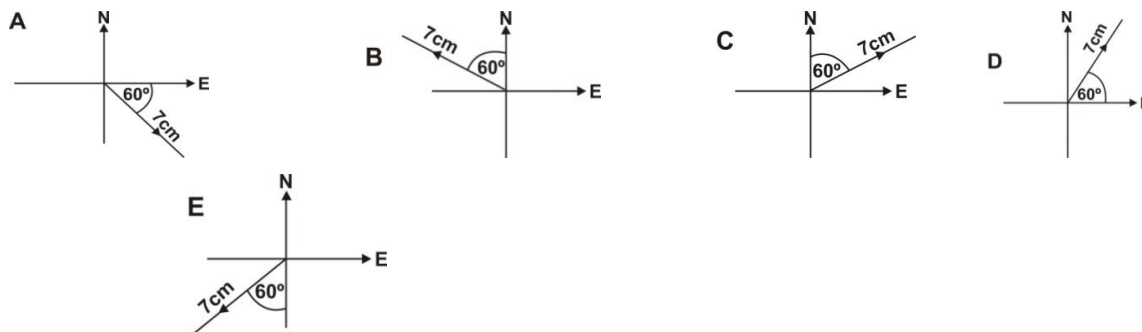
26. Solve for x if $2x + 5 = 3x - 7$

- A) 12
- B) 2
- C) $\frac{2}{3}$
- D) -2
- E) -12

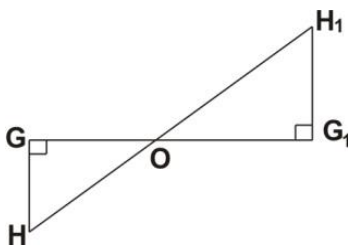
27. Evaluate $(\frac{2}{3} - \frac{1}{4}) \div \frac{5}{6}$

- A) $\frac{1}{2}$
- B) $\frac{1}{5}$
- C) $\frac{2}{3}$
- D) -2
- E) -12

28. A boy walked 7km on a bearing 060° . Which of the following diagrams shows his direction.



29.



In the diagram, $G'OH'$ is an enlargement of triangle GOH with scale factor k . If $|GG'| = 5\text{cm}$, $|GO| = 2\text{cm}$ and $|G'H'| = 1\text{cm}$. What is the value of k ?

- A) $-\frac{5}{2}$
- B) $-\frac{3}{2}$
- C) $-\frac{2}{5}$
- D) $\frac{2}{3}$
- E) $\frac{3}{2}$

30. If $14_x = 9_{\text{ten}}$, find x .

- A) Nine B) Eight C) Seven D) Six E) Five

31. How many faces has a cuboid ?

- A) 6 B) 8 C) 12 D) 16 E) 32

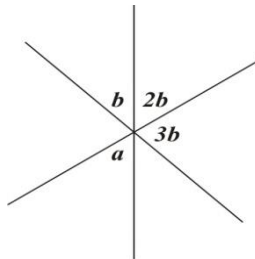
32. Which of the following is a factor of the expression $ac - 2bc + ad - 2bd$?

- A) $c - d$ B) $a - 2b$ C) $a + b$ D) $a + 2b$ E) $c + 2d$

33. Three boys weeded a piece of land in 4 hours. How long would it take 18 boys to weed the same piece of land weeding at the same rate?

- A) $\frac{2}{3} h$ B) $3 \frac{1}{3} h$ C) $4 \frac{2}{3} h$ D) 22 h E) 24 h

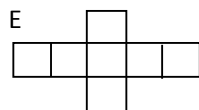
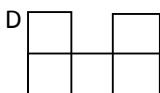
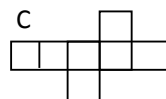
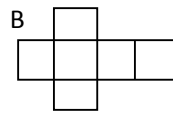
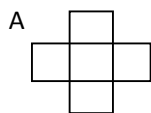
34.



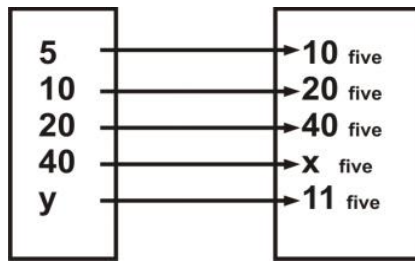
Find the size of the angle marked a in the diagram above.

- A) 30° B) 60° C) 90° D) 120° E) 180°

35. Which of the following is the net of a cube?



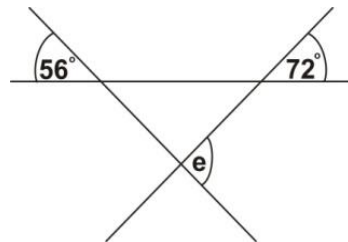
36. Use the mapping below to answer question 36



Find the value of x

- A) 30_{five} B) 100_{five} C) 110_{five} D) 120_{five} E) 130_{five}

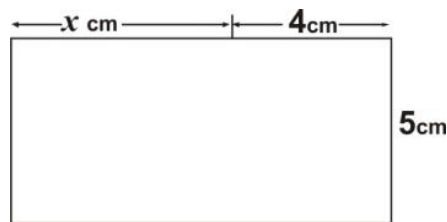
37.



In the diagram above, find the size of the angle marked e° .

- A) 52° B) 56° C) 72° D) 108° E) 128°

38.



If the area of the figure below is 60cm^2 , find x .

- A) 8cm B) 9cm C) 12cm D) 16cm E) 20cm

39. The mean of the numbers 4, 3, 3, x is 5, find x

- A) 20 B) 10 C) 5 D) 4 E) 3

40. If a number is selected at random from the table below, what is the probability that the number is 5?

| Number | 1 | 3 | 5 | 7 | 9 |
|-----------|----|----|---|----|---|
| Frequency | 25 | 15 | 8 | 10 | 2 |

- A) $\frac{8}{25}$ B) $\frac{4}{25}$ C) $\frac{1}{12}$ D) $\frac{2}{15}$ E) $\frac{5}{8}$

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. A. $\{12, 6, 4, 3, 2, 1\}$

2. C) $A \cap B = \emptyset$

3. B) 25 years

4. B) 2

5. D) 9

6. A. $\{1, 2\}$

7. A) 4 years

8. B) $m = \frac{t}{s} - f$

9. E) Distributive

10. C) 225

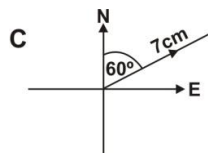
11. D) $\frac{2}{3}$

12. A) 72°

13. B. $(x - 2)(x - 3)$

14. D) ₦250,000.00

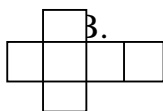
15. B) 6,600
16. B) $\frac{1}{2}$
17. C) $\frac{1}{4}$
18. D) 33.3%
19. B) 3^2
20. B) 4.3216×10^{-3}
21. E) -28
22. B) $-1 \leq x < \frac{3}{2}$
23. E) 71.4 cm
24. A) 3cm
25. B. ¢36,000.00
26. A) 12
27. A) $\frac{1}{2}$



- 28.
29. B) $-\frac{3}{2}$
30. E) Five
31. A) 6
32. B) $a - 2b$
33. A) $\frac{2}{3}$ hour

34. B) 60°

- 35.



36. E) 130_{five}

37. E) 128°

38. A) 8cm

39. B) 10

40. D) $\frac{2}{15}$

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

*Attempt **four** questions **only** from this section*

All working must be clearly shown.

The use of calculators is not allowed

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Multiply $(a - b)$ by $(2b - a)$

(b) Find the truth set of $2x - 6 \leq 5(3 - x)$.

Illustrate your answer on a number line.

(c) Given that $u = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $v = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$, find $\frac{1}{3}(u + \frac{1}{2}v)$

2. (a) A ladder leans against a wall. The end of the ladder touches the wall 12m from the ground. The foot of the ladder is 9m away from the foot of the wall.

(i) What is the length of the ladder?

(ii) Calculate the angle that the ladder makes with the wall.

(b) Given that $\pi = 3.14$ and $g = 20$. Find the value of F in the relation $F = \frac{3}{4}\pi g^2$

3. Using a ruler and a pair of compasses only,

- a) construct triangle PQR in which $|PQ| = 8\text{cm}$, angle $QPR = 45^\circ$ and angle $PQR = 90^\circ$. Measure $|QR|$
- b) construct the mediator of line PQ to meet line PR at the point S.
- c) With S as the centre and radius 3cm, construct a circle.

4. Using a scale of 2cm to 1 unit on both axis, draw two perpendicular lines OX and OY on a graph sheet. Mark the x-axis from -5 to 5 and the y-axis from -6 to 6 . Mark the origin O. Draw on the same graph sheet, indicating in each case, the co-ordinates of all the vertices,

- (i) The square ABCD where A(1,2), B(4, 2), C(4,5) and D(1,5)
- (ii) Using the y-axis as a mirror line draw the image $A_1B_1C_1D_1$ of square ABCD where $A \rightarrow A_1$, $B \rightarrow B_1$, $C \rightarrow C_1$ and $D \rightarrow D_1$
- (iii) Draw an enlargement $A_2B_2C_2D_2$ of the square ABCD with scale factor -1 from O, such that $A \rightarrow A_2$, $B \rightarrow B_2$, $C \rightarrow C_2$ and $D \rightarrow D_2$
- (iv) What single transformation maps $A_2B_2C_2D_2$ onto the square $A_1B_1C_1D_1$?

5. The following table gives the distribution of sales of soft drinks sold by the Akrokyere JSS canteen in one week.

| Soft Drink | Number of bottles sold |
|------------|------------------------|
| Fanta | 13 |
| Pepsi | 21 |
| Mirinda | 14 |
| Coca-cola | 17 |
| Sprite | 7 |

Draw a pie chart to illustrate the sales.

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

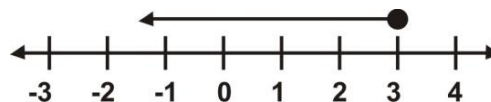
1 (a)

$$\begin{aligned} & (a - b)(2b - a) \\ & 2ab - a^2 - 2b^2 + ab \\ \Rightarrow & 2ab + ab - a^2 - 2b^2 \\ \Rightarrow & \underline{3ab - a^2 - 2b^2} \end{aligned}$$

(b)

$$\begin{aligned} 2x - 6 & \leq 5(3 - x) \\ \Rightarrow 2x - 6 & \leq 15 - 5x \\ \Rightarrow 2x + 5x & \leq 15 + 6 \\ \Rightarrow 7x & \leq 21 \\ \Rightarrow \frac{7x}{7} & \leq \frac{21}{7} \\ \Rightarrow \underline{\underline{x \leq 3}} \end{aligned}$$

The number line illustration is shown below:

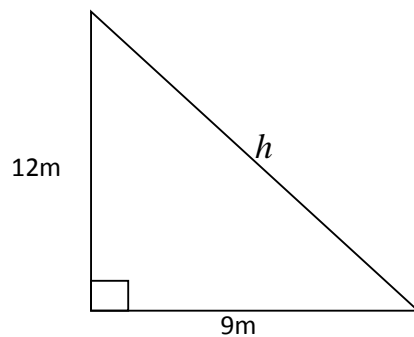


(c)

$$\begin{aligned} & \frac{1}{3}(\mathbf{u} + \frac{1}{2}\mathbf{v}) \\ = & \frac{1}{3}\left[\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \frac{1}{2}\begin{pmatrix} 2 \\ 6 \end{pmatrix}\right] \end{aligned}$$

$$\begin{aligned}
&= \frac{1}{3} \left[\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} \frac{1}{2} \times 2 \\ \frac{1}{2} \times 6 \end{pmatrix} \right] \\
&= \frac{1}{3} \left[\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix} \right] \\
&= \frac{1}{3} \begin{pmatrix} -2+1 \\ 3+3 \end{pmatrix} = \frac{1}{3} \begin{pmatrix} -1 \\ 6 \end{pmatrix} \\
&= \begin{pmatrix} \frac{1}{3} \times -1 \\ \frac{1}{3} \times 6 \end{pmatrix} = \underline{\underline{\begin{pmatrix} -\frac{1}{3} \\ 2 \end{pmatrix}}}
\end{aligned}$$

- 2 (a) (i)** From the Pythagorean Theorem, if h is the hypotenuse of a right-angled triangle and a and b are the other two sides, then $h^2 = a^2 + b^2$



From the diagram above, if h = length of ladder, we have

$$h^2 = (12\text{m})^2 + (9\text{m})^2$$

$$h^2 = 144\text{m}^2 + 81\text{m}^2$$

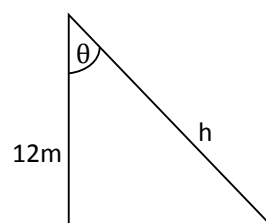
$$h^2 = 225\text{m}^2$$

$$h = \sqrt{225\text{m}^2}$$

$$h = \underline{\underline{15\text{ m}}}$$

The length of the ladder is 15m

(a) (ii)



$$\tan \theta = \frac{\text{Opposite side}}{\text{adjacent side}}$$

From the diagram above,

$$\Rightarrow \tan \theta = \frac{9 \text{ m}}{12 \text{ m}}$$

$$\Rightarrow \tan \theta = \frac{3}{4}$$

$$\Rightarrow \theta = \tan^{-1}\left(\frac{3}{4}\right)$$

$$\Rightarrow \underline{\underline{\theta \approx 36.87^\circ}} \quad (\text{Using tables or a scientific calculator})$$

(b) $F = \frac{3}{4} \pi g^2,$

given that $\pi = 3.14$ and $g = 20$

$$= \frac{3}{4} \times 3.14 \times 20^2$$

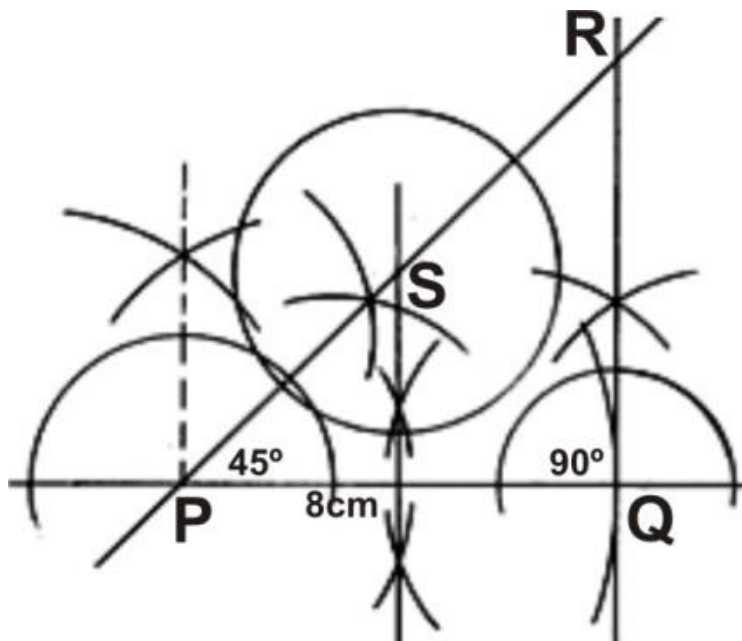
$$= \frac{3}{4} \times 3.14 \times 400$$

