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MATHEMATICS
PAPER 1
November 2024
2¼ hours

WAKISSHA JOINT EXAMINATIONS

Uganda Certificate of Education

End of Year Assessment

SENIOR THREE

MATHEMATICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **two** *sections;* **A** *and* **B.** *It has* **six** *items.*

Section **A** *has* **two** *compulsory items.*

Section **B** *has* **two** *parts;* **I** *and* **II.** *Answer* **one** *item from each part.*

Answer **four** *items in all.*

Any additional item(s) answered will **not** *be scored.*

All *answers* **must** *be written in the Answer booklet(s) / sheets provided.*

Graph Paper is provided.

Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

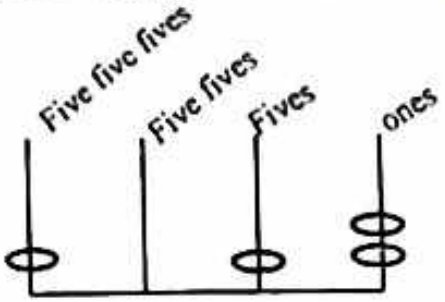
SECTION A

Answer both items from this section.

Item 1.

Mevah wants to start a business of selling shoes in her S.4 vacation. She has six hundred sixty thousand shillings and according to her budget, she is remaining with two thirds of the total amount she wants. Her father has agreed to give her the remaining amount. She is not sure of how much her father is to give her.

She orders for the shoes and the shoes are delivered in a container. She buys the container of shoes at a cost equivalent to the total amount she wants. She will sell the shoes in pairs and on receiving the container that has the shoes, the total number of shoes is represented as shown below.



She wants to know the number of pairs of shoes that are in the container.

Her target is to make a total profit of 60% but she does not know how much she must sell each pair to reach this target.

Task:

(a) How much will Mevah get from her father?

(b) How many pairs of shoes are in the container?

(c) Calculate the price at which Mevah should sell each pair of shoes to reach her target.

Item 2.

Julius and his son are to go to a certain hospital for medication. Julius wants to know whether the 4 litres of fuel he filled in his car will be enough to take and bring them back. His vehicle consumes 1.5 litres of fuel for every 7 km and 2.5 litres of fuel for every 11 km. The distance from the set off point to hospital is 17 km When at the hospital, Julius realizes that he forgot his son's birth certificate yet he is not sure of his age and it is highly needed by the doctor. Julius tells the doctor that he remembers correctly that his age is twice the square of his son's age and the difference between his age and son's age is 45 years. The doctor wants to know the age of Julius' son using the remembered information.

Julius is also going to buy 4 packs of tablets and 3 syrups but he does not know their total cost. The doctor tells him that 2 packs of tablets and a syrup cost a total of Shs. 14,500 and a pack of tablets and 2 syrups cost a total of Shs. 14,000.

Task:

(a) (i) Determine the relationship between distance and litres of fuel for Julius' vehicle.
(ii) Use the relationship to decide whether the fuel he filled in his car will be enough.

(b) Use the information that Julius remembers to help the doctor know the age of the son.

(c) How much money will Julius pay for the quantity of tablets and syrups he is to buy?

SECTION B

Part I

Answer only one item from this part.

Item 3.

Elizephan runs a stationary shop that deals in coloured printing. He has ordered for three main colours; Green, Blue and Red and his target is to have atleast 70% of the colours not being blue.

Out of the 70 boxes offloaded at his shop, he realized that there were boxes with colours rather than the ones he mainly wanted and he now wants to clearly find out what the offloaded package has. Of the boxes offloaded, 10 boxes had green only, 13 had blue only and 4 had red only. 7 boxes had all the three colours he wanted. 34 boxes had green, 31 had blue and 23 boxes had red

Task

(a) Help Elizephan to determine the number of boxes that had;
   (i) atleast two of the colours he wanted
   (ii) other colours

(b) Did the offloaded order meet his target?

(c) What is the probability that if a box is chosen at random from the offloaded order, it did not have green colour?

Item 4

Wilson is a father to three girls; Rina, Rita and Samali. He sent all his three girls to the same shop to get scholastic materials so as he goes there later to pay the bill. While at the shop; Rina ordered for 8 books, 8 pens and 12 pencils. Rita ordered for 7 books, 6 pens and 8 pencils. Samali ordered for 11 books, 5 pens and 9 pencils. A book, a pen and a pencil is sold at Shs. 8500, Shs. 800 and Shs. 300 respectively. Wilson goes to the shop to pay with Shs. 250,000 but he does not know whether the money is enough to cater for the bill for all the girls

While at home; Rina, Rita and Samali enter into a disagreement on who should drive the car while going to school since all of them know how to drive. They decide to make a decision by playing a game. They get a box and put there identical ball gums of which 4 are red and 5 are blue. Each person is to choose randomly two ball gums one after the other without replacement. The one who will drive is that person who will choose ball gums of the same colour

Task

(a) Is the money that Wilson carried enough for the bill?

