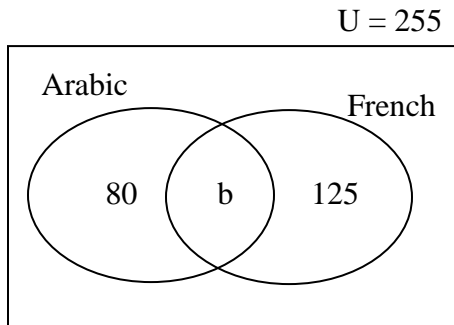


**2011 BECE MATHEMATICS 2 SOLUTION**  
**MATHEMATICS 2**

ESSAY

- 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,

$$80 + b + 125 = 255$$

$$\Rightarrow b + 205 = 255$$

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

$$\Rightarrow b = 50$$

$$\Rightarrow \underline{\underline{50 \text{ students study both Arabic and French.}}}$$

$$\begin{aligned} (\beta) \text{ Number of French students} &= b + 125 \\ &= 50 + 125 \\ &= \underline{\underline{175}} \end{aligned}$$

**(b)**

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

$$\begin{aligned} \text{(c) (i) Total cost price} &= 80 \times \text{GHc } 3.50 \\ &= \underline{\text{GHc } 280.00} \end{aligned}$$

$$\begin{aligned} \text{(ii) Profit on each book} &= \text{GHc } 4.20 - \text{GHc } 3.50 \\ &= \text{GHc } 0.70 \quad (\text{or } 70 \text{ Gp}) \\ \text{Cost price of each book} &= \text{GHc } 3.50 \quad (\text{or } 350 \text{ Gp}) \end{aligned}$$

$$\begin{aligned} \text{Percentage profit} &= \frac{\text{Profit}}{\text{Original Cost}} \times 100\% \quad [\text{NB: } 100\%, \text{ not } 100] \\ &= \frac{70}{350} \times 100\% \quad [\text{Substituting values (of profit and} \\ \text{original cost)}] \\ &= \frac{1}{5} \times 100\% \quad [\text{Simplifying}] \\ &= \underline{20\%} \end{aligned}$$

$$2. \text{ (a) (i) Since School D's share} = 80^\circ \equiv 8000 \text{ books}$$

By inspection of the above correspondence, it is obvious that

there is a factor of 100 (ie,  $80 \times 100 = 8000$ ). Hence,

$$\text{School A's share} = 60^\circ \equiv 6000 \text{ books}$$

$$\text{School B's share} = 50^\circ \equiv 5000 \text{ books}$$

$$\text{School C's share} = 42^\circ \equiv 4200 \text{ books}$$

$$\text{School F's share} = 70^\circ \equiv 7000 \text{ books}$$

$$\text{Now, School E's angle} = 360^\circ - (80^\circ + 42^\circ + 50^\circ + 60^\circ + 70^\circ)$$

$$= 360^\circ - 302^\circ$$

$$= 58^\circ$$

$$\text{Hence, School E's share} = 5800 \text{ books}$$

(ii) Average number of books given

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

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

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

$$= \quad \underline{\underline{6000 \text{ books}}}$$

**(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

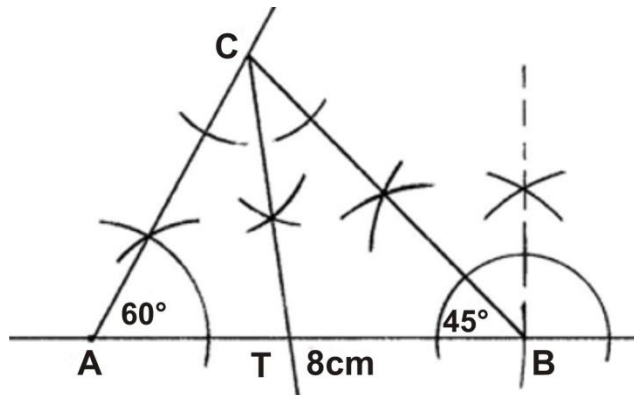
$\Rightarrow 4x + 12 \geq 6x + 6 - 3x$

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

$\Rightarrow 4x - 3x \geq 6 - 12$       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  $\approx \underline{\underline{97^\circ}}$  (or  $\underline{\underline{98^\circ}}$ )