$$= 3 \times 3.14 \times 100$$

$$= 3 \times 314$$

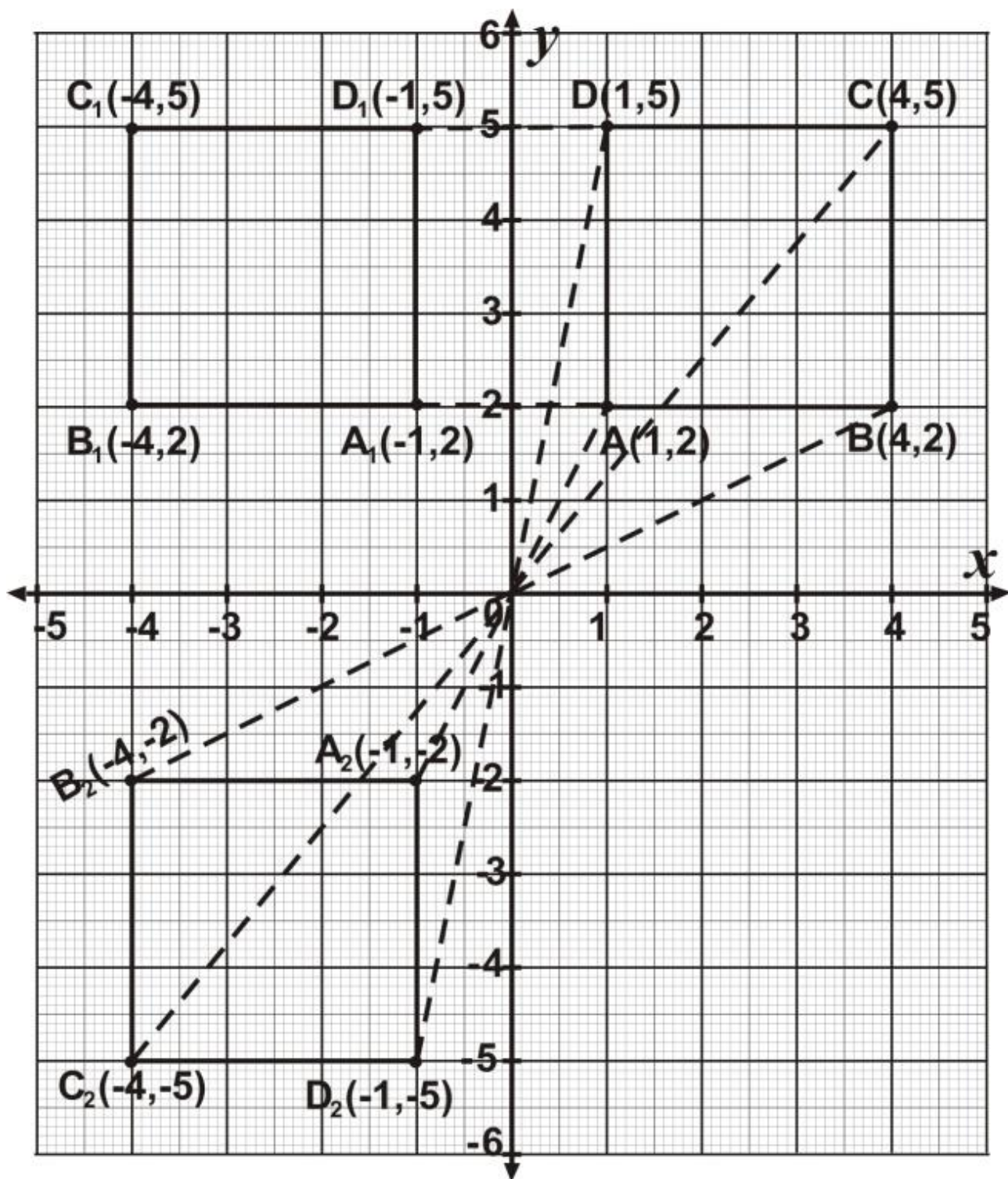
$$= \underline{\underline{942}}$$

3.



(a) $|QR| = \underline{\underline{8\text{ cm}}}$

4. Approach 1 ([By Inspection / Construction](#))



4. (ii)

Approach 2 [\(The rule / formula\)](#)

Reflecting (x, y) in the y-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$OA \begin{pmatrix} 1 \\ 2 \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} -1 \\ 2 \end{pmatrix}, \quad \therefore A_1(-1, 2)$$

$$OB\begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OB_1\begin{pmatrix} -4 \\ 2 \end{pmatrix}, \quad \therefore B_1(-4, 2)$$

$$OC\begin{pmatrix} 4 \\ 5 \end{pmatrix} \rightarrow OC_1\begin{pmatrix} -4 \\ 5 \end{pmatrix}, \quad \therefore C_1(-4, 5)$$

$$OD\begin{pmatrix} 1 \\ 5 \end{pmatrix} \rightarrow OD_1\begin{pmatrix} -1 \\ 5 \end{pmatrix}, \quad \therefore D_1(-1, 5)$$

\therefore Plot and join $A_1(-1, 2)$, $B_1(-4, 2)$, $C_1(-4, 5)$ and $D_1(-1, 5)$ as the image of ABCD under a reflection in the y axis.

(iii) Enlargement from (0,0) by scale factor k

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow k \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} kx \\ ky \end{pmatrix}$$

$$OA\begin{pmatrix} 1 \\ 2 \end{pmatrix} \rightarrow OA_2\begin{pmatrix} -1 \times 1 \\ -1 \times 2 \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}, \quad \therefore A_2(-1, -2)$$

$$OB\begin{pmatrix} 4 \\ 2 \end{pmatrix} \rightarrow OB_2\begin{pmatrix} -1 \times 4 \\ -1 \times 2 \end{pmatrix} = \begin{pmatrix} -4 \\ -2 \end{pmatrix}, \quad \therefore B_2(-4, -2)$$

$$OC\begin{pmatrix} 4 \\ 5 \end{pmatrix} \rightarrow OC_2\begin{pmatrix} -1 \times 4 \\ -1 \times 5 \end{pmatrix} = \begin{pmatrix} -4 \\ -5 \end{pmatrix}, \quad \therefore C_2(-4, -5)$$

$$OD\begin{pmatrix} 1 \\ 5 \end{pmatrix} \rightarrow OD_2\begin{pmatrix} -1 \times 1 \\ -1 \times 5 \end{pmatrix} = \begin{pmatrix} -1 \\ -5 \end{pmatrix}, \quad \therefore D_2(-1, -5)$$

\therefore Plot and join $A_2(-1, -2)$, $B_2(-4, -2)$, $C_2(-4, -5)$ and $D_2(-1, -5)$ as the image of triangle ABCD under an enlargement by scale factor -1 from the origin (as shown above)

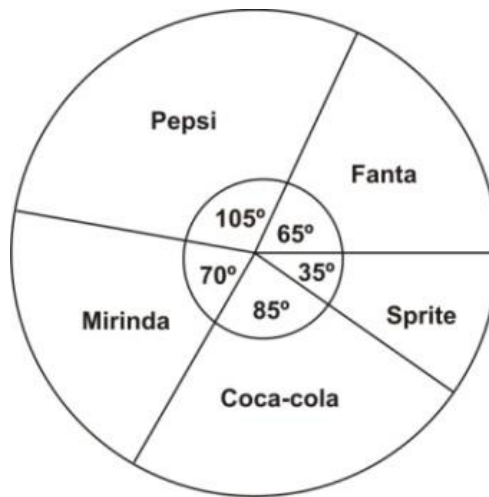
(iv) The single transformation that maps $A_2B_2C_2D_2$ onto $A_1B_1C_1D_1$ is reflection in the x-axis

5.

| Soft Drink | Number of bottles sold | Angle of sector |
|------------|------------------------|--|
| Fanta | 13 | $\frac{13}{72} \times 360^\circ = 65^\circ$ |
| Pepsi | 21 | $\frac{21}{72} \times 360^\circ = 105^\circ$ |
| Mirinda | 14 | $\frac{14}{72} \times 360^\circ = 70^\circ$ |

| | | |
|--------------|-----------|---|
| Coca-cola | 17 | $\frac{17}{72} \times 360^\circ = 85^\circ$ |
| Sprite | 7 | $\frac{7}{72} \times 360^\circ = 35^\circ$ |
| TOTAL | 72 | 360° |

Pie chart showing the distribution of sales of soft drinks sold
by the Akrokyere JSS canteen in one week



August 1993

MATHEMATICS

SECTION A OBJECTIVE TEST

1 hour

1. Expand $(2a + b)(a + 2b)$

- A) $2a^2 + 2b^2$
- B) $2a^2 + b^2$
- C) $5a^2 + 2a^2$
- D) $2a^2 + 2a + 4ab^2$
- E) $2a^2 + 5ab + 2b^2$

2. Find the missing number in the following binary operation:

$$\begin{array}{r} 1100110 \\ - \text{xxxxxxx} \\ \hline 111011 \end{array}$$

- A) 111011 B) 101001 C) 100011 D) 101110 E) 101011

3. If $x = \{1, 3, 5, 7, 9, 11, 13, 15\}$, find the truth set of $x - 3 \geq 10$.

- A. $\{15\}$
- B. $\{13, 15\}$
- C. $\{11, 13, 15\}$
- D. $\{9, 11, 13, 15\}$
- E. $\{7, 9, 11, 13, 15\}$

4. Which of these has the least number of lines of symmetry ?

- A) an equilateral triangle
- B) a rectangle

- C) a square
- D) a circle
- E) an isosceles triangle

5. Find 2% of ₦2,000.00

- A) ₦40.00 B) ₦50.00 C) ₦100.00 D) ₦800.00 E) ₦5,000.00

6. Find the highest common factor of 18, 36 and 120.

- A) $2^2 \times 3^3 \times 5$ B) $2 \times 3 \times 5$ C) 2×3 D) $2^3 \times 2^2$ E) $3^2 \times 2^2$

7. Arrange the fractions $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$ in ascending order.

- A) $\frac{2}{3}$, $\frac{3}{4}$, $\frac{3}{5}$
- B) $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$
- C) $\frac{3}{5}$, $\frac{2}{3}$, $\frac{3}{4}$
- D) $\frac{3}{5}$, $\frac{3}{4}$, $\frac{2}{3}$
- E) $\frac{3}{4}$, $\frac{3}{5}$, $\frac{2}{3}$

8. Make b the subject of the relation $\frac{1}{a} = \frac{1}{b} + c$

A) $b = \frac{ac - 1}{c}$

B) $b = \frac{a}{a + ac}$

C) $b = \frac{c}{1 - ac}$

D) $b = \frac{a}{1 - ac}$

E) $b = \frac{1 - ac}{a}$

9. A man has three children whose ages are 9 years, 12 years and 24 years. Find the ratio of their ages.

- A) 1:2:3 B) 1:2:4 C) 2:3:6 D) 3:4:8 E) 3:6:8

10. Ten students in Kwamekrom JSS took 9 days to weed the school compound. How long would 15 students take to weed the compound if they worked at the same rate?

A) 5 days B) 6 days C) $13\frac{1}{2}$ days D) 14 days E) 16 days

11. Which of the following inequalities is / are true?

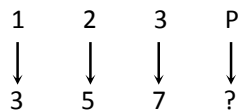
I: $\frac{5}{6} > \frac{3}{4}$

II: $\frac{3}{4} > \frac{3}{5}$

III: $\frac{3}{8} > \frac{1}{2}$

- A. I only
B. II only
C. III only
D. I and II only
E. I and III only

12. Find the image of P in the mapping below



A) P^2+2 B) P^2+1 C) $2P+1$ D) $P+2$ E) p^2-2

13. A car travelled a distance of 50km in an hour. What distance did it travel in 30 minutes at the same speed?

A) 1,500km B) 100km C) 80km D) 25km E) 20km

14. In an enlargement, the area of the object was multiplied by 144 to get the area of the image. Find the scale factor of the enlargement.

A) 12 B) 36 C) 48 D) 72 E) 144

15. Mr. Yevu saved ₵2,500.00 at a simple interest rate of 25% per annum for 4 years. Calculate the interest he earned on his savings.

- A) ₵625.00
B) ₵2,500.00
C) ₵3,125.00
D) ₵5,000.00
E) ₵10,000.00

The table below gives the number of goals scored by a football team in a league season.

| | | | | | | |
|-----------------------------------|---|---|---|---|---|---|
| No. of goals scored in a match | 0 | 1 | 2 | 3 | 4 | 5 |
| Frequency | 1 | 7 | 6 | 4 | 1 | 1 |

- 16.** Find the number of goals scored by the team.
- A) 41 B) 40 C) 20 D) 19 E) 15
- 17.** What is the mean number of goals scored by the team?
- A) 7 B) 6 C) 4 D) 2 E) 1
- 18.** What is the total number of matches played in the league season?
- A) 6 B) 7 C) 19 D) 20 E) 40
- 19.** The probability of obtaining a head when a coin is tossed is $\frac{1}{3}$. What is the probability of obtaining a tail?
- A) 1 B) $\frac{2}{3}$ C) $\frac{1}{2}$ D) $\frac{1}{3}$ E) 0
- 20.** Given that $\mathbf{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$, find $\mathbf{a} + 2\mathbf{b}$
- A. $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ B. $\begin{pmatrix} 2 \\ 13 \end{pmatrix}$ C. $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$ D. $\begin{pmatrix} 6 \\ 13 \end{pmatrix}$ E. $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$
- 21.** Find in base ten the value of 4 in 143_{five} .
- A) 48 B) 40 C) 25 D) 20 E) 9
- 22.** If the interior angle of a regular polygon is 120° , how many sides does it have?

- A) 5 B) 6 C) 7 D) 8 E) 9

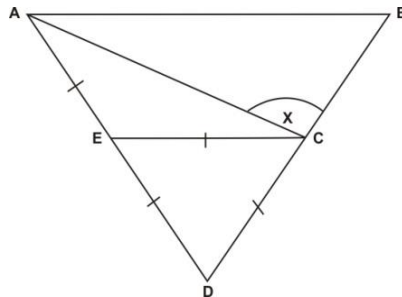
23. Simplify $(3\frac{1}{2} + 7) \div (4\frac{1}{3} - 3)$

- A) $6\frac{7}{8}$ B) 7 C) $7\frac{7}{8}$ D) $10\frac{1}{2}$ E) 14

24. Find the solution set of $n - \frac{2}{3} > \frac{1}{3} - n$

- A. $\{n: n > -\frac{1}{6}\}$
 B. $\{n: n = 0\}$
 C. $\{n: n > \frac{1}{3}\}$
 D. $\{n: n > \frac{1}{2}\}$
 E. $\{n: n > 1\}$

25. In the diagram below, $|AE| = |ED| = |DC| = |CE|$. Calculate the size of the angle marked x.



- A) 150° B) 120° C) 90° D) 60° E) 30°

26. Five times a number is four more than the number. Find the number.

- A) $\frac{3}{2}$ B) 1 C) $\frac{2}{3}$ D) $\frac{1}{2}$ E) -1

27. A basket contains 450 oranges, if each orange costs ₺15.00, find the total cost of the oranges.

- A) ₺30.00 B) ₺465.00 C) ₺435.00 D) ₺675.00 E) ₺6,750.00

28. A bottle of soft drink costs ₺200.00. The commission paid on one bottle is 2% of the cost price. Find the commission paid on 24 bottles of the soft drink.

- A) ₺96.00 B) ₺296.00 C) ₺400.00 D) ₺4,704.00 E) ₺4,800.00

29. If $\frac{9}{21}$ is equivalent to $\frac{1+x}{7}$, find the value of x .

- A) 1 B) 2 C) 4 D) 5 E) 6

30. Write 39.975km correct to three significant figures

- A) 39km B) 39.975km C) 49km D) 40.0km E) 40.9km

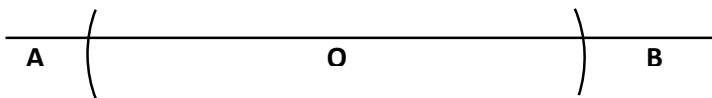
31. Find x if $\frac{1}{x} + \frac{1}{3} = 1$

- A) $-\frac{3}{2}$ B) $-\frac{2}{3}$ C) $\frac{2}{3}$ D) $\frac{3}{4}$ E) $\frac{3}{2}$

32. The bearing of Aboku from Bebek is 055° . What is the bearing of Bebek from Aboku?

- A) 035° B) 055° C) 125° D) 235° E) 305°

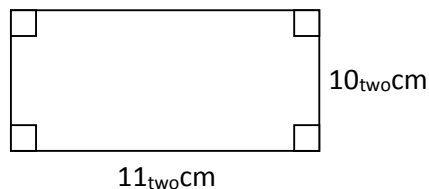
33.