(b) What is the probability that a person will pick the ball gums that will qualify her to drive?

3

Turn Over

PART II

Answer only one item from this part.

Item 5.

Hassan is a builder who has been contracted by his boss to build a house with a balcony at its top. According to the plan, the boss wants that if he sits at the balcony, he views the top of a hotel building, 21.4 ft away at an angle of elevation of 25^0. The height of hotel building is 45 ft. Hassan wants to know the height from the ground at which he should build the balcony to meet his boss' plan.

Hassan is also going to design the compound of the house with a triangular garden that will be surrounded by circular fence. The garden will have two sides measuring 36 m and 42 m and the angle between these sides will be 60^0. Hassan wants to know the perimeter of the fence he will use.

Task:

(a) Help Hassan to determine the height at which he is to build the balcony.

(b) Draw an accurate diagram to show how the triangular garden will be like.

(c) Determine the perimeter of the fence he will use.

Item 6

Phionah has just been employed by an organization that gives a gross monthly income of Shs. 517,000. The organization gives the following non taxable allowances.

Housing – Shs. 70,000, electricity – Shs. 45,000, annual insurance – Shs. 744,000, medical – Shs. 30,000, married person – Shs. 50,000 and unmarried person – Shs. 180,000 per year. The employees' income taxed according to the structure below

Income (Shs.)	Rate (%)
First 100,000	5
Next 100,000	10
Next 120,000	15
Next 180,000	20
Next 250,000	30s

Phionah is not married and she wants a total of Shs. 900,000 that she wants to invest in a business at the end of the month. Her target is to use her net income of the first month to raise part of the money she wants and then, she borrows the balance from her friend. The friend will borrow her the money at a compound interest rate of 8% per annum for 3 years. Phionah wants to know the amount she will borrow and the interest she will return in this period

Task

(a) Determine Phionah's net income.

(b) Help Phionah to know how much she will;

(i) borrow from the friend.

(ii) return as interest in the 3 years.

END

4

PROPOSED GUIDE FOR MAKISSHA
S.3 END OF YEAR ASSESSMENT
BY: NAKABAALE SAMUEL
0701070801

ITEM ONE

(a) She has shs. 660,000

Remaining with $\frac{2}{3}$ of the total amount.

Let the total amount she needs be x.

$$\frac{x - 660,000}{1} = \frac{2}{3}x.$$

$$3(x - 660,000) = 2x.$$

$$3x - 1,980,000 = 2x.$$

$$3x - 2x = 1,980,000$$

$$x = \text{shs. } 1,980,000$$

∴ The total amount she needs is shs. 1,980,000.

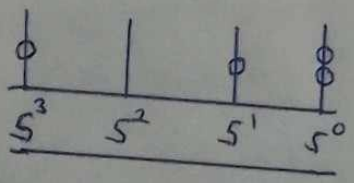
The amount Merah will get from her father $= \frac{2}{3}x.$

$$= \frac{2}{3} \times 1,980,000$$

$$= \text{shs. } 1,320,000$$

Merah will get from her father shs. 1,320,000.

(b).



Total number of shoes in the container $= 1 \times 5^3 + 0 \times 5^2 + 1 \times 5^1 + 2 \times 5^0$

$= 1 \times 5 \times 5 \times 5 + 0 \times 5 \times 5 + 1 \times 5 + 2 \times 1$

$= 125 + 0 + 5 + 2$

$= 132$ shoes

pairs of shoes in the container $= \frac{132}{2}$

$= 66$ pairs of shoes.

(c)

$$\% \text{ profit} = \frac{SP - CP}{CP} \times 100$$

$$60 = \frac{SP - 1,980,000}{1,980,000} \times 100$$

$$\frac{60}{1} = \frac{SP - 1,980,000}{1,980,000}$$

$$60 \times 19,800 = SP - 1,980,000$$

$$1,188,000 = SP - 1,980,000$$

$$1,188,000 + 1,980,000 = SP$$

$$SP = \text{shs. } 3,168,000$$

Each pair should be sold $= \frac{3,168,000}{66}$

$= \text{shs. } 48,000$

∴ Mevah should sell each pair at shs. 48,000 to reach her target.

ITEM TWO

BY NAKABAALE SAMUEL
0701070806

(a) (i)

Let x represents for litres of fuel and y represents for the distance.

(1.5, 7) , (2.5, 11)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{11 - 7}{2.5 - 1.5}$$

$$= \frac{4}{1}$$

$$= 4.$$

Taking $m = 4$, (1.5, 7) and (x, y).