**(c)**

	Fraction	Amount (GH¢)
✓	Spent	$\frac{3}{8}$
✓	<b>Left</b>	$\frac{5}{8}$
✓	<b>Total</b> (M. salary)	$\frac{8}{8}$

NB: Fraction left  
= 'Total fraction' – Fraction spent  
 $= 1 - \frac{3}{8}$   
 $= \frac{8}{8} - \frac{3}{8} = \frac{5}{8}$

From the above table, we have

$$\frac{5/8}{8/8} = \frac{15}{m} \quad \text{[From the 'Left' and 'Total' rows]}$$

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

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

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

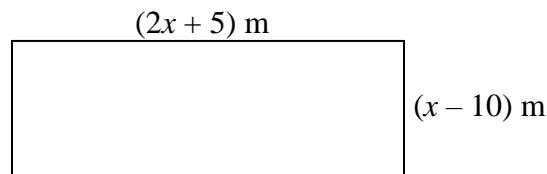
$$\Rightarrow m = 15 \times \frac{8}{5}$$

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

$$\Rightarrow \underline{m = 24}$$

Therefore he had GHC 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)

$$\Rightarrow 6x = 90$$

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

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

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

**(ii)** Area of the plot = Length  $\times$  Width

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

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

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

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

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

**(iii)** If  $1\text{m}^2$  costs GHc 0.24

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

$$\Rightarrow 175\text{m}^2 \text{ costs } \underline{\text{GHc } 42.00}$$

$$\Rightarrow \underline{\text{The cost of weeding the plot is GHc } 42.00}$$

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

$$= 46^\circ$$

Since  $|AB| = |BC|$

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

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

$$x + x + 46^\circ = 180^\circ \text{ (Substituting: } \angle BCA = x, \angle BAC = x)$$

$$2x + 46 = 180^\circ \text{ [Simplifying]}$$

$$2x = 180^\circ - 46^\circ \text{ [Grouping like terms]}$$

$$2x = 134^\circ$$

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

$$x = 134^\circ \div 2$$

$$\underline{x = 67^\circ}$$

Therefore  $\angle BAC = 67^\circ$

$$\Rightarrow \angle BAC + w = 180^\circ \text{ (Sum of angles at a point on a straight line)}$$

$$\Rightarrow 67^\circ + w = 180^\circ$$

$$\Rightarrow w = 180^\circ - 67^\circ$$

$$\Rightarrow \underline{w = 113^\circ}$$

5. (a) (i)

$$\mathbf{a + 2b}$$

$$= \begin{pmatrix} -3 \\ 3 \end{pmatrix} + 2 \begin{pmatrix} 4 \\ -6 \end{pmatrix}$$

Substituting

$$= \begin{pmatrix} -3 \\ 3 \end{pmatrix} + \begin{pmatrix} 8 \\ -12 \end{pmatrix}$$

Simplifying

$$= \begin{pmatrix} -3 + 8 \\ 3 + (-12) \end{pmatrix}$$

$$= \begin{pmatrix} 5 \\ -9 \end{pmatrix}$$

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

$$= \frac{1}{2} \left[ 2 \begin{pmatrix} -3 \\ 3 \end{pmatrix} - \begin{pmatrix} 4 \\ -6 \end{pmatrix} \right]$$

$$= \frac{1}{2} \left[ \begin{pmatrix} -6 \\ 6 \end{pmatrix} - \begin{pmatrix} 4 \\ -6 \end{pmatrix} \right]$$

$$= \frac{1}{2} \left[ \begin{pmatrix} -6 - 4 \\ 6 - (-6) \end{pmatrix} \right]$$

$$= \frac{1}{2} \begin{pmatrix} -10 \\ 12 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2} \times -10 \\ \frac{1}{2} \times 12 \end{pmatrix}$$

$$= \begin{pmatrix} -5 \\ 6 \end{pmatrix}$$

(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)**  $312_{\text{five}}$  to a base ten numeral