The diagram above shows the construction of :

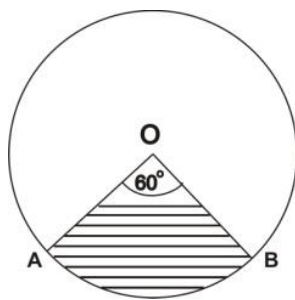
- A) the perpendicular bisector of the line
B) an angle of 45° at the point A
C) an angle of 45° at the point B
D) an angle of 90° at the point O
E) an angle of 90° at the point B

34. The dimensions of the rectangle are given in base two. Find its perimeter.



- A) $100_{\text{two}} \text{ cm}$
- B) $101_{\text{two}} \text{ cm}$
- C) $110_{\text{two}} \text{ cm}$
- D) $1001_{\text{two}} \text{ cm}$
- E) $1010_{\text{two}} \text{ cm}$

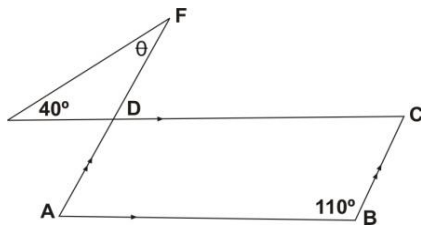
35.



The area of circle, centre O, is 120cm^2 . Angle AOB is 60° . Find the area of sector AOB.

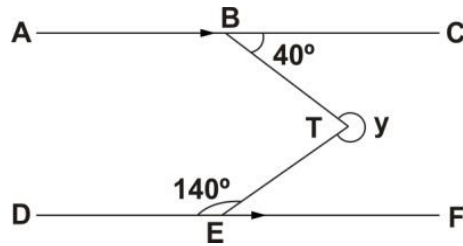
- A) 2cm^2
- B) 3cm^2
- C) 6cm^2
- D) 20cm^2
- E) 60cm^2

36. In the diagram, ABCD is a parallelogram; EC and AF are straight lines. Angle ABC = 110° and angle DEF = 40° . Find the angle marked θ



- A) 30°
- B) 40°
- C) 50°
- D) 70°
- E) 110°

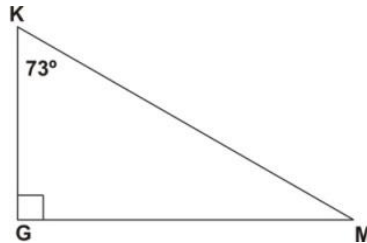
37. In the diagram below $AC \parallel DF$. Angle CBT is 40° and angle DET is 140°



Find the value of the reflex angle marked y .

- A) 320° B) 280° C) 220° D) 100° E) 80°

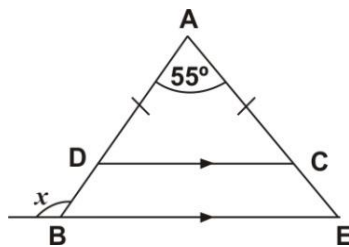
38.



In the diagram above, the angle of elevation of K from M is

- A) 17° B) 73° C) 90° D) 107° E) 163°

39. In the diagram below, ACD is an isosceles triangle in which $|AD| = |AC|$ and DC is parallel to BE, find the value of the angle marked x .



- A) 55° B) 62.5° C) 110° D) 117.5° E) 125°

40. Three girls Ama, Adjoa and Abena measured the length of the sides of 3 right-angled triangles as follows.

Ama's measurements were 80mm, 40mm, 50mm. Adjoa's measurements were 50mm, 120mm, 130mm. Abena's measurements were 20mm, 30mm and 40mm.

Whose measurement(s) was / were correct ?

- A) Ama's only
B) Abena's and Ama's

- C) Adjoa's and Abena's
- D) Ama's and Adjoa's only
- E) Adjoa's only

August 1993

MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. E) $2a^2 + 5ab + 2b^2$
2. E) 101011
3. B. {13,15}
4. E) An isosceles triangle
5. A) ₦40.00
6. C) 2×3
7. C) $\frac{3}{5}, \frac{2}{3}, \frac{3}{4}$
8. C) $b = \frac{c}{1 - ac}$
9. D) 3:4:8
10. B) 6 days
11. D. I and II only
12. C) $2P+1$
13. D) 25km
14. A) 12
15. B) ₦2,500.00

16. B) 40
17. D) 2
18. D) 20
19. B) $\frac{2}{3}$
20. B. $\begin{pmatrix} 2 \\ 13 \end{pmatrix}$
21. A) 48
22. B) 6
23. C) $7\frac{7}{8}$
24. D. $\{n: n > \frac{1}{2}\}$
25. C) 90°
26. B) 1
27. E) ₦6,750.00
28. A) ₦96.00
29. B) 2
30. D) 40.0km
31. E) $\frac{3}{2}$
32. D) 235°
33. D) an angle of 90° at the point O
34. E) 1010_{two} cm
35. D) 20 cm²
36. A) 30°
37. B) 280°
38. A) 17°
39. D) 117.5°

40. E) Adjoa's only

August 1993

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

Attempt four questions only from this section

All working must be clearly shown.

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Simplify $\frac{2a+4b}{3} - \frac{3(a-b)}{2}$
- (b) Solve $5(a-5) - \frac{1}{2}(2a+6) = 4$
- (c) If $r = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $q = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$, calculate $6(r+2q)$
2. Using a ruler and a pair of compasses only,
- a) construct a triangle ABC such that $|BA| = 10\text{cm}$, angle $ABC = 90^\circ$ and angle $BAC = 30^\circ$.
Measure the length BC.
- b) (i) Bisect the angle ACB to meet BA at D.
(ii) What type of triangle is CDA?
- c) Calculate the area of triangle ABC

3. Olu bought a radio for ₦65,000.00. After one year the radio was valued at 75% of the cost price.
- What was the price of the radio after one year?
 - If he sold the radio for ₦55,700.00, calculate his profit or loss over the cost price.
4. (a) Using a scale of 2cm to 1 unit on both axes, draw two perpendicular lines OX and OY on a graph sheet.
- (b) On this graph sheet, mark the x -axis from -5 to 5 and the y -axis from -6 to 6 .
- (c) Plot on the same graph sheet the points A($-2, 4$) and B($4, -5$). Join the points A and B with the help of a ruler.
- (d) Using the graph, find
- the gradient (slope) of the line AB;
 - the value of x , when $y = 0$;
 - the value of y when $x = 2$
- (e) Plot on the same graph sheet the points C($-3, -1$) and D($3, 3$). Join the points C and D. with the help of a protractor, measure the angle between the lines AB and CD. What is the gradient of the line CD?
5. The ages of 20 school children were recorded as follows:
- 13, 9, 15, 17, 13, 9, 11, 9, 11, 15,
17, 15, 11, 9, 9, 11, 15, 11, 11, 11.
- Make a frequency table for the data using the ages of 9, 11, 13, ...
 - Use your table to calculate the mean age
(correct to the nearest whole number)

August 1993

MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1 (a)

$$\begin{aligned} & \frac{2a+4b}{3} - \frac{3(a-b)}{2} \\ \Rightarrow & \frac{2a+4b}{3} - \frac{3a-3b}{2} \\ \Rightarrow & \frac{2(2a+4b) - 3(3a-3b)}{6} \\ \Rightarrow & \frac{4a + 8b - 9a + 9b}{6} \\ \Rightarrow & \frac{4a - 9a + 8b + 9b}{6} \\ \Rightarrow & \frac{-5a + 17b}{6} \\ = & \frac{17b - 5a}{6} \quad \text{or} \end{aligned}$$

$$\text{Or } \frac{1}{6} (17b - 5a)$$

1 (b)

$$5(a-5) - \frac{1}{2}(2a+6) = 4$$

Approach 1 [\(Expanding first\)](#)

$$\begin{aligned}5a - 25 - a - 3 &= 4 \\ \Rightarrow 5a - a &= 4 + 25 + 3 \\ \Rightarrow 4a &= 32 \\ \Rightarrow \frac{4a}{4} &= \frac{32}{4} \\ \Rightarrow a &= \underline{\underline{8}}\end{aligned}$$

1 (b)

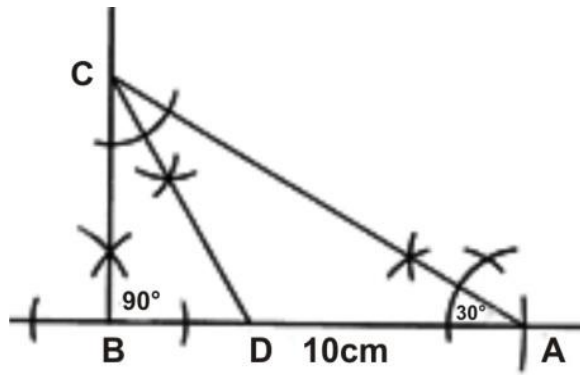
Approach 2 [\(Multiplying by 2 first to clear fractions\)](#)

$$\begin{aligned}2 \times 5(a - 5) - 2 \times \frac{1}{2}(2a + 6) &= 2(4) \\ \Rightarrow 10(a - 5) - (2a + 6) &= 2(4) \\ \Rightarrow 10a - 50 - 2a - 6 &= 8 \\ \Rightarrow 10a - 2a &= 8 + 50 + 6 \\ \Rightarrow 8a &= 64 \\ \Rightarrow a &= 64 \div 8 \\ \Rightarrow a &= \underline{\underline{8}}\end{aligned}$$

1 (c)

$$\begin{aligned}&6(\mathbf{r} + 2\mathbf{q}) \\ &= 6 \left[\begin{pmatrix} 3 \\ 1 \end{pmatrix} + 2 \begin{pmatrix} -2 \\ 1 \end{pmatrix} \right] \\ &= 6 \left[\begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \times -2 \\ 2 \times 1 \end{pmatrix} \right] \\ &= 6 \left[\begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} -4 \\ 2 \end{pmatrix} \right] \\ &= 6 \begin{pmatrix} 3 + (-4) \\ 1 + 2 \end{pmatrix} \\ &= 6 \begin{pmatrix} 3 - 4 \\ 1 + 2 \end{pmatrix} = 6 \begin{pmatrix} -1 \\ 3 \end{pmatrix} \\ &= \begin{pmatrix} 6 \times -1 \\ 6 \times 3 \end{pmatrix} = \underline{\underline{\begin{pmatrix} -6 \\ 18 \end{pmatrix}}}\end{aligned}$$

2 (a)



(a) $|BC| \approx \underline{5.7 \text{ cm}}$

(b) (ii) CDA is an isosceles triangle

(c)

| | | |
|------------------|---|---|
| Area of triangle | = | $\frac{1}{2} \times \text{base} \times \text{height}$ |
| | = | $\frac{1}{2} \times 10 \text{ cm} \times 5.7 \text{ cm}$ |
| | = | $\frac{1}{2} \times 57 \text{ cm}^2$ |
| | = | $28\frac{1}{2} \text{ cm}^2$ |
| | = | $\underline{28\frac{1}{2} \text{ cm}^2}$ or $\underline{28.5 \text{ cm}^2}$ |

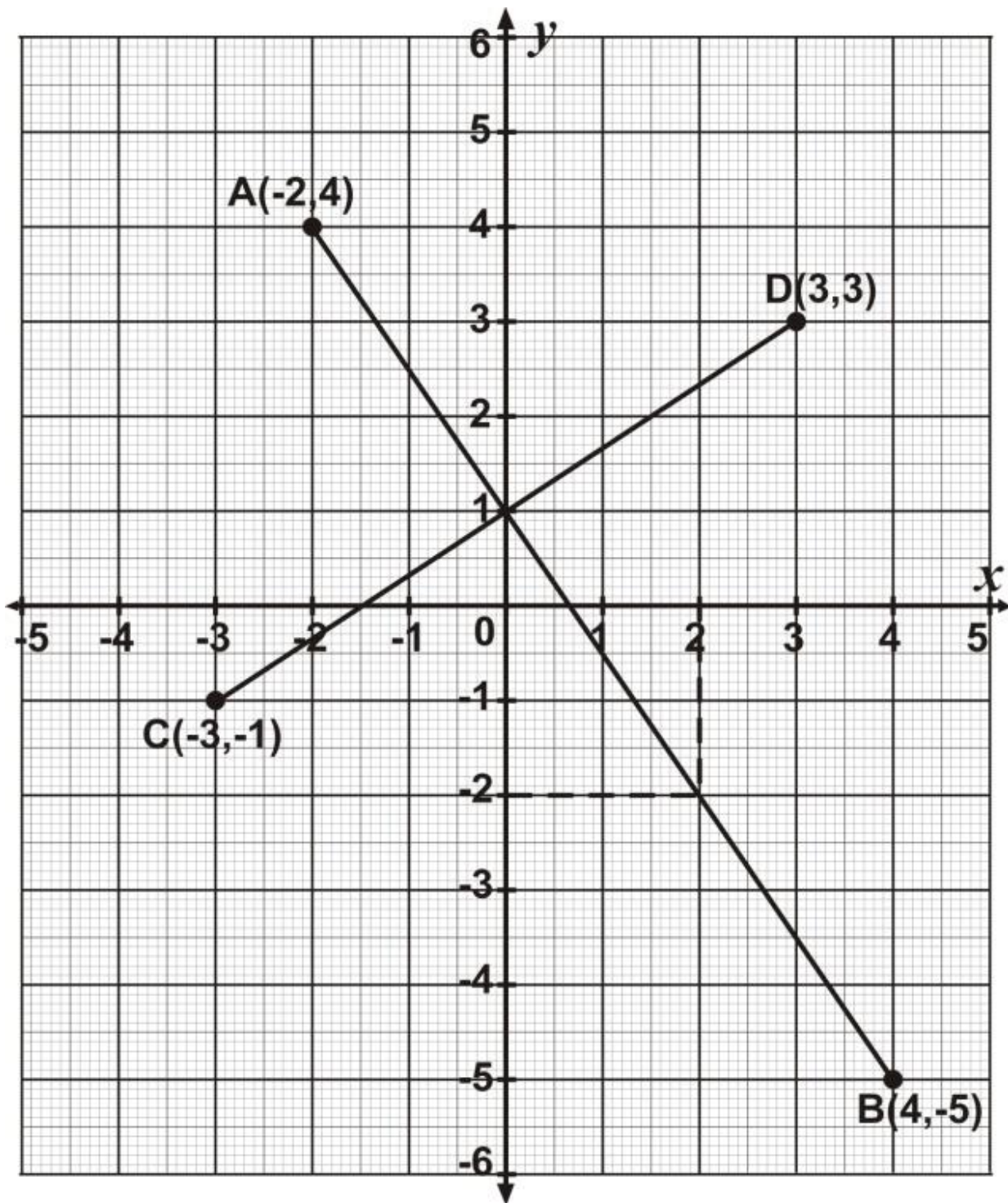
3 (a)

| | | |
|----------------------|---|--|
| Price after one year | = | 75% of the cost price |
| | = | $\frac{75}{100} \times \text{¢}65,000$ |
| | = | $75 \times \text{¢}650$ |
| | = | $\underline{\text{¢}48,750}$ |

(b)

| | | | | | | |
|------------------------------------|---|------------------|---|------------------|---|-----------------|
| Since price (value) after one year | = | CP | = | $\text{¢}48,750$ | | |
| Profit | = | SP | − | CP | | |
| | = | $\text{¢}55,700$ | − | $\text{¢}48,750$ | = | $\text{¢}6,950$ |

