2011 BECE Mathematics (Maths) Past Questions Paper One

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∩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. $(b + f)(m + b)$

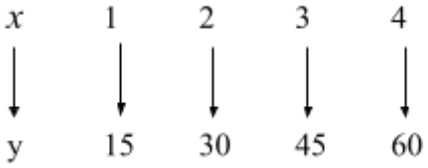
12. Simplify: -13 – (-3) + (-10)

   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. $-\frac{1}{6}$

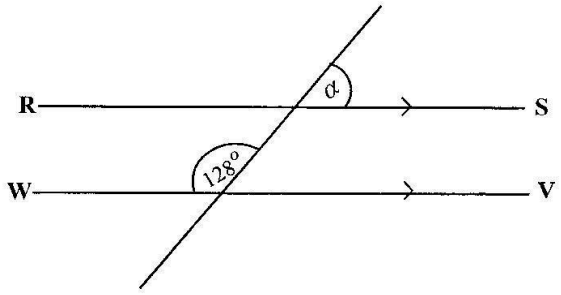
B. $-\frac{1}{2}$

C. 2
D. 6

23. A car is travelling at 60 km per hour. How far does it travel in 2 ½ 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°



NOT DRAWN TO SCALE

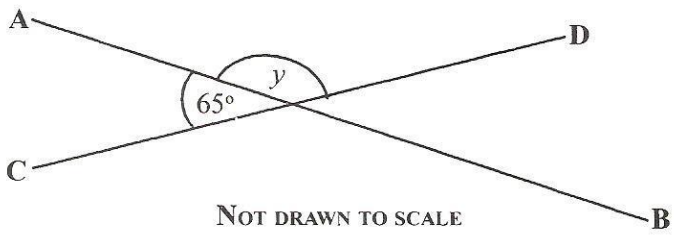
25. Given that $a = (5\ 2n)$ and $b = (2n - 1\ 6)$. If $a = b$, find the values of n.

    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°

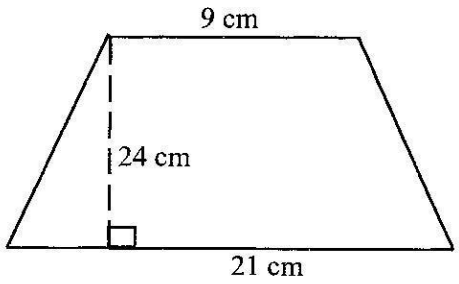


NOT DRAWN TO SCALE

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.



NOT DRAWN TO SCALE

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 $r = (\ 2\ \ -\ 5\ )$ and $s = (-\ 2\ \ 5\ )$, calculate $2\mathbf{r} - 3\mathbf{s}$

A. $(-\ 10\ \ -\ 25\ )$
B. $(-\ 2\ \ -\ 25\ )$
C. $(\ 10\ \ -\ 25\ )$
D. $(10\ 25\ )$

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

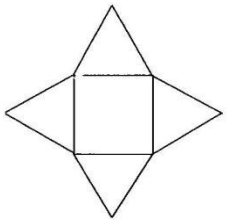
33. What is the modal age?
    A. 14
    B. 15
    C. 16
    D. 17

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

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. $(\ 10\ -\ 25\ )$

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

2011 BECE Mathematics (Maths) Past Questions Paper Two

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?

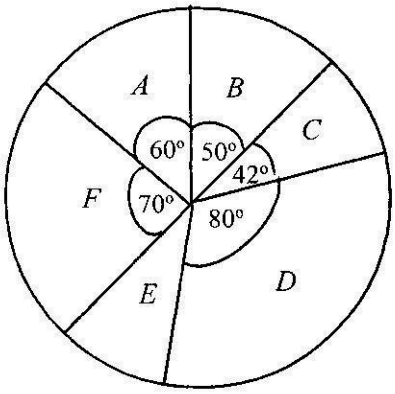
(b) Make h the subject of $v = \frac{1}{3}\pi r^2 h$

(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

$$\frac{1}{3}x+1 \quad \geq \quad \frac{1}{2}x \ + \frac{1}{4}(2-x)$$

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

(i) triangle ABC such that $|AB| = 8$cm, angle CBA = 45° and CAB = 60°.

(ii) the bisector of angle ACB to meet AB at T

(b) Measure

(i) $|CT|$;

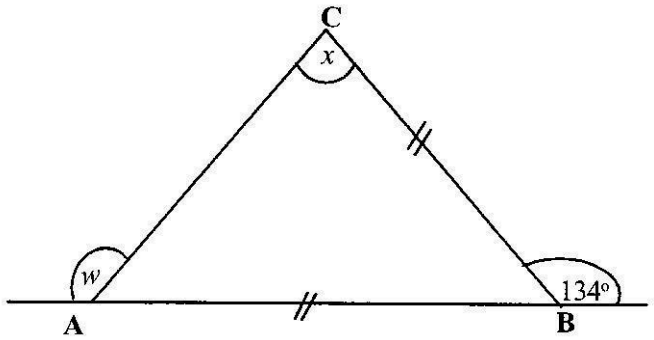
(ii) angle CTB.