<b>3</b>	<b>1</b>	<b>2</b>
$5^2$	$5^1$	$5^0$

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

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

$$= 75 + 5 + 2$$

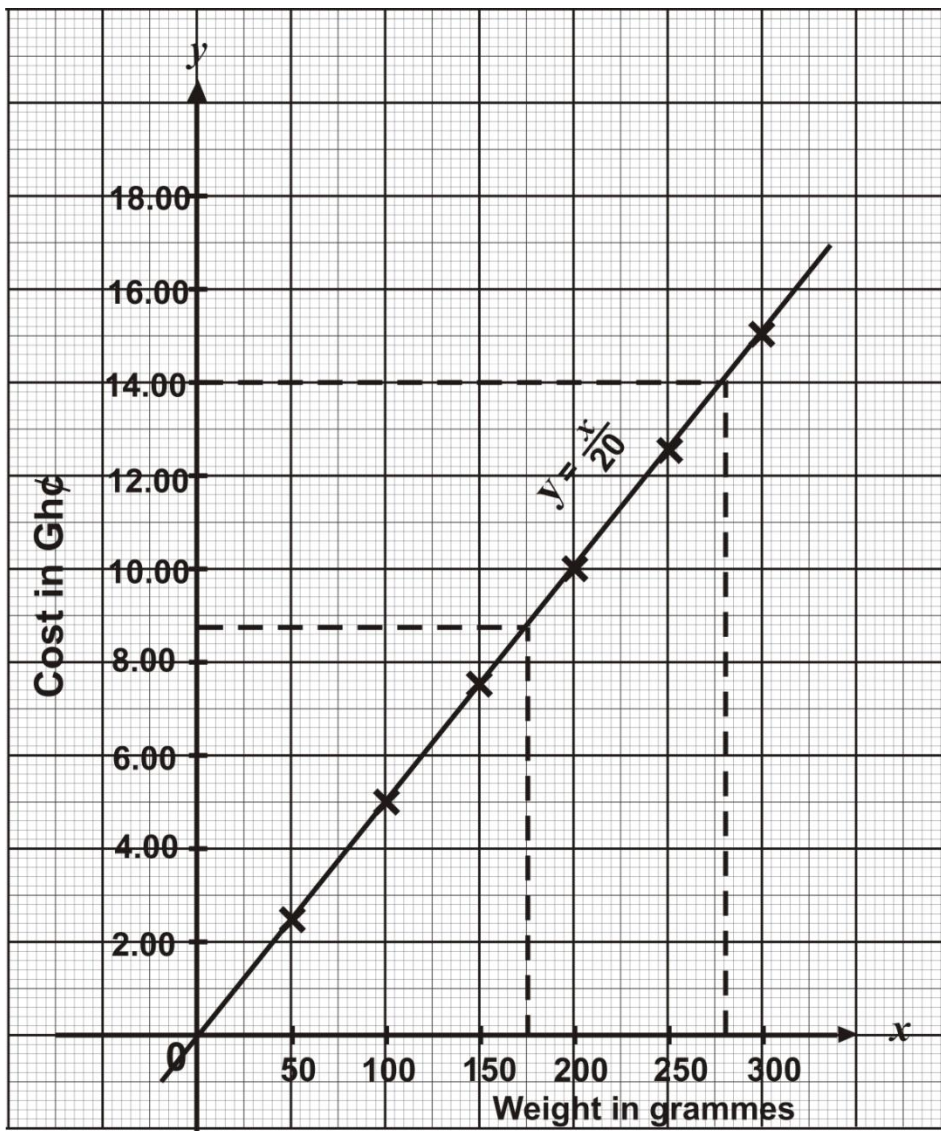
$$= \underline{82} \quad (\text{or } \underline{82_{\text{ten}}})$$

**6. (a)**  $y = \frac{x}{20}$

$$\frac{50}{20} = 2.50, \quad \frac{150}{20} = 7.50, \quad \frac{200}{20} = 10.00, \quad \frac{300}{20} = 15.00$$

<i>x</i> (weight in grammes)	50	100	150	200	250	300
<i>y</i> (cost in GHc)	<b>2.50</b>	5.00	<b>7.50</b>	<b>10.00</b>	12.50	<b>15.00</b>

**(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]

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