\Rightarrow He made a profit of $\underline{\text{¢}6,950}$



4 (d) From the graph, using the points A (-2, 4) and B (4, -5),

(d) (i) The gradient of line AB

$$\begin{aligned} \frac{y_2 - y_1}{x_2 - x_1} &= \frac{-5 - 4}{4 - (-2)} = \frac{-9}{6} = \frac{-3}{2} \\ &= \underline{\underline{-1\frac{1}{2}}} \quad \text{or } \underline{\underline{-1.5}} \end{aligned}$$

(d) (i) [Approach 2](#)

$$\frac{y_1 - y_2}{x_1 - x_2} = \frac{4 - (-5)}{-2 - 4} = \frac{9}{-6} = \frac{-3}{2}$$

$$= \underline{\underline{-1\frac{1}{2}}} \quad \text{or} \quad \underline{\underline{-1.5}}$$

(d) (ii) When $y = 0$, $\underline{\underline{x \approx 0.7}}$

(d) (iii) When $x = 2$, $\underline{\underline{y = -2}}$

(e) From the graph, the gradient of line CD

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-1)}{3 - (-3)} = \frac{4}{6} = \underline{\underline{\frac{2}{3}}}$$

(e) **Or:**

$$\frac{y_1 - y_2}{x_1 - x_2} = \frac{-1 - 3}{-3 - 3} = \frac{-4}{-6} = \underline{\underline{\frac{2}{3}}}$$

5 (a) Frequency Table

| Age | Tally | Frequency |
|-----|--------|-----------|
| 9 | ### | 5 |
| 11 | ### // | 7 |
| 13 | // | 2 |
| 15 | //// | 4 |
| 17 | // | 2 |

5 (b)

| Age (x) | Tally | Frequency (f) | fx |
|------------|--------|------------------|----|
| 9 | ### | 5 | 45 |
| 11 | ### // | 7 | 77 |

| | | | |
|----|------|-----------------------------------|-------------------------------------|
| 13 | // | 2 | 26 |
| 15 | //// | 4 | 60 |
| 17 | // | 2 | 34 |
| | | $\Sigma f = 20$ | $\Sigma fx = 242$ |

From the frequency table,

$$\begin{aligned}
 \text{The mean age} &= \frac{\Sigma f x}{\Sigma f} = \frac{242}{20} \\
 &= \underline{\underline{12\frac{1}{10} \text{ years}}} \quad \text{or} \quad \underline{\underline{12.1 \text{ years}}}
 \end{aligned}$$

August 1992

MATHEMATICS

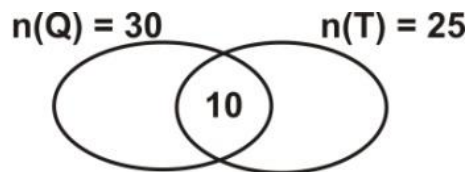
SECTION A OBJECTIVE TEST

1 hour

1. Find the set of prime factors of 12
A. {3} B. {2, 3} C. {3, 4} D. {2, 6} E. {2,3,4,6,12}

2. If $P = \{7, 11, 13\}$ and $Q = \{9, 11, 13\}$. Find $P \cup Q$.
A. {7}
B. {9}
C. {7, 9}
D. {7, 9, 11}
E. {7, 9, 11, 13}

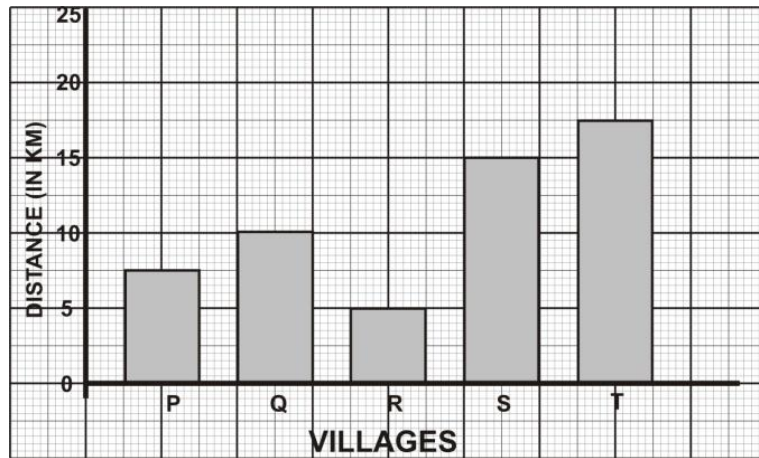
3. In the diagram, set Q has 30 members and set T has 25 members. $Q \cap T$ has 10 members. Find the number of members of $Q \cup T$.



- A) 35 B) 45 C) 55 D) 65 E) 75
4. Find the value of $\sqrt{6\frac{1}{4}}$
A) 5.0 B) 4.9 C) 2.5 D) 2.4 E) 1.2
5. Convert 39_{ten} to a base five numeral.
A) 100111 B) 1110 C) 234 D) 124 E) 103

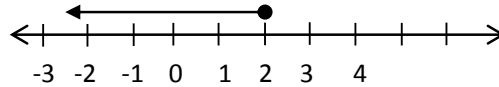
6. Find the least whole number which must be added to 207 to make it divisible by 17
A) 0 B) 3 C) 13 D) 14 E) 15
7. Simplify $2 \times (3\frac{1}{3} + 1\frac{1}{6})$
A) $2\frac{1}{3}$ B) $4\frac{1}{4}$ C) $6\frac{2}{3}$ D) 8 E) 9
8. If $8.51 \div 2.3 = 3.7$, find the value of $85.1 \div 2.3$
A) 0.037 B) 0.37 C) 3.7 D) 37 E) 370
9. Express 0.625 as a fraction in its lowest term.
A) $\frac{7}{8}$ B) $\frac{3}{4}$ C) $\frac{5}{8}$ D) $\frac{1}{2}$ E) $\frac{1}{3}$
10. An amount of money is shared between Kofi and Ama in the ratio 3:5. If Ama received ₵4,650.00, what is Kofi's share?
A) ₵930.00 B) ₵1,550.00 C) ₵1,743.75 D) ₵2,790.00 E) ₵2,906.25
11. If \$1.00 = ₵340.00, what was the cedi value of an article which cost \$6.50?
A) ₵6,630.00
B) ₵2,380.00
C) ₵2,210.00
D) ₵346.50
E) ₵333.50
12. Find the simple interest on ₵28,000.00 at $3\frac{1}{2}\%$ per annum for 6 months.
A) ₵490.00
B) ₵560.00
C) ₵980.00
D) ₵4,000.00
E) ₵5,880.00

The bar chart shows the distances of 5 villages, P, Q, R, S and T from a market town. Use it to answer questions 13 and 14



13. Which village is farthest from the market town?
- A) P B) Q C) R D) S E) T
14. How much farther is village Q than village R from the market town?
- A) 2 km B) 3 km C) 4km D) 5km E) 6km
15. There are 20 beads in a box. Some are red and some green. The chance that one bead taken at random from the box is red is $\frac{1}{4}$. Find the number of red beads in the box.
- A) 16 B) 15 C) 10 D) 5 E) 4
16. A bag contains 12 mangoes of which 4 are not ripe. What is the chance of picking at random a ripe mango from the bag?
- A) $\frac{1}{8}$ B) $\frac{1}{4}$ C) $\frac{1}{3}$ D) $\frac{1}{2}$ E) $\frac{2}{3}$
17. Find the value of $p^2 - 6p + 9$ when $p = -2$
- A) -7 B) 1 C) 12 D) 13 E) 25
18. If $x = 2$, find the value of q in the equation $3x - 4 = x + q$
- A) 8 B) 1 C) 0 D) -1 E) -8

19.



Which of the following inequalities is shown on the number line above, where P is a real number.?

- A) $p \geq 2$ B) $p > 2$ C) $p = 2$ D) $p \leq 2$ E) $p < 2$

Use the mapping below to answer questions 20 to 21

| | | | | | | | |
|-----|----|---|---|---|---|-----|-----|
| -2 | -1 | 0 | 2 | 3 | 4 | ... | x |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | |
| y | -1 | 1 | 5 | 7 | 9 | ... | 21 |

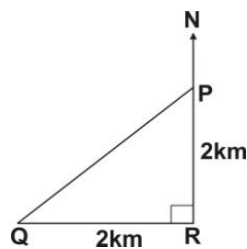
20. Find the value of x

- A) -7 B) 5 C) 6 D) 7 E) 10

21. Find the value of y

- A) 3 B) 1 C) -1 D) -3 E) -5

22. In the diagram, find the bearing of P from Q.



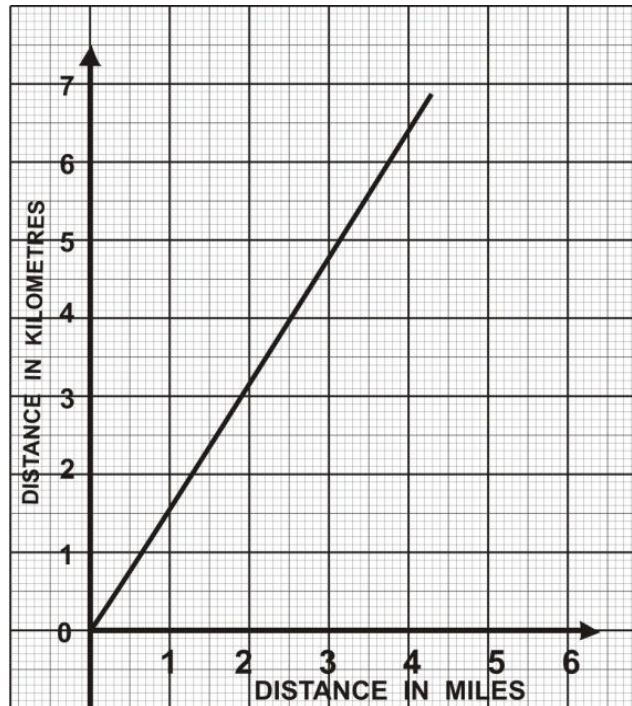
- A) 045° B) 090° C) 135° D) 180° E) 270°

23. A polygon has 10 sides. Which of the following gives the sum of its interior angles?

- A) $2 \times 180^\circ$
 B) $4 \times 180^\circ$
 C) $6 \times 180^\circ$
 D) $8 \times 180^\circ$

E) $10 \times 180^\circ$

The diagram shows the conversion graph for miles and kilometres.



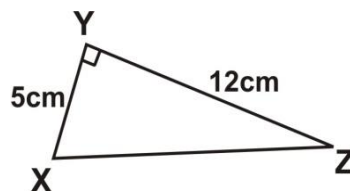
24. Find in kilometres, the equivalent of 4 miles

- A) 2.5 B) 3 C) 3.5 D) 6 E) 6.4

25. Express 4 kilometres in miles

- A) 6.4 B) 6 C) 3.5 D) 3 E) 2.5

The diagram below is a right-angled triangle. Use it to answer questions 26 and 27



26. Find $|XZ|$

- A) 2.4cm B) 7cm C) 13cm D) 17cm E) 60cm

27. Find $\tan \angle YXZ$

A) $\frac{5}{13}$

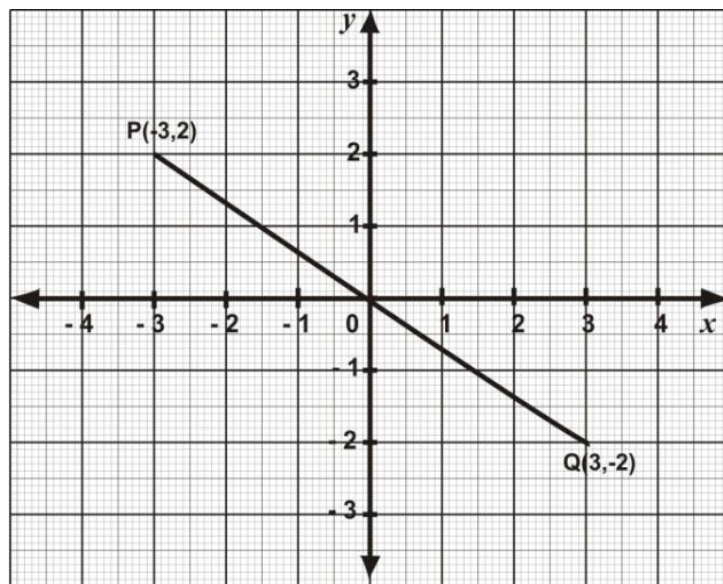
B) $\frac{5}{12}$

C) $\frac{12}{13}$

D) $\frac{12}{5}$

E) $\frac{13}{5}$

28. The diagram below shows two points P and Q in the number plane. Find the vector PQ.



A. $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$

B. $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$

C. $\begin{pmatrix} -6 \\ 4 \end{pmatrix}$

D. $\begin{pmatrix} 4 \\ -6 \end{pmatrix}$

E. $\begin{pmatrix} -4 \\ -6 \end{pmatrix}$

29. Find the length of the vector $P = \begin{pmatrix} -5 \\ 12 \end{pmatrix}$

A) 7

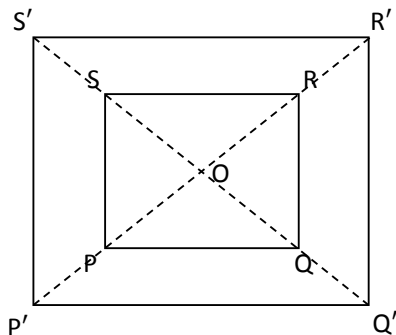
B) 10

C) 13

D) 17

E) 25

30.



In the diagram, square P'Q'R'S' is an enlargement of square PQRS from centre O. The area of PQRS is 4cm^2 and the area of P'Q'R'S' is 9cm^2 . Find the scale factor of the enlargement.

- A) $\frac{2}{3}$ B) $\frac{4}{9}$ C) $1\frac{1}{2}$ D) $-\frac{2}{3}$ E) $-\frac{9}{4}$

31. The volume of a cube is 27cm^3 . Find the area of one of its faces.

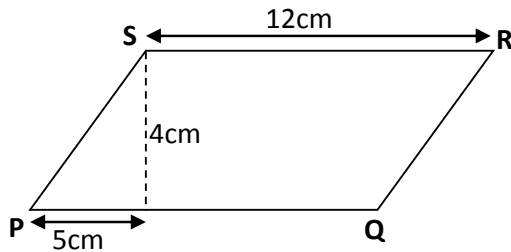
- A) 3cm^2 B) 6cm^2 C) 9cm^2 D) 18cm^2 E) 54cm^2

32. A cylinder is of height 3 cm and radius 2 cm. Find its curved surface area.

[Take $\pi = 3.142$]

- A) 7 cm^2 B) 12 cm^2 C) 18 cm^2 D) 38 cm^2 E) 54 cm^2

33.



Find the area of the parallelogram PQRS

- A) 20cm^2 B) 21cm^2 C) 48cm^2 D) 60cm^2 E) 240cm^2

34. If one-third of a number is added to one-fifth of the same number, the result is 8. Find the number.

- A) 3 B) 5 C) 15 D) 40 E) 45

35. If 1: x is equivalent to $6\frac{1}{4}:25$, find x.

- A) 4 B) 5 C) 6.25 D) 24 E) 100

36. Express $\frac{3}{8}$ as a percentage.

- A) 0.373% B) 12% C) 25% D) $37\frac{1}{2}\%$ E) 40%

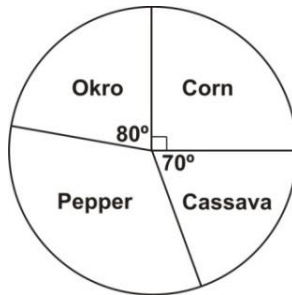
37. Akosua buys 480 pineapples for ₵24,000.00. She sells all the pineapples for ₵28,000.00. Find her profit percent.

- A) 13.9% B) 16.7% C) 20% D) 40% E) 83.3%

38. How many edges has a cuboid ?

- A) 4 B) 6 C) 8 D) 10 E) 12

The pie chart shows the distribution of crops on a farm of area 250 hectares.