(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

(i) value of x;
(ii) area of the plot;
(iii) cost of weeding the plot at GH¢ 0.24 per m^2.

(b) Find the value of x and w in the diagram 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

(i) $\mathbf{a} + 2\mathbf{b}$;
(ii) $\frac{1}{2}(2\mathbf{a} - \mathbf{b})$

(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

(i) Find the number of pupils in the school
(ii) What is the mean number of pupils in a class?
(iii) 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

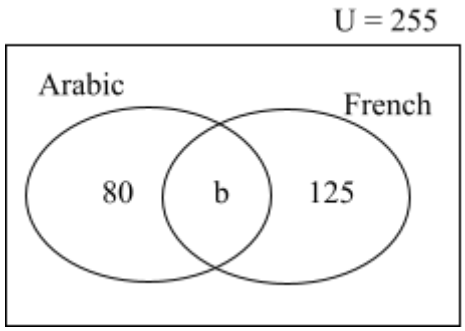
(ii) the weight of rice that can be bought with GH¢14.00

(d) Factorize: $3a^2 - 8bc - 12ac + 2ba$

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) (α) From the Venn diagram above,

$80 + b + 125 = 255$

$\Rightarrow \quad b + 205 = 255$

$\Rightarrow \quad b = 255 - 205$ [Subtracting 205 from both sides (carrying + 205 to the other side)]

$\Rightarrow \quad b = 50$

$\Rightarrow$ <u>50 students study both Arabic and French</u>.

(β) Number of French students $= b + 125$

$= 50 + 125$

$= \underline{175}$

(b) $v = \frac{1}{3}\pi r^2 h$

$3 \times v = 3 \times \frac{1}{3}\pi r^2 h$ [Multiplying both sides by 3 (to clear fraction)]

$\Rightarrow \quad 3v = \pi r^2 h$ [Simplifying]

$\Rightarrow \quad \frac{3v}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$ [Dividing both sides by πr^2]

$\Rightarrow \quad \frac{3v}{\pi r^2} = h$

$\Rightarrow \quad h = \frac{3v}{\pi r^2}$

(c) (i) Total cost price = 80 × GHc 3.50

= <u>GHc 280.00</u>

(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 = $\frac{Profit}{Original\ Cost} \times 100\%$ [NB: 100%, **not** 100]

= $\frac{70}{350} \times 100\%$ [Substituting values (of profit and original cost)]

= $\frac{1}{5} \times 100\%$ [Simplifying]

= <u>20%</u>

2. **(a) (i)** Since School D's share = 80° ≡ 8000 books

By inspection of the above correspondence, it is obvious that there is a factor of 100 (ie, 80 × **100** = 8000). Hence,

School A's share = 60° ≡ 6000 books

School B's share = 50° ≡ 5000 books

School C's share = 42° ≡ 4200 books

School F's share = 70° ≡ 7000 books

Now, School E's angle = 360° - (80°+42+50°+60°+70°)

= 360° - 302°

= 58°

Hence, School E's share = 5800 books

(ii) Average number of books given

$$= \frac{Total\ number\ of\ books\ given}{Number\ of\ schools}$$

$$= \frac{8000 + 6000 + 5000 + 4200 + 7000 + 5800}{6} \text{books}$$

$$= \frac{36000}{6} \text{books}$$

= 6000 books

(iii) Schools B, C and E had less than 6000 books

Therefore 3 schools had less than the average number of books.

(b) $\frac{1}{3}x + 1 \geq \frac{1}{2}x + \frac{1}{4}(2 - x)$

$\Rightarrow 12\left(\frac{1}{3}x\right) + 12(1) \geq 12\left(\frac{1}{2}x\right) + 12\left[\frac{1}{4}(2 - x)\right]$ Multiplying through by 12 (the LCM of the denominators)

$\Rightarrow 4x + 12 \geq 6x + 3(2 - x)$ Simplifying

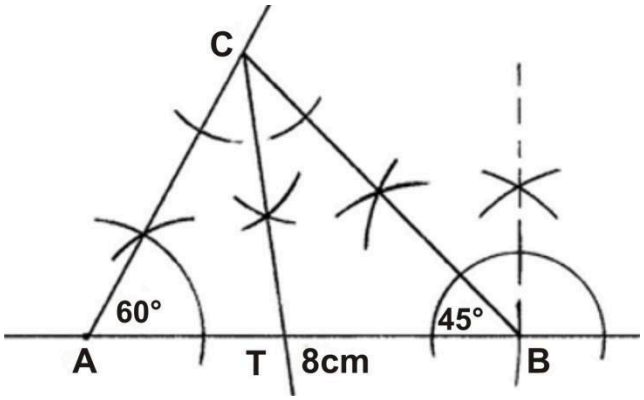
$\Rightarrow 4x + 12 \geq 6x + 6 - 3x$

$\Rightarrow 4x + 12 \geq 3x + 6$

$\Rightarrow \quad 4x - 3x \geq 6 - 12$ Grouping like terms on one side

$\Rightarrow \quad x \geq -6$

3. (a)