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{4}{1} \times \frac{y - 7}{x - 1.5}$$

$$4(x - 1.5) = y - 7$$

$$4x - 6 = y - 7$$

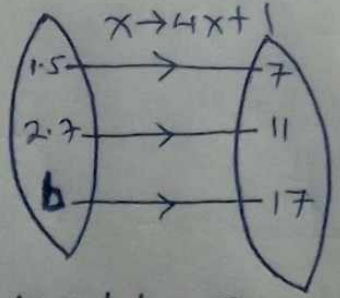
$$y - 7 = 4x - 6$$

$$y = 4x - 6 + 7$$

$$y = 4x + 1$$

$$X \rightarrow 4x + 1$$

(ii)



$4x + 1 = 17$

$4b + 1 = 17$

$4b = 17 - 1$

$\frac{4b}{4} = \frac{16}{4}$

$b = 4$ litres of fuel.

∴ The fuel he filled will be enough for his car because he uses 4 litres of fuel for 17 km from the set off point to hospital.

∴ The fuel he filled will be enough for his car.

(b)

Let the son's age be x and his father Julius be y.

$$y = 2x^2 \quad \text{——} (i)$$

$$y - x = 45 \quad \text{——} (ii)$$

Sub (i) in (ii)

$$y - x = 45$$

$$2x^2 - x = 45$$

By completing squares;

$$\frac{2x^2}{2} - \frac{x}{2} = \frac{45}{2}$$

$$x^2 - \frac{x}{2} = \frac{45}{2}$$

$$x^2 - \frac{x}{2} + \left(-\frac{1}{4}\right)^2 = \frac{45}{2} + \left(-\frac{1}{4}\right)^2$$

$$\left(x - \frac{1}{4}\right)^2 = \frac{45}{2} + \frac{1}{16}$$

$$\sqrt{\left(x - \frac{1}{4}\right)^2} = \pm\sqrt{\frac{361}{16}}$$

$$x - \frac{1}{4} = \pm\frac{19}{4}$$

$$x = \pm\frac{19}{4} + \frac{1}{4}$$

Either $x = +\frac{19}{4} + \frac{1}{4}$ or $x = -\frac{19}{4} + \frac{1}{4}$

$x = 5$ $\qquad$ $x = -4.5$

$\therefore x = 5$ years.

The son is 5 years old.

OR By factorisation;

$$2x^2 - x = 45$$

$$2x^2 - x - 45 = 0$$

$F(-10, 9)$

$$2x^2 - 10x + 9x - 45 = 0$$

$$2x(x-5) + 9(x-5) = 0$$

$$(2x+9)(x-5) = 0$$

Either; $2x + 9 = 0$ or $x - 5 = 0$

$x = \frac{-9}{2}$ $\qquad$ $x = 5$.

$\therefore x = 5$ years.

(c) BY MAKABAALE SAMUEL
0701070806

Let the cost for each pack of tablet be x and each syrup be y.

$2x + y = 14,500$ — (i)

$x + 2y = 14,000$ — (ii)

By elimination method; (i) − (ii)

$$\begin{array}{l|l} 1 & 2x + y = 14,500 \\ 2 & x + 2y = 14,000 \end{array}$$

$$\begin{array}{rl} & 2x + y = 14,500 \\ - & 2x + 4y = 28,000 \\ \hline & -3y = -13,500 \end{array}$$

$$\frac{-3y}{-3} = \frac{+13,500}{+3}$$

$y = \text{shs. } 4,500$

Sub $y = 4,500$ in (i)

$2x + y = 14,500$

$2x + 4,500 = 14,500$

$2x = 14,500 - 4,500$

$\frac{2x}{2} = \frac{10,000}{2}$

$x = \text{shs. } 5000$.

Total cost $= 4x + 3y$

$= 4(5,000) + 3(4,500)$

$= 20,000 + 13,500$

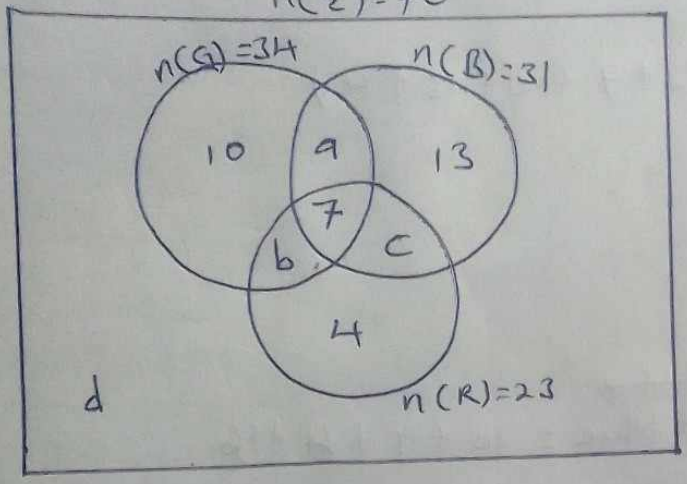
$= \text{shs. } 33,500$

∴ Julius will pay shs. 33,500 for the quantity of tablets and syrups he is to buy.