39. Find the area of the plot with corn.

- A) 48.6ha B) 55.3ha C) 62.5ha D) 83.3ha E) 125.0ha

40. What fraction of the farm is planted with pepper?

- A) $\frac{1}{3}$ B) $\frac{1}{4}$ C) $\frac{1}{5}$ D) $\frac{2}{9}$ E) $\frac{7}{32}$

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. B. $\{2, 3\}$
2. E. $\{7, 9, 11, 13\}$
3. B) 45
4. C) 2.5
5. D) 124
6. D) 14
7. E) 9
8. D) 37
9. C) $\frac{5}{8}$
10. D) ₦2,790.00
11. C) ₦2,210.00
12. A) ₦490.00
13. E) T
14. D) 5km
15. D) 5

16. E) $\frac{2}{3}$
17. E) 25
18. C) 0
19. D) $p \leq 2$
20. E) 10
21. D) -3
22. A) 045°
23. D) $8 \times 180^\circ$
24. E) 6.4
25. E) 2.5
26. C) 13cm
27. D) $12/5$
28. B. $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$
29. C) 13
30. C) $1\frac{1}{2}$
31. C) 9cm^2
32. D) 38cm^2
33. C) 48 cm^2
34. C) 15
35. A) 4
36. D) $37\frac{1}{2}\%$
37. B) 16.7%
38. E) 12
39. C) 62.5ha

40.

A) $\frac{1}{3}$

August 1992

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

Attempt four questions only from this section

All working must be clearly shown.

Marks will not be awarded for correct answers without corresponding working.

All questions carry equal

1. (a) Solve $5 - 2x > x + 2$, where x is a real number.
Illustrate your result on the number line.

(b) Find the truth set of the equation: $\frac{2}{3}(3y - 1) - (y + 2) = \frac{1}{3}$

(c) Factorize completely: $mp + np - mt - nt$

(d) Make t the subject of the relation $v = u + at$

2. A landlady rented out her house for ¢240,000.00 for one year. During the year she paid 15% of the rent as income tax. She also paid 25% of the rent as property tax and spent ¢10,000.00 on repairs.
Calculate:

a) The landlady's total expenses.

b) The remainder of the rent after the landlady's expenses.

c) The percentage of the rent she spent on repairs.

3. (a) Using a scale of 2cm to 1 unit on both axes, draw perpendicular lines OX and OY on a graph sheet.
- (b) On this graph sheet, mark the x-axis from -5 to 5 and the y-axis from -6 to 6
- (c) Plot on the same graph sheet the points A(1,1), B(4,3) and C(2,5). Join the points A,B and C to form a triangle.
- (d) Using the y-axis as the mirror line, draw the image $A_1B_1C_1$ of the triangle ABC, such that $A \rightarrow A_1$, $B \rightarrow B_1$ and $C \rightarrow C_1$. Write down the co-ordinates of A_1 , B_1 and C_1 .
- (e) Using the x-axis as the mirror line, draw the image $A_2B_2C_2$ of triangle ABC where $A \rightarrow A_2$, $B \rightarrow B_2$ and $C \rightarrow C_2$.
4. The table below gives the frequency distribution of the marks obtained in a class test by a group of 64 pupils.

| Marks (out of ten) | Frequency |
|-----------------------|-----------|
| 2 | 9 |
| 3 | 14 |
| 4 | 13 |
| 5 | 10 |
| 6 | 5 |
| 7 | 8 |
| 8 | 2 |
| 9 | 3 |

- (a) Draw a bar chart for the distribution
- (b) A pupil is chosen at random from the class. What is the probability that the pupil obtained 7 marks?
5. Using a ruler and a pair of compasses only,
- (a) draw $|PQ| = 9$ cm
- (b) construct a perpendicular to PQ at Q
- (c) construct angle $QPS = 60^\circ$ at the point P on PQ such that $|PS| = 6.5$ cm

- (d) construct a line parallel to PQ through S . let the perpendicular through Q and the parallel through S , meet at R . Measure $|PR|$.

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MATHEMATICS

SECTION B ESSAY

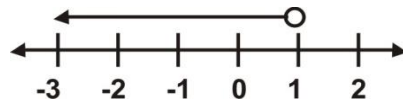
SOLUTIONS

1 (a)

$$\begin{aligned}5 - 2x &> x + 2 \\ \Rightarrow 5 - 2 &> x + 2x \\ \Rightarrow 3 &> 3x \\ \Rightarrow 1 &> x \\ \Rightarrow \underline{\underline{x < 1}}\end{aligned}$$

Turning the ' $1 > x$ '
around reverses the $>$

The number line illustration is shown below:



1 (b)

$$\frac{2}{3}(3y - 1) - (y + 2) = \frac{1}{3}$$

Approach 1 (Expanding and grouping first)

$$\begin{aligned}\Rightarrow \frac{2}{3} \times 3y - \frac{2}{3} \times 1 - y - 2 &= \frac{1}{3} \\ \Rightarrow 2y - \frac{2}{3} - y - 2 &= \frac{1}{3} \\ \Rightarrow 2y - y &= \frac{1}{3} + \frac{2}{3} + 2 \\ \Rightarrow y &= 1 + 2 \\ \Rightarrow \underline{\underline{y = 3}}\end{aligned}$$

1 (b)

Approach 2 (Multiplying by 3 first – to clear fractions)

$$\begin{aligned}
3 \times \frac{2}{3}(3y-1) - 3 \times (y+2) &= 3 \times \frac{1}{3} \\
\Rightarrow 2(3y-1) - 3(y+2) &= 1 \\
\Rightarrow 6y-2-3y-6 &= 1 \\
\Rightarrow 3y-8 &= 1+2+6 \\
\Rightarrow 3y &= 9 \\
\Rightarrow y &= 9 \div 3 \\
\Rightarrow \underline{\underline{y}} &= \underline{\underline{3}}
\end{aligned}$$

$$\begin{aligned}
\mathbf{1 (c)} \quad & mp + np - mt - nt \\
&= p(m+n) - t(m+n) \\
&= \underline{\underline{(m+n)(p-t)}}
\end{aligned}$$

$$\mathbf{1 (d)} \quad v = u + at, \quad \text{making } t \text{ the subject}$$

Placing terms containing t on one side:

$$\begin{aligned}
v - u &= at \\
\Rightarrow \frac{v-u}{a} &= \frac{at}{a} \\
\Rightarrow \frac{v-u}{a} &= t \\
\Rightarrow \underline{\underline{t}} &= \underline{\underline{\frac{v-u}{a}}}
\end{aligned}$$

$$\begin{aligned}
\mathbf{2 (a)} \quad \text{Total expenses} &= \text{Income tax} + \text{property tax} + \text{repairs} \\
&= (15\% \text{ of } \text{¢}240,000) + (25\% \text{ of } \text{¢}240,000) + \text{¢}10,000 \\
&= \left(\frac{15}{100} \times \text{¢}240,000\right) + \left(\frac{25}{100} \times \text{¢}240,000\right) + \text{¢}10,000 \\
&= \text{¢}36,000 + \text{¢}60,000 + \text{¢}10,000 \\
&= \text{¢}106,000 \\
\Rightarrow \text{The landlady's total expenses} &= \underline{\underline{\text{¢}106,000.00}}
\end{aligned}$$

$$\begin{aligned}
\mathbf{2 (b)} \quad \text{The remainder} &= \text{Total Amount} - \text{Expenses} \\
&= \text{¢}240,000.00 - \text{¢}106,000.00 \\
&= \underline{\underline{\text{¢}134,000.00}}
\end{aligned}$$

2 (c)

Percentage of the rent spent on repairs

$$= \frac{\text{Amount on repairs}}{\text{Total income from rent}} \times 100\%$$

$$= \frac{10,000}{240,000} \times 100\%$$

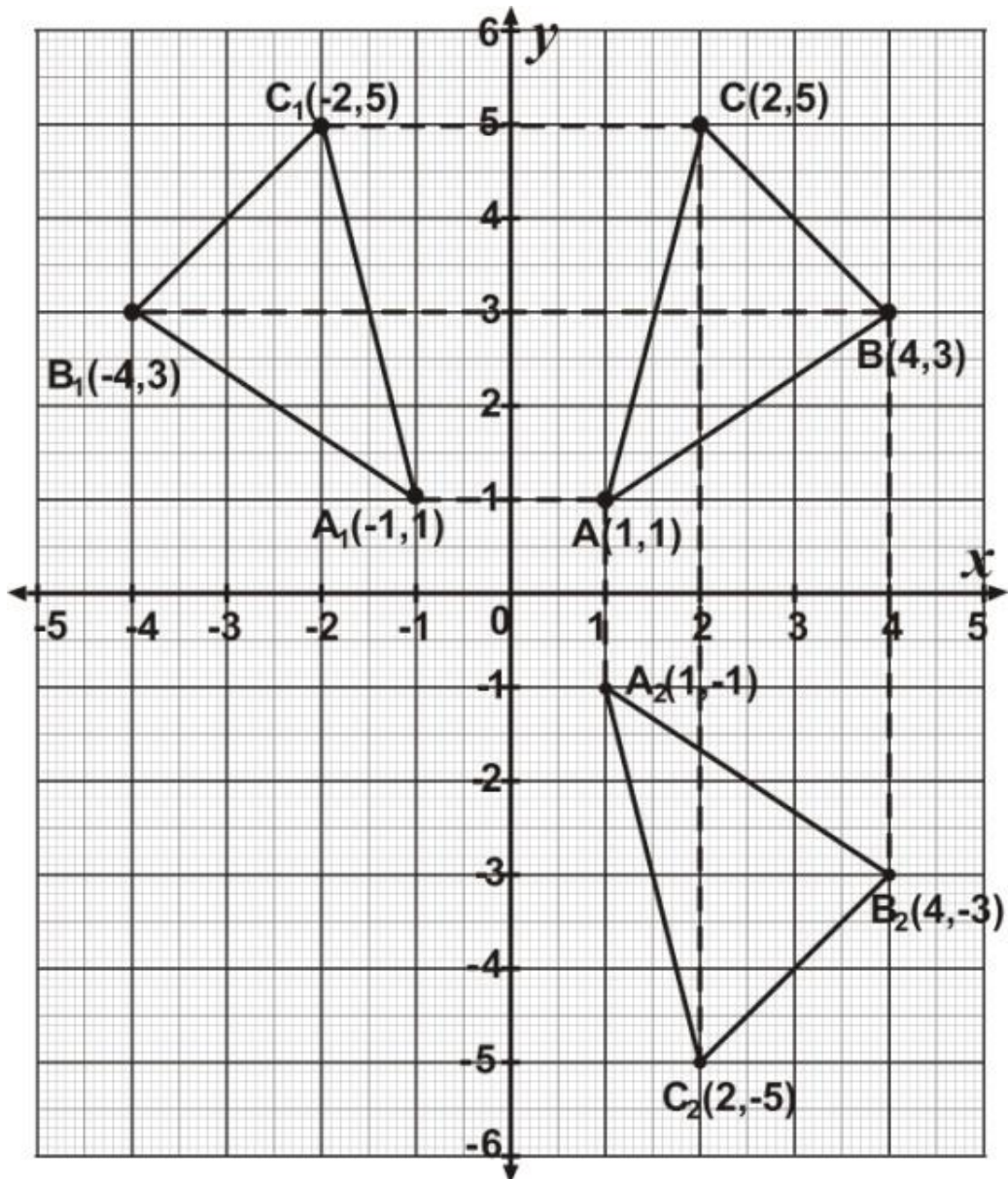
$$= \frac{25}{6} \%$$

$$= \underline{\underline{4\frac{1}{6} \%}} \quad \text{or} \quad \approx \underline{\underline{4.167\%}}$$

3.

Approach 1

(By Inspection / Construction)



3 (d)

Approach 2 (The rule / formula)

Reflecting (x, y) in the y-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} -x \\ y \end{pmatrix}$$

$$OA \begin{pmatrix} 1 \\ 1 \end{pmatrix} \rightarrow OA_1 \begin{pmatrix} -1 \\ 1 \end{pmatrix}, \quad \therefore A_1(-1, 1)$$

$$OB \begin{pmatrix} 4 \\ 3 \end{pmatrix} \rightarrow OB_1 \begin{pmatrix} -4 \\ 3 \end{pmatrix}, \quad \therefore B_1(-4, 3)$$

$$OC \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OC_1 \begin{pmatrix} -2 \\ 5 \end{pmatrix}, \quad \therefore C_1(-2, 5)$$

\therefore Plot and join $A_1(-1, 1)$, $B_1(-4, 3)$ and $C_1(-2, 5)$ as the image of triangle ABC under a reflection in the y axis.

3 (e)

Reflection in the x-axis

$$\begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{pmatrix} x \\ -y \end{pmatrix}$$

$$OA \begin{pmatrix} 1 \\ 1 \end{pmatrix} \rightarrow OA_2 \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \quad \therefore A_2(1, -1)$$

$$OB \begin{pmatrix} 4 \\ 3 \end{pmatrix} \rightarrow OB_2 \begin{pmatrix} 4 \\ -3 \end{pmatrix}, \quad \therefore B_2(4, -3)$$

$$OC \begin{pmatrix} 2 \\ 5 \end{pmatrix} \rightarrow OC_2 \begin{pmatrix} 2 \\ -5 \end{pmatrix}, \quad \therefore C_2(2, -5)$$

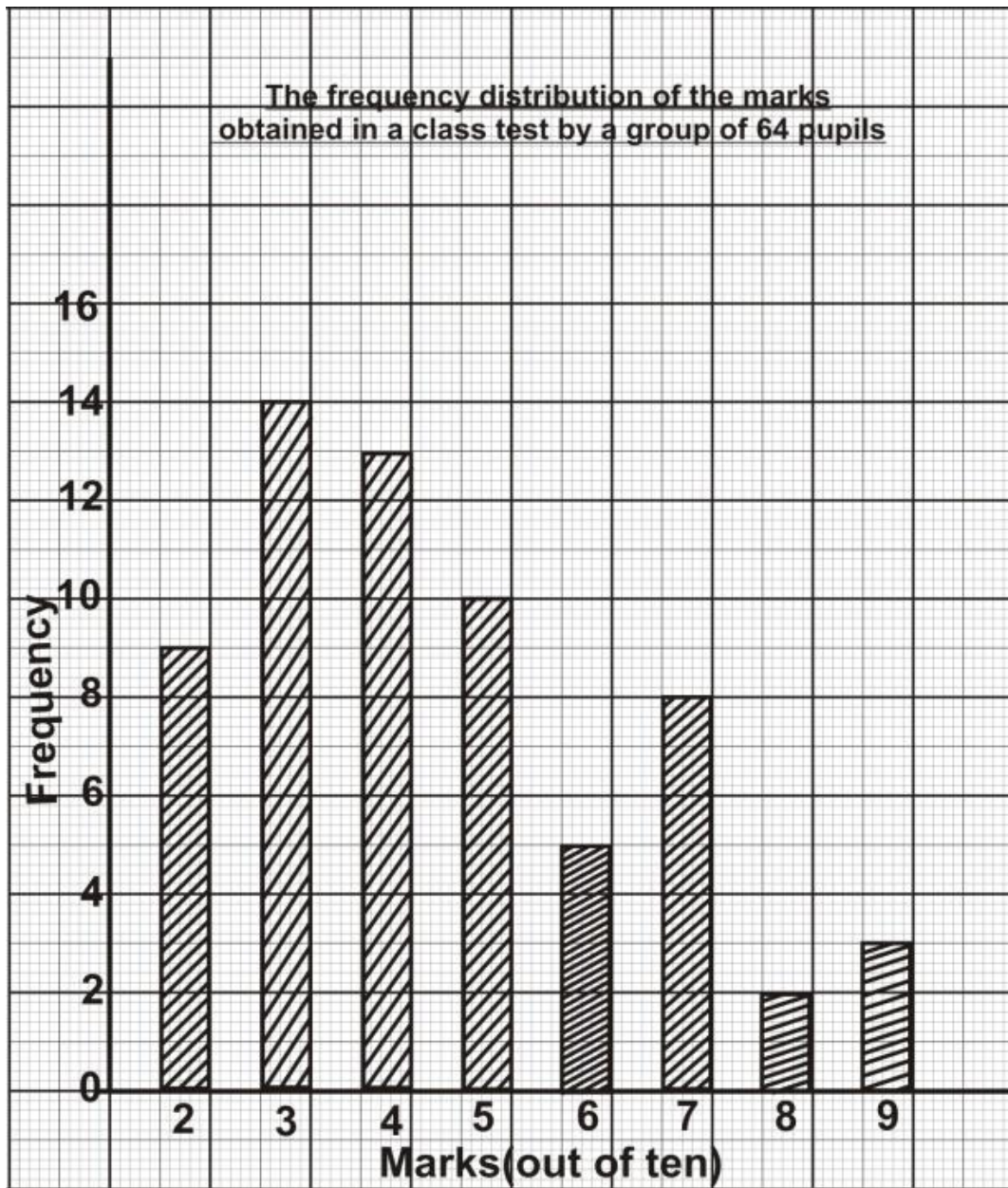
\therefore Plot and join $A_2(1, -1)$, $B_2(4, -3)$ and $C_2(2, -5)$ as the image of triangle ABC under a reflection in the x- axis