(b) (i) $|CT| \approx 5.1$ cm

(ii) angle CTB $\approx$ 97° (or 98°)

(c)

	Fraction	Amount (GH¢)
Spent	$\frac{3}{8}$	**?**
✔ ***Left***	$\frac{5}{8}$	**15**
✔ ***Total*** (M. salary)	$\frac{8}{8}$	**m**

NB: Fraction left
= 'Total fraction' – Fraction spent
=

From the above table, we have $\frac{\frac{5}{8}}{\frac{8}{8}} = \frac{15}{m}$ [From the '*Left*' and '*Total*' rows]

$\Rightarrow \quad \frac{5}{8} \times m = 15 \times \frac{8}{8}$ [Cross-multiplying]

$\Rightarrow \quad \frac{5}{8} \times m = 15$

$\Rightarrow \quad \frac{8}{5} \times \frac{5}{8} \times m = 15 \times \frac{8}{5}$ [Multiplying both sides by $\frac{8}{5}$ (to remove $\frac{5}{8}$)]

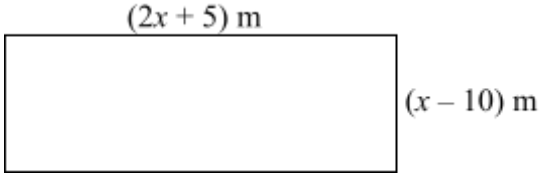
$\Rightarrow \quad m = 15 \times \frac{8}{5}$

$\Rightarrow \quad m = 3 \times 8$ [Simplifying]

$\Rightarrow \quad m = 24$

Therefore he had <u>GHc 24.00</u>

4. (a)



(i) Since Perimeter = 80 m

$\Rightarrow$ 2 (Length) + 2 (width) = 80 m

$\Rightarrow$ $2(2x + 5) + 2(x - 10) = 80$ Substituting the values of length and width

$\Rightarrow$ $4x + 10 + 2x - 20 = 80$ Expanding

$\Rightarrow$ $4x + 2x + 10 - 20 = 80$ Grouping like terms

$\Rightarrow$ $6x - 10 = 80$ Simplifying

$\Rightarrow$ $6x = 80 + 10$ Adding 10 to both sides (carrying -10 to the other side)

$\Rightarrow$ $6x = 90$

$\Rightarrow \quad \frac{6x}{6} = \frac{90}{6}$ Dividing both sides by 6 (the co-efficient of x)

$\Rightarrow \quad x = 90 \div 6$

$\Rightarrow \quad \underline{x = 15}$

(ii) Area of the plot = Length × Width

$= [2x + 5] \times [x - 10]$ Substituting the expressions of length and width

$= [2(15) + 5] \times [15 - 10]$ Substituting the value of x(15)

$= [30 + 5] \times [15 - 10]$ Simplifying

$= 35\text{m}^2 \times 5\text{m}^2$

$= \underline{175\ \text{m}^2}$

(iii) If 1m^2 costs GHc 0.24

Then, $175\ \text{m}^2$ costs $175 \times$ GHc 0.24

$\Rightarrow$ $175\ \text{m}^2$ costs <u>GHc 42.00</u>

$\Rightarrow$ <u>The cost of weeding the plot is GHc 42.00</u>

(b) $\angle ABC = 180° - 134°$ (Sum of angles at a point on a straight line = 180°)

$= 46°$

Since $|AB| = |BC|$

$\Rightarrow \quad \angle BCA = x = \angle BAC$ (Base angles of isosceles triangle equal)

Now, $\angle BCA + \angle BAC + 46° = 180°$ (Sum of angles in a triangle = 180°)

$x + x + 46° = 180°$ (Substituting: $\angle BCA = x$, $\angle BAC = x$)

$2x + 46 = 180°$ [Simplifying]

$2x = 180° - 46°$ [Grouping like terms]

$2x = 134°$

$$\frac{2x}{2} = \frac{134°}{2}$$ [Dividing both sides by 2 (the co-efficient of x)

$$x = 134° \div 2$$

$$\underline{x = 67°}$$

Therefore $\angle BAC = 67°$

$\Rightarrow$ $\angle BAC + w = 180°$ (Sum of angles at a point on a straight line)

$\Rightarrow$ $67° + w = 180°$

$\Rightarrow$ $w = 180° - 67°$

$\Rightarrow$ $\underline{w = 113°}$

5. **(a) (i)** $\mathbf{a} + 2\mathbf{b}$

$= (-3 \;\; 3) + 2(4 \;\; -6)$

Substituting

$= (-3 \;\; 3) + (8 \;\; -12)$

Simplifying

$= (-3 + 8 \;\; 3 + (-12))$

$= (5 \;\; -9)$

(ii) $\frac{1}{2}(2a - b)$

$= \frac{1}{2}[2(-3 \;\; 3) - (4 \;\; -6)]$

$= \frac{1}{2}[(-6 \;\; 6) - (4 \;\; -6)]$

$= \frac{1}{2}[(-6 - 4 \;\; 6 - (-6))]$

$= \frac{1}{2}(-10 \;\; 12)$

$= \quad \left(\frac{1}{2} \times -10\ \frac{1}{2} \times 12\right)$

$= \quad (-56)$

(b) (i) The number of pupils in the school

$= \quad 24 + 35 + 35 + 20 + 21 + 45$

$= \quad 180$

<u>There are 180 pupils in the school</u>

(ii) The mean number of pupils in a class

$= \quad \frac{Total\ number\ of\ pupils\ in\ the\ school}{Number\ of\ classes}$

$= \quad \frac{24 + 35 + 35 + 20 + 21 + 45}{6}$

$= \quad \frac{180}{6}$

$= \quad$ <u>30 pupils</u>

(iii) The percentage of pupils in class six

$= \quad \frac{No.\ of\ pupils\ in\ class\ six}{Total\ no.\ of\ pupils} \times 100\%$

$= \quad \frac{45}{180} \times 100\%$

$= \quad \frac{1}{4} \times 100\%$

$= \quad$ <u>25%</u>

(c) 312_{five} to a base ten numeral

3	1	2
5^2	5^1	5^0

$\Rightarrow \quad (3 \times 5^2) + (1 \times 5^1) + (2 \times 5^0)$

$= \quad (3 \times 25) + (1 \times 5) + (2 \times 1)$

$= \quad 75 + 5 + 2$

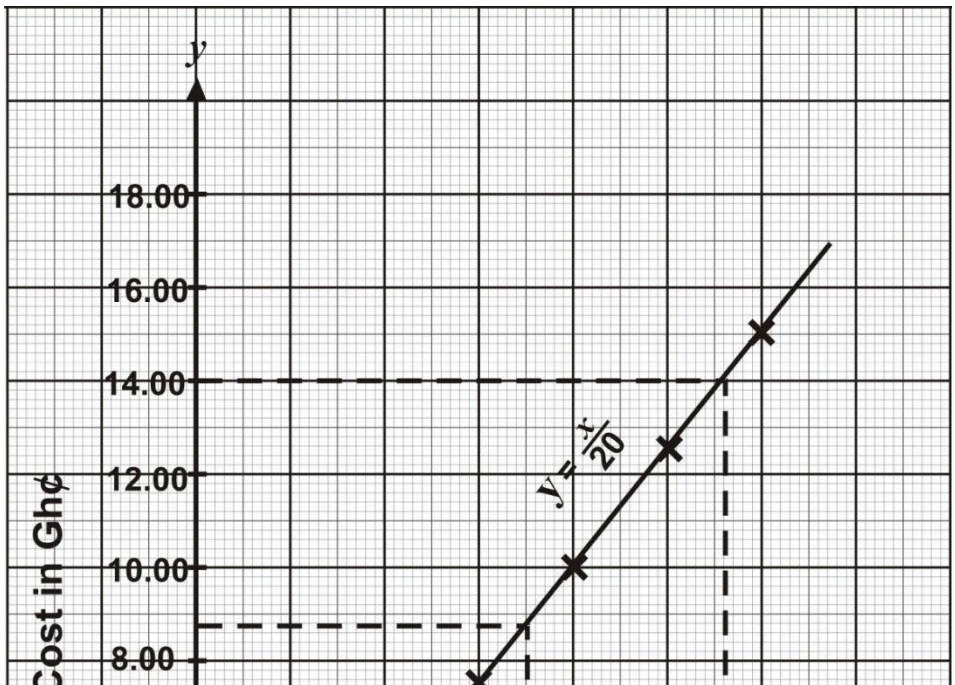
$= \quad \underline{82} \quad (\text{or } \underline{82}_{ten})$

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 or rice that can be bought with GHc 14.00 = 280 grammes

(d) $3a^2 - 8bc - 12ac + 2ba$

$= 3a^2 - 12ac + 2ba - 8bc$ [Re-arranging terms]

$= 3a(a - 4c) + 2b(a - 4c)$ [Factorizing]

$= (a - 4c)(3a + 2b)$