(as shown in the diagram above)

4 (a)

Bar chart

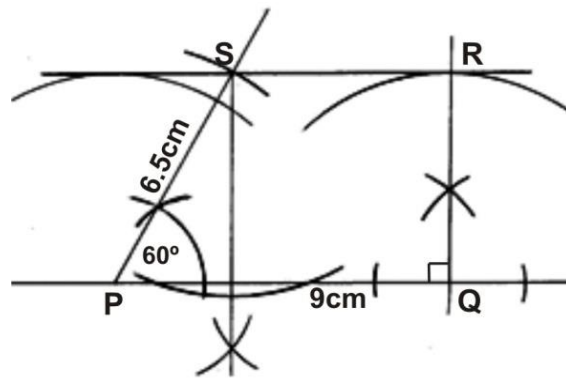
Vertical Axis Scale: **2 cm to 2 pupils (1cm to 1 pupil)**



4 (b)

$$\begin{aligned}
 P(7 \text{ marks}) &= \frac{\text{Number of pupils that obtained 7 marks}}{\text{Total number of pupils}} \\
 &= \frac{8}{9+14+13+10+5+8+2+3} \\
 &= \frac{8}{64} = \frac{1}{8}
 \end{aligned}$$

5.



5 (d)

$$|PR| = \underline{\underline{10.6 \text{ c m}}}$$

August 1991

MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

1. $P = \{1, 2, 3, 8, 10\}$, $Q = \{8, 1, x, 3, 2\}$. If $P = Q$, what is the value of x ?
A) 1 B) 2 C) 3 D) 8 E) 10
2. If $Y = \{\text{house, tree}\}$ and $V = \{\text{cat, house, tree}\}$ which of the following is true of Y and V ?
A) $Y = V$ B) $Y \subset V$ C) $V \subset Y$ D) $V \in Y$ E) $Y \in V$
3. The following addition is in base ten. Find the missing addend.

$$\begin{array}{r} 2345 \\ 1045 \\ \hline * * * * \\ 5110 \end{array}$$

- A) 1300 B) 1720 C) 2765 D) 4065 E) 9500
4. Given that $2^2 \times 3^2 \times 7 = 252$, find the least number that should be multiplied by 252 to make the product a perfect square.
A) 2 B) 3 C) 6 D) 7 E) 252
5. Write 4687.02 in standard form
A) 46.8702×10^3
B) 46.8702×10^4
C) 4.68702×10^5
D) 4.68702×10^3
E) 0.468702×10^4
6. Convert 11001_{two} to a decimal numeral
A) 6 B) 7 C) 14 D) 25 E) 50

7. A boy spent $\frac{2}{7}$ of his pocket money on transport and $\frac{1}{5}$ on sweets. What fraction of his pocket money does he spend on transport and sweets?

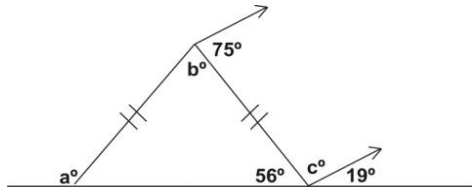
A) $\frac{2}{35}$ B) $\frac{3}{35}$ C) $\frac{1}{7}$ D) $\frac{17}{35}$ E) $\frac{18}{35}$

8. The product of three numbers is 1197. Two of the numbers are 3 and 19. Find the third number.

A) 21 B) 54 C) 210 D) 544 E) 1175

9. Find the GCF (HCF) of $2^3 \times 3^2$ and $2^3 \times 3^4$.

A) 8 B) 9 C) 72 D) 81 E) 648



10. Find the value of a°

A) 68° B) 75° C) 105° D) 112° E) 124°

11. What is the value of b° ?

A) 68° B) 75° C) 105° D) 112° E) 124°

12. What is the value of c° ?

A) 68° B) 75° C) 105° D) 112° E) 124°

13. Simplify $2ab^2 \times 3a^2b$

A) $5a^3b^3$ B) $5a^2b^2$ C) $6a^3b^3$ D) $5a^2b^2$ E) $36ab$

14. In the relation $v = u + at$, find v when $u = 6$, $a = 10$ and $t = 2$

A) 18 B) 26 C) 32 D) 48 E) 120

15. The marks obtained by 10 children in a mental drill are:

0, 1, 3, 3, 5, 7, 8, 9, 9, 9. What is the modal mark?

A) 3 B) 5 C) 7 D) 8 E) 9

16. The marks obtained by 10 children in a mental drill are:

0, 1, 3, 3, 5, 7, 8, 9, 9, 9. Find the median mark.

- A) 3 B) 5 C) 6 D) 7 E) 8

17. The marks obtained by 10 children in a mental drill are:

0, 1, 3, 3, 5, 7, 8, 9, 9, 9. Calculate the mean mark.

- A) -54 B) 5.4 C) 10 D) 54 E) 540

18. The marks obtained by 10 children in a mental drill are: 0, 1, 3, 3, 5, 7, 8, 9, 9, 9.

What is the probability that a child chosen at random scored 3 marks?

- A) $\frac{2}{54}$ B) $\frac{3}{54}$ C) $\frac{2}{10}$ D) $\frac{3}{10}$ E) $\frac{1}{3}$

19. A trader received a commission of $12\frac{1}{2}\%$ on sales made in a month. His commission was ₦35,000.00. Find his total sales for the month.

- A) ₦36,250.00
B) ₦59,750.00
C) ₦245,000.00
D) ₦280,000.00
E) ₦315,000.00

20. A map of a large town is drawn to the scale of 1:100,000. What is the distance in kilometres (km) represented by a line segment 4cm along the map?

- A) 0.04km B) 0.4km C) 4km D) 40km E) 400km

21. Adjoa and Ama share ₦600.00 between them in the ratio 3:2. Find Adjoa's share.

- A) ₦200.00 B) ₦240.00 C) ₦300.00 D) ₦360.00 E) ₦400.00

Simplify: $\frac{2a}{3} - \frac{a-b}{2}$

22. A) $a - 3b$ B) $\frac{a-3b}{6}$ C) $\frac{a+3b}{6}$ D) $a + 3b$ E) $a - b$

23. If $a^6 \div a^4 = 64$. Find a

- A) 8 B) 10 C) 16 D) 20 E) 24

24. Find one-hundredth of 1.0756

- A) 107.56 B) 10.756 C) 0.01756 D) 0.010756 E) 0.001756

25. What is the rule for this mapping

| | | | | | |
|---|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| y | 1 | 3 | 5 | 7 | 9 |

- A) $x \rightarrow 2x-1$ B) $x \rightarrow 2(x-1)$ C) $x \rightarrow 2x+1$ D) $x \rightarrow 2(x+1)$ E) $x \rightarrow 2^x-1$

26. The circumference of a circular track is 440m. Find the diameter of this track.

[Take $\pi = \frac{22}{7}$]

- A) 70m B) 140m C) 280m D) 690m E) 1400m

27. If $\mathbf{r} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\mathbf{s} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$, calculate $6(\mathbf{r} + 2\mathbf{s})$

- A. $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$ B. $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$ C. $\begin{pmatrix} 7 \\ 3 \end{pmatrix}$ D. $\begin{pmatrix} -6 \\ 18 \end{pmatrix}$ E. $\begin{pmatrix} 6 \\ 18 \end{pmatrix}$

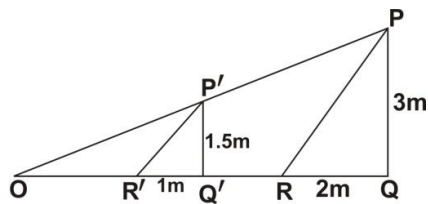
28. Which of the following would you use to measure an angle?

- A) Ruler
B) A pair of compasses
C) A set square
D) A protractor

29. Express the ratio of 64cm to 48cm in its simplest form.

- A) 3:4 B) 4:3 C) 16:12 D) 12:16 E) 64:48

30.



In the diagram, $P \rightarrow P'$, $Q \rightarrow Q'$, $R \rightarrow R'$, where $P'Q'R'$ is an enlargement.

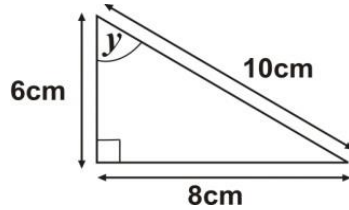
What is the scale factor of this enlargement?

- A) -2 B) $\frac{1}{3}$ C) $\frac{1}{2}$ D) 2 E) 3

31. If $|PR| = 3.6\text{m}$, what is $|P'R'|$?

- A) -7.2m B) -1.8m C) 1.2m D) 1.8m E) 7.2m

32. Find the tangent of the angle marked Y in the diagram



- A) $\frac{3}{5}$ B) $\frac{3}{4}$ C) $\frac{4}{5}$ D) $\frac{4}{3}$ E) $\frac{5}{3}$
33. Kojo paid ₵270,000.00 for a TV set after he had been given a discount of 10%. Find the marked price.

- A) ₵300,000.00
B) ₵297,000.00
C) ₵280,000.00
D) ₵260,000.00
E) ₵243,000.00

In a secondary school class, 23 pupils study Economics, 6 pupils study both Government and Economics. 48 pupils study either Government or Economics or both.

34. What is the total number of pupils who study Government?

- A) 17 B) 23 C) 24 D) 25 E) 31

35. How many pupils study only Government?

- A) 17 B) 23 C) 24 D) 25 E) 31

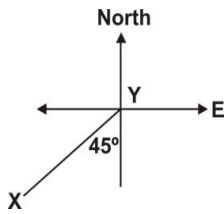
36. How many pupils study only Economics?

- A) 17 B) 23 C) 24 D) 25 E) 31

37. When a certain number is subtracted from 10 and the result is multiplied by 2, the final result is 4. Find the number.

- A) 8 B) 12 C) 16 D) 24 E) 32

38. From the diagram below, calculate the bearing of point X from Y

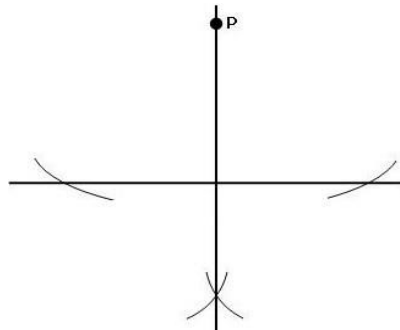


- A) 035° B) 045° C) 135° D) 145° E) 225°

39. If 22% of the length of a rope is 55cm, find the full length of the rope.

- A) 12.1cm B) 25cm C) 121cm D) 250cm E) 2500cm

40. Which of these best describes the given construction?



- A) Bisecting a line
 B) Constructing the bisector of a line segment.
 C) Constructing the perpendicular to a line
 D) Constructing a perpendicular to a given line from a point outside the line.
 E) Constructing a perpendicular to a given line through a point on the line.

August 1991

MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. E) 10
2. B) $Y \subset V$
3. B) 1720
4. D) 7
5. D) 4.68702×10^3
6. D) 25
7. D) $\frac{17}{35}$
8. A) 21
9. C) 72
10. E) 124°
11. A) 68°
12. C) 105°
13. C) $6a^3b^3$
14. B) 26
15. E) 9

16. C) 6
17. B) 5.4
18. C) $\frac{2}{10}$
19. D) ₪280,000.00
20. C) 4km
21. D) ₪360.00
22. C) $\frac{a+3b}{6}$
23. A) 8
24. D) 0.010756
25. A) $x \rightarrow 2x-1$
26. B) 140 m
27. D. $\begin{pmatrix} -6 \\ 18 \end{pmatrix}$
28. D) A protractor
29. B) 4:3
30. D) 2
31. D) 1.8m
32. D) $\frac{4}{3}$
33. A) ₪300,000.00
34. E) 31
35. D) 25
36. A) 17
37. A) 8
38. E) 225°

39. D) 250cm

40. D) Constructing a perpendicular to a given line from a point outside the line.

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MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

1. (a) If $X = \{\text{Prime numbers less than 13}\}$ and $Y = \{\text{odd numbers less than 13}\}$
- (i) List the members of X and Y
 - (ii) List the members of $\{X \cap Y\}$ and $\{X \cup Y\}$
- (b) Three school children share some oranges as follows: Akwasi gets $\frac{1}{3}$ of the total, and the remainder is shared between Abena and Jantuah in the ratio 3:2. If Jantuah gets 24 oranges, how many does Akwasi get?
2. Using a ruler and a pair of compasses only,
- a) construct the triangle XYZ , in which $|YZ| = 6\text{cm}$, angle $XYZ = 60^\circ$ and $|XZ| = 9\text{cm}$. Measure $|XY|$
 - b)
 - (i) construct the mediator of YZ .
 - (ii) draw a circle, centre X and radius 5cm . Measure $|YA|$, where A is the point of intersection of the mediator and the circle in the triangular region XYZ
3. (a) Solve the equation:
$$\frac{2x-1}{3} - \frac{x-2}{4} = 1$$
- (b) Given that $m = -2$ and $n = \frac{3}{4}$, find the value of
- (i) $m^2(n-1)$
 - (ii) $n^2 - \frac{3}{m}$
- (c) Factorize completely $2ap + aq + bq - 2bp$

4. (a) The following table shows the distribution of votes in an election for class prefect.

| Name | Number of votes |
|----------|-----------------|
| Acquaye | 6 |
| Borquaye | 12 |
| Commey | 18 |

- (i) Draw a pie chart to illustrate the distribution.
(ii) What fraction of the votes was cast for Borquaye?

- (b) The heights in cm of 10 school children are as follows:

165, 165, 155, 159, 174,

154, 169, 155, 155, 150

Make a frequency table for this data

Use your table to find the mode and median of the distribution.

August 1991

MATHEMATICS

SECTION B

ESSAY

ESSAY

SOLUTIONS

1 (a)

$$\begin{aligned} \text{(i)} \quad X &= \{2, 3, 5, 7, 11\} \\ Y &= \{1, 3, 5, 7, 9, 11\} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad X \cap Y &= \{3, 5, 7, 11\} \\ X \cup Y &= \{1, 2, 3, 5, 7, 9, 11\} \end{aligned}$$

1 (b)

Since Akwasi gets $\frac{1}{3}$ of the total, remaining fraction $= 1 - \frac{1}{3} = \frac{2}{3}$

\Rightarrow the remainder $= \frac{2}{3}$ of total

\Rightarrow Abena's + Jantuah's $= \frac{2}{3}$ of total

| | Abena | Jantuah |
|----------------|-------|---------|
| Ratio | 3 | 2 |
| No. of oranges | a | 24 |

From the table above, $\frac{3}{a} = \frac{2}{24}$

$$\Rightarrow 3 \times 24 = 2 \times a \quad \Rightarrow 2 \times a = 24 \times 3,$$

$$\Rightarrow a = \frac{24 \times 3}{2} = 36$$

⇒ Abena gets 36 oranges

Hence, $\frac{2}{3}$ of the total → (36 + 24) oranges = 60 oranges

| | Fraction | No. of oranges |
|-----------------|---------------|--------------------------|
| Abena + Jantuah | $\frac{2}{3}$ | $36 + 24$ = 60 |
| Akwasi | $\frac{1}{3}$ | ? |

Approach 1

Now, if $\frac{2}{3} \rightarrow 60$ oranges

Then $\frac{1}{3} \rightarrow ?$ (less)

If less, more (i.e., $\frac{2}{3}$) divides, hence we have

$$\begin{aligned}\frac{\frac{1}{3}}{\frac{2}{3}} \times 60 \text{ oranges} &= \frac{1}{3} \div \frac{2}{3} \times 60 \text{ oranges} \\ &= \frac{1}{3} \times \frac{3}{2} \times 60 \text{ oranges} \\ &= \underline{30 \text{ oranges}} \\ &\Rightarrow \text{Akwasi gets } \underline{30 \text{ oranges}}\end{aligned}$$

Approach 2

$$\frac{\frac{2}{3}}{\frac{1}{3}} = \frac{60 \text{ oranges}}{x}$$

Cross-multiplying, we have $\frac{2}{3} x = \frac{1}{3} \times 60 \text{ oranges}$

Multiplying both sides by $\frac{3}{2}$ (to remove $\frac{2}{3}$) :

$$\begin{aligned}\frac{3}{2} \times \left(\frac{2}{3} x \right) &= \frac{3}{2} \times \left(\frac{1}{3} \times 60 \text{ oranges} \right) \\ x &= \frac{3}{2} \times \frac{1}{3} \times 60 \text{ oranges} \\ x &= \underline{30 \text{ oranges}} \\ &\Rightarrow \text{Akwasi gets } \underline{30 \text{ oranges}}\end{aligned}$$

Approach 3

Let the total no. = T, then $\frac{2}{3}$ of T = 60 oranges

$$\Rightarrow \frac{2}{3} \times T = 60$$

Solving for T by multiplying through by $\frac{3}{2}$, we have

$$\frac{3}{2} \times \frac{2}{3} T = \frac{3}{2} \times 60 \Rightarrow T = \frac{3}{2} \times 60 = 90$$

\Rightarrow The total no. of oranges = 90 oranges

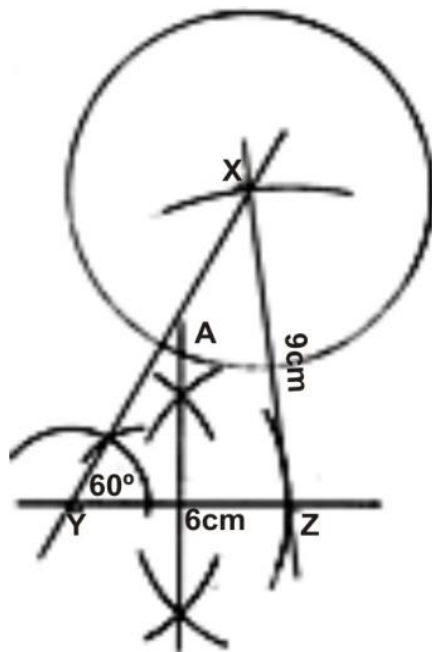
\Rightarrow Akwasi's share = $\frac{1}{3}$ of total

$$= \frac{1}{3} \times 90 \text{ oranges}$$

$$= \underline{30 \text{ oranges}}$$

\Rightarrow Akwasi gets 30 oranges

2)



(a) $|XY| \approx \underline{10.3 \text{ cm}}$

(b) $|YA| \approx \underline{5.7 \text{ cm}}$

3 (a)

$$\frac{2x-1}{3} - \frac{x-2}{4} = 1$$

Approach 1 ([Simplifying the LHS first](#))

$$\begin{aligned}
& \frac{4(2x-1) - 3(x-2)}{12} = 1 \\
\Rightarrow & \frac{8x-4-3x+6}{12} = 1 \\
\Rightarrow & \frac{5x+2}{12} = 1 \\
\Rightarrow & 5x+2 = 1 \times 12 \\
\Rightarrow & 5x = 12-2 \\
\Rightarrow & 5x = 10 \\
\Rightarrow & \frac{5x}{5} = \frac{10}{5} \\
\Rightarrow & \underline{\underline{x = 2}}
\end{aligned}$$

3 (a)

Approach 2 [\(Multiplying by 12 – to clear fractions\)](#)

$$\begin{aligned}
& 12 \times \left(\frac{2x-1}{3} \right) - 12 \times \left(\frac{x-2}{4} \right) = 12 \times 1 \\
\Rightarrow & 4(2x-1) - 3(x-2) = 12 \\
\Rightarrow & 8x-4-3x+6 = 12 \\
\Rightarrow & 8x-3x = 12+4-6 \\
\Rightarrow & 5x = 10 \\
\Rightarrow & x = 10 \div 5 \\
\Rightarrow & \underline{\underline{x = 2}}
\end{aligned}$$

3 (b)

Given that $m = -2$ and $n = \frac{3}{4}$

(i)

$$\begin{aligned}
& m^2(n-1) \\
\Rightarrow & (-2)^2(\frac{3}{4}-1) \\
= & 4(-\frac{1}{4}) \\
= & \underline{\underline{-1}}
\end{aligned}$$

(ii)

$$\begin{aligned}
& n^2 - \frac{3}{m} \\
\Rightarrow & \left(\frac{3}{4} \right)^2 - \frac{3}{-2} \\
= & \frac{9}{16} + \frac{3}{2}
\end{aligned}$$

$$= \frac{9 + 24}{16}$$

$$= \frac{23}{16} = \underline{\underline{1\frac{7}{16}}}$$

3 (c)

$$2ap + aq - bq - 2bp$$

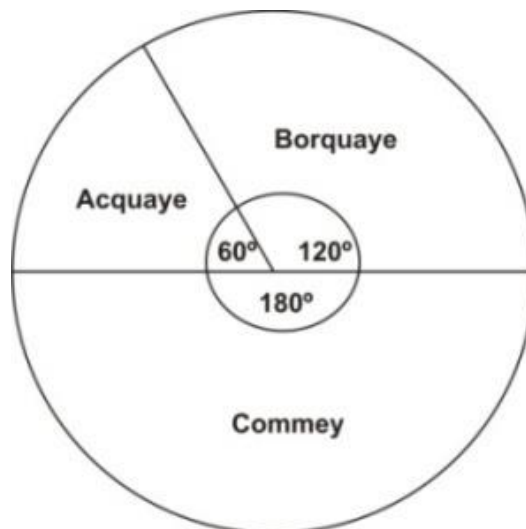
$$= a(2p + q) - b(q + 2p)$$

$$= \underline{\underline{(2p + q)(a - b)}}$$

4 (a) (i)

| Name | Number of votes | Angle of sector |
|--------------|-----------------|--|
| Acquaye | 6 | $\frac{6}{36} \times 360^\circ = 60^\circ$ |
| Borquaye | 12 | $\frac{12}{36} \times 360^\circ = 120^\circ$ |
| Commey | 18 | $\frac{18}{36} \times 360^\circ = 180^\circ$ |
| TOTAL | 36 | 360° |

Pie chart showing the distribution of votes in an election for class prefect



4 (a) (ii) Borquaye's fraction

Approach 1

$$\frac{\text{Borquaye's number of votes}}{\text{Total number of votes}} = \frac{12}{36} = \frac{1}{3}$$

4 (a) (ii) Approach 2

$$\frac{\text{Borquaye's angle}}{\text{Total angle}} = \frac{120}{360} = \frac{1}{3}$$

4 (b) (i)

Frequency table

| Height (in cm) | Tally | Frequency |
|-------------------|-------|-----------|
| 150 | / | 1 |
| 154 | / | 1 |
| 155 | /// | 3 |
| 159 | / | 1 |
| 165 | // | 2 |
| 169 | / | 1 |
| 174 | / | 1 |

(ii) (α) From the table, the mode = 155 cm

(ii) (β) **Finding the median**

Approach 1

Listing all the given heights, we have

150, 154, 155, 155, 155, 159, 165, 165, 169, 174

The middle heights (in cm) are 155 and 159

$$\begin{aligned}\therefore \text{The median} &= \frac{155 \text{ cm} + 159 \text{ cm}}{2} \\ &= \frac{314}{2} \text{ cm} = \underline{157 \text{ cm}}\end{aligned}$$

(ii) (β) Approach 2

The median

= the height (in cm) at the $\frac{1}{2}(\Sigma f+1)$ th position

\Rightarrow the $\frac{1}{2}(10+1)$ th position

= $\frac{1}{2}(11)$ = $5\frac{1}{2}$ th position

The height at the $5\frac{1}{2}$ th position

= the average of the heights at the 5th and 6th positions

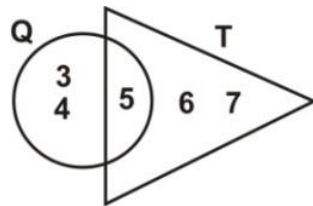
$$= \frac{155cm + 159cm}{2} = \underline{\underline{157cm}}$$

August 1990

MATHEMATICS

SECTION A OBJECTIVE TEST 1 hour

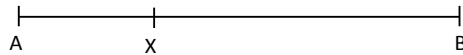
1. If $P = \{7, 9, 13\}$, $Q = \{1, 7, 13\}$. Find $P \cap Q$
- A. $\{1, 7, 13\}$
B. $\{1, 9, 13\}$
C. $\{7, 13\}$
D. $\{7, 9, 13\}$
E. $\{13\}$
2. In the diagram, Q is the set of numbers inside the circle and T is the set of numbers inside the triangle. Find $Q \cup T$.



- A. $\{5\}$
B. $\{6, 7\}$
C. $\{3, 4, 5\}$
D. $\{5, 6, 7\}$
E. $\{3, 4, 5, 6, 7\}$
3. Given that $(23 \times 82) \times 79 = 148,994$, find the exact value of $(2.3 \times 82) \times 7.9$
- A) 14.8994 B) 148.994 C) 1489.94 D) 14899.4 E) 148994.0
4. Convert 25_{ten} to a base two numeral
- A) 1000 B) 100111 C) 10101 D) 11001 E) 11100

5. If $(3.14 \times 18) \times 17.5 = 3.14 \times (3a \times 17.5)$. Find the value of a.
 A) 3.0 B) 5.8 C) 6.0 D) 9.0 E) 18.0
6. If 26039 oranges are shared equally among 13 women, how many oranges does each woman receive?
 A) 23 B) 1203 C) 230 D) 2003 E) 2300
7. Mr. Mensah withdrew some money from the bank. He gave $\frac{1}{2}$ of it to his sons and $\frac{1}{3}$ to his daughter. If he had ₵500.00 left, how much did he take from the bank?
 A) ₵600.00 B) ₵750.00 C) ₵1500.00 D) ₵2000.00 E) ₵3000.00
8. Simplify $\frac{1}{2} (1\frac{1}{2} + \frac{3}{4} \div \frac{1}{4})$
 A) $1\frac{1}{2}$ B) $2\frac{1}{4}$ C) $2\frac{3}{4}$ D) $4\frac{1}{2}$ E) 6
9. If $21:2x = 7:10$, find x.
 A) 3 B) $2\frac{1}{4}$ C) 15 D) 35 E) 50

10.



X is a point on the line segment AB such that $|AB| = 10\text{cm}$ and $|AX| = 4\text{cm}$. Find the ratio $|AX| : |XB|$

- A) 5:3 B) 3:2 C) 5:4 D) 1:1 E) 2:3
11. In an examination, 60% of the candidates passed. The number that passed was 240. How many candidates failed?
 A) 140 B) 160 C) 360 D) 400 E) 600
12. A table which cost ₵2,400.00 to manufacture was sold for ₵3,000.00. Find the profit percent.
 A) 80% B) 25% C) 24% D) 20% E) 11.1%
13. If $a = 2^2 \times 2^3 \div 2^4$, find the value of a
 A) 2^9 B) 2^5 C) 2^2 D) 2 E) 2^0

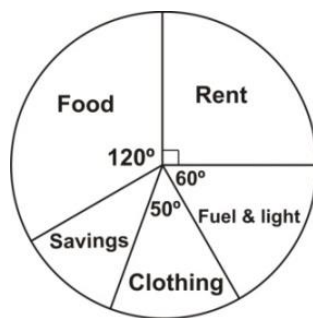
14. The distance between two towns is 12875km.

Express this distance in standard form.

- A) $1.2875 \times 10^3 \text{ km}$
- B) $1.2875 \times 10^4 \text{ km}$
- C) $12.875 \times 10^3 \text{ km}$
- D) $128.75 \times 10^2 \text{ km}$
- E) $12.875 \times 10^4 \text{ km}$

The pie chart shows the monthly expenditure of Mr. A

whose monthly income is ₺18,000.00.



15. What fraction of Mr. A's income is spent on food?

- A) $\frac{1}{6}$
- B) $\frac{1}{4}$
- C) $\frac{1}{3}$
- D) $\frac{2}{5}$
- E) $\frac{1}{2}$

16. How much does Mr. A spend on rent?

- A) ₺90.00
- B) ₺450.00
- C) ₺4,500.00
- D) ₺9,000.00
- E) ₺16,200.00

17. What is the size of the angle that represents savings?

- A) 40° B) 60° C) 130° D) 230° E) 320°

18. Find the missing addend

20.45

19.18

44.30

- A) 83.39 B) 19.69 C) 25.12 D) 23.85 E) 4.67

19. Remove the brackets: $a - 2(b - 3c)$

A) $a - 2b - 3c$

B) $a - 2b - 6c$

C) $a - 2b + 6c$

D) $a + 2b + 6c$

E) $a - 2b + 3c$

20. Simplify $\frac{2a}{3} - \frac{a-b}{2}$

A) $a - 3b$

B) $\frac{a-3b}{6}$

C) $\frac{a+3b}{6}$

D) $a + 3b$

E) $a - b$

21. If $q = ut + \frac{1}{2}ft$, find q when $u = 20$, $t = 10$ and $f = 15$

A) 350

B) 275

C) 237.5

D) 55

E) 42.5

22. If $\frac{3}{15}$ is equivalent to $\frac{45}{a}$, find a

A) 225

B) 150

C) 135

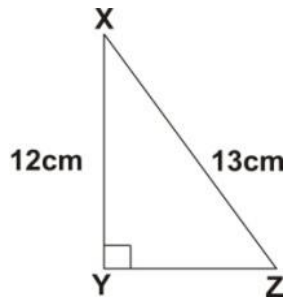
D) 30

E) 9

23. Find the least common multiple of 7, 14 and 18

- A) 71418 B) 1764 C) 252 D) 126 E) 98

24.



In triangle XYZ, $|XZ| = 13\text{cm}$, $|XY| = 12\text{cm}$ and angle $XYZ = 90^\circ$. Find $|YZ|$ if the area of the triangle is 30cm^2 .

- A) 25 cm B) 14 cm C) 12.5 cm D) 5 cm E) 1 cm

25. Write 1204_{five} as a number in base ten.

- A) 9996 B) 179 C) 39 D) 35 E) 19

26. Multiply $(2x + y)$ by $(2x - y)$

- A) $4x^2 - 4xy - y^2$
B) $4x^2 + xy - y^2$
C) $4x^2 - xy - y^2$
D) $4x^2 + y^2$
E) $4x^2 - y^2$

27. A watchman was paid a basic wage of ₦250.00 a day. If he worked every day in the month, calculate his basic wage for February 1988.

- A) ₦6250.00
B) ₦7200.00
C) ₦7250.00
D) ₦7750.00

E) €8750.00

28. A tank contains 250 litres of water. If 96 litres are used, what percentage of the original quantity is left?

- A) 61.6% B) 60.5% C) 59.0% D) 54.2% E) 38.4%

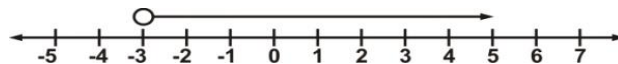
29. Evaluate $10 \div \left(3\frac{1}{2} + 1\frac{1}{5}\right)$

- A) $2\frac{6}{47}$ B) $2\frac{1}{6}$ C) 4 D) $4\frac{2}{35}$ E) $4\frac{7}{10}$

30. A bag contains 24 marbles, 10 of which are blue and the rest green. A boy picks a marble at random from the bag. What is the probability that he picks a green marble?

- A) $\frac{1}{14}$ B) $\frac{7}{17}$ C) $\frac{5}{12}$ D) $\frac{7}{12}$ E) $\frac{7}{10}$

31.



Which of the following inequalities is represented on the number line, where n is a real number?

- A) $n \geq -3$ B) $n < -3$ C) $n \leq -3$ D) $n > -3$ E) $n = 3$

32. What is the name of the line segment drawn to join any two points on the circumference of a circle?

- A) arc B) chord C) radius D) sector E) segment

Use the mapping to answer questions 33 and 34

| | | | | |
|---------------|---|---|---|-------|
| $\frac{1}{2}$ | → | 1 | → | 3.14 |
| 1 | → | 2 | → | 6.28 |
| 2 | → | 4 | → | 12.56 |
| 3 | → | 6 | → | x |

33. Find the value of x

- A) 9.42 B) 12 C) 18 D) 18.84 E) 25.12

34. Find the value of y

- A) 2 B) 5 C) 7 D) 9 E) 10

35. The area of a square is 49cm^2 . Find the perimeter of the square.

- A) 7cm B) 14cm C) 28cm D) 49cm E) 196cm

36. The least number in a set of real numbers is 24 and the greatest is 30. Which of the following is the correct interpretation of the statement?

A) $24 \leq x \leq 30$

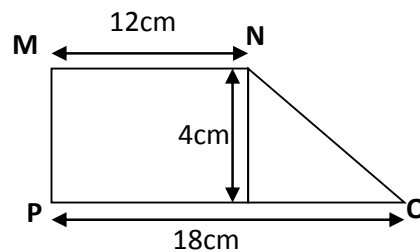
B) $24 < x < 29$

C) $23 < x < 29$

D) $24 < x < 30$

E) $23 \leq x \leq 29$

37.



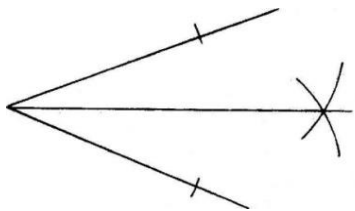
Find the area of the trapezium MNOP.

- A) 120cm^2 B) 72cm^2 C) 60cm^2 D) 48cm^2 E) 38cm^2

38. The length of a field, 1.2 km long is represented on a map by a line 40 mm long. What is the scale of the map?

- A) 1:100 B) 1:300 C) 1:1000 D) 1:3000 E) 1:30000

39.



The diagram shows the construction for:

- A) Copying a given angle
- B) Bisecting a line segment
- C) Drawing a perpendicular to a given line
- D) Bisecting a given angle
- E) Drawing an angle of 30°

40. Simplify

$$\begin{pmatrix} 2 \\ -3 \end{pmatrix} - \begin{pmatrix} -1 \\ 5 \end{pmatrix}$$

A. $\begin{pmatrix} -3 \\ 8 \end{pmatrix}$

B. $\begin{pmatrix} 3 \\ -8 \end{pmatrix}$

C. $\begin{pmatrix} -3 \\ -8 \end{pmatrix}$

D. $\begin{pmatrix} 3 \\ 8 \end{pmatrix}$

E. $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

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MATHEMATICS

SECTION A OBJECTIVE TEST

SOLUTIONS

1. C. $\{7, 13\}$
2. E. $\{3, 4, 5, 6, 7\}$
3. C) 1489.94
4. D) 11001
5. C) 6.0
6. D) 2003
7. E) ₦3000.00
8. B) $2\frac{1}{4}$
9. C) 15
10. E) 2:3
11. B) 160
12. B) 25%
13. D) 2
14. B) 1.2875×10^4
15. C) $\frac{1}{3}$

16. C) ₪4,500.00
17. A) 40°
18. E) 4.67
19. C) $a-2b+6c$
20. C) $\frac{a+3b}{6}$
21. B) 275
22. A) 225
23. D) 126
24. D) 5cm
25. B) 179
26. E) $4x^2-y^2$
27. C) ₪7250.00
28. A) 61.6%
29. A) $2\frac{6}{47}$
30. D) $\frac{7}{12}$
31. D) $n > -3$
32. B) chord
33. 33. D) 18.84
34. 34. B) 5
35. C) 28cm
36. A) $24 \leq x \leq 30$
37. C) 60 cm^2
38. E) 1:30000
39. D) bisecting a given angle

40. B. $\begin{pmatrix} 3 \\ -8 \end{pmatrix}$

August 1990

MATHEMATICS

SECTION B

ESSAY

1 hour

[60 marks]

1. List the members of each of the sets

$B = \{\text{Whole numbers from 20 to 30}\}$. $D = \{\text{factors of 63}\}$

(a) List the members of (i) $B \cap D$

(ii) $B \cup D$

(b) In a class of 60 students, 46 passed Mathematics and 42 passed English language. Everybody passed at least one of the two subjects.

(i) Illustrate this information on a Venn diagram

(ii) How many students passed in both subjects?

2. (a) Factorize completely $3a^2 + 2ab - 12ac - 8bc$

(b) Solve $\frac{x}{4} + \frac{3}{5} = \frac{3x}{5} - 2$

(c) Find the solution set of $x + 3 > 19 - 3x$, where x is a real number.

Illustrate your answer on the number line.

3. (a) Using a ruler and a pair of compasses only

(i) Construct triangle PQR such that $|PQ| = 6\text{cm}$, $|QR| = 4\text{cm}$ and angle $PQR = 90^\circ$

(ii) Construct the perpendicular bisectors of PQ and QR. Name the intersection O.

(iii) Draw a circle O as centre and OQ as radius

(b) Measure (i) $|PR|$ (ii) angle QPR

4. The following is the result of a survey conducted in a class of a junior secondary school to find the favourite soft drink of each pupil in the class.

| Soft Drink | Number of pupils |
|------------|------------------|
| Coca-cola | 6 |
| Pepsi-cola | 5 |
| Pee-cola | 8 |
| Fanta | 3 |
| Muscatella | 5 |
| Mirinda | 4 |
| Club cola | 6 |
| Sprite | 3 |

- (a) Draw a bar chart showing this information, using a scale of 2cm to 1unit on the vertical axis.
- (b) How many pupils are in the class?
- (c) What is the percentage of pupils who prefer club-cola?

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MATHEMATICS

SECTION B ESSAY

SOLUTIONS

1 (a)

$$B = \{20, 21, 22, 23, \dots, 30\}$$

$$D = \{1, 3, 7, 9, 21, 63\}$$

(i) $B \cap D = \{21\}$

(ii) $B \cup D = \{1, 3, 7, 9, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 63\}$

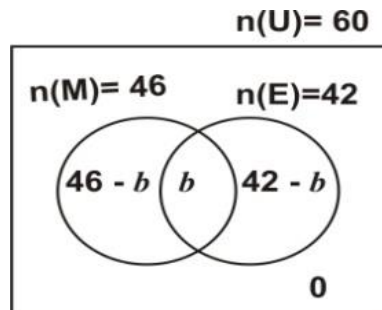
1 (b) (i)

Let $n(U)$ = No. of students in the class

$n(M)$ = No. of students that passed Maths

$n(E)$ = No. of students that passed English

b = No. of students that passed both Maths and English



(b) (ii)

From the diagram above,

$$46 - b + b + 42 - b + 0 = 60$$

$$\Rightarrow 46 + 0 + 42 - b + 0 = 60$$

$$\Rightarrow 46 + 42 - b = 60$$

$$\Rightarrow 88 - b = 60$$

$$\Rightarrow 88 - 60 = b$$

$$\Rightarrow \underline{\underline{b = 28}}$$

\therefore 28 students passed in both subjects

2 (a)

$$3a^2 + 2ab - 12ac - 8bc$$

$$= a(3a + 2b) - 4c(3a + 2b)$$

$$= \underline{\underline{(3a + 2b)(a - 4c)}}$$

2 (b)

$$\frac{x}{4} + \frac{3}{5} = \frac{3x}{5} - 2$$

Approach 1 [\(Grouping and simplifying first\)](#)

$$\Rightarrow 2 + \frac{3}{5} = \frac{3x}{5} - \frac{x}{4}$$

$$\Rightarrow \frac{10 + 3}{5} = \frac{12x - 5x}{20}$$

$$\Rightarrow \frac{13}{5} = \frac{7x}{20}$$

$$\Rightarrow 13 \times 20 = 7x \times 5$$

$$\Rightarrow \frac{13 \times 20}{7 \times 5} = \frac{7x \times 5}{7 \times 5}$$

$$\Rightarrow \frac{52}{7} = x$$

$$\Rightarrow \underline{\underline{x = 7\frac{3}{7}}} \quad \text{or}$$

$$\Rightarrow \underline{\underline{x \approx 7.429}}$$

2 (b)

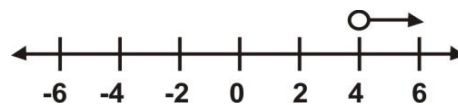
Approach 2 ([Multiplying by 20 first – to clear fractions](#))

$$\begin{aligned}\frac{x}{4} + \frac{3}{5} &= \frac{3x}{5} - 2 \\ 20 \times \left(\frac{x}{4} + \frac{3}{5} \right) &= 20 \times \left(\frac{3x}{5} - 2 \right) \\ \Rightarrow 20 \times \frac{x}{4} + 20 \times \frac{3}{5} &= 20 \times \frac{3x}{5} - 20 \times 2 \\ \Rightarrow 5 \times x + 4 \times 3 &= 4 \times 3x - 20 \times 2 \\ \Rightarrow 5x + 12 &= 12x - 40 \\ \Rightarrow 40 + 12 &= 12x - 5x \\ \Rightarrow 52 &= 7x \\ \Rightarrow 7x &= 52 \\ \Rightarrow x &= 52 \div 7 \\ \Rightarrow \underline{\underline{x = 7\frac{3}{7} \quad \text{or}}} \\ \Rightarrow \underline{\underline{x \approx 7.429}}\end{aligned}$$

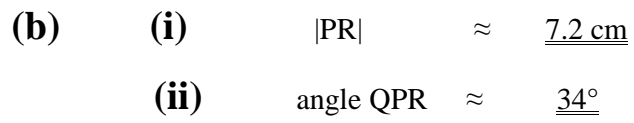
2 (c)

$$\begin{aligned}x + 3 &> 19 - 3x \\ \Rightarrow x + 3x &> 19 - 3 \\ \Rightarrow 4x &> 16 \\ \Rightarrow x &> 16 \div 4 \\ \Rightarrow \underline{\underline{x > 4}}\end{aligned}$$

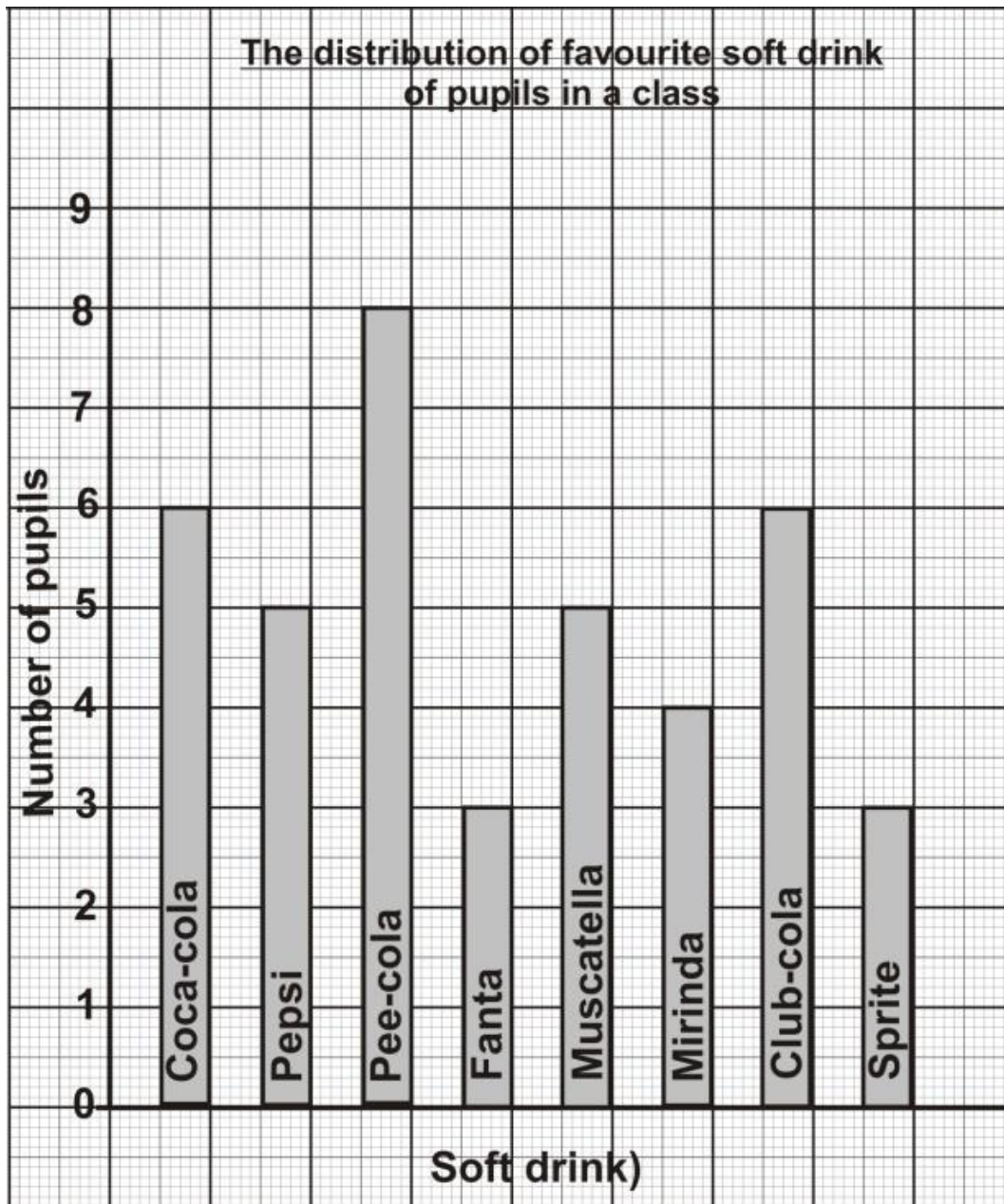
The number line illustration is shown below:



3 (a)



Vertical AxisScale: 2 cm to 1 pupil



4 (b)

Total number of pupils

$$= 6 + 5 + 8 + 3 + 5 + 4 + 6 + 3$$

$$= \underline{40}$$

(c)

Percentage of pupils who prefer Club-cola

$$= \frac{\text{No. of pupils who prefer club-cola}}{\text{Total no. of pupils}} \times 100\%$$

$$= \frac{6}{40} \times 100\% = \underline{15\%}$$

\Rightarrow 15% of the pupils prefer Club-cola