ITEM 3 BY NAKABAALE SAMUEL
0701070806

Let G represents for green, B represents for blue and R represents for red.

$n(\varepsilon)=70$, $n(G)\text{only}=10$, $n(B)\text{only}=13$, $n(R)\text{only}=4$, $n(G\cap B\cap R)=7$
$n(G)=34$, $n(B)=31$, $n(R)=23$.



Let the $n(G\cap B)\text{only}$ be a, $n(B\cap R)\text{only}$ be c and $n(G\cap R)\text{only}$ be b.

$a+b+7+10=34$

$a+b=17$ —— (i)

$b+c+7+4=23$

$b+c+11=23$

$b+c=12$ —— (ii)

$a+c+7+13=31$

$a+c+20=31$

$a+c=11$ —— (iii)

From (i)

$a=17-b$ —— (iv)

Sub (iv) in (iii)

$a+c=11$

$17-b+c=11$

$-b+c=-6$ —— (v).

Solve (ii) and (v) simultaneously;

$$\begin{array}{r} b+c=12 \\ +\ -b+c=-6 \\ \hline \frac{2c}{2}=\frac{6}{2} \end{array}$$

$c=3$

Sub $c=3$ in (iii)

$a+3=11$

$a=11-3$

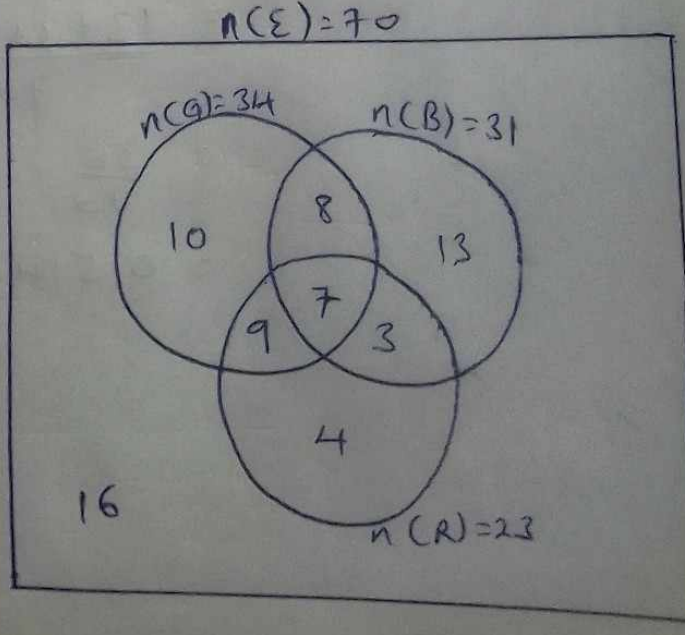
$a=8$

$b+c=12$

$b+3=12$

$b=12-3$

$b=9$



a (i)

Number of boxes that had atleast two of the colours Elizephan wanted = 8 + 9 + 3 + 7

= 27 boxes.

(ii)

other colours = 70 − (8 + 9 + 3 + 7 + 10 + 13 + 4)

= 70 − 54

= 16 boxes.

(b)

~~Number of boxes that are not blue~~

Number of boxes that are not blue = 10 + 9 + 4 + 16

= 39 boxes.

Percentage of boxes that are not blue = $\frac{39}{70} \times 100\%$

= 55.7%.

Elizephan did not meet his goal because the percentage is less than 70% of the colours not being blue.

(c) probability = ~~n(event)~~ $\frac{n(E)}{n(S)}$

= $\frac{13 + 3 + 4 + 16}{70}$

= $\frac{36}{70}$

= 0.5143 (4 d.p).

ITEM 4 BY NAKABAALE SAMUEL
0701070806

Items	Books	Pens	Pencils
Rina	8	8	12
Rita	7	6	8
Samali	11	5	9

$$\begin{pmatrix} 8 & 8 & 12 \\ 7 & 6 & 8 \\ 11 & 5 & 9 \end{pmatrix}$$ 3 x 3 matrix.

Items	Cost (shs)
Books	8,500
Pens	800
Pencils	300

$$\begin{pmatrix} 8,500 \\ 800 \\ 300 \end{pmatrix}$$ 3x1 matrix.

By matrix multiplication;

$$\begin{pmatrix} 8 & 8 & 12 \\ 7 & 6 & 8 \\ 11 & 5 & 9 \end{pmatrix} \begin{pmatrix} 8,500 \\ 800 \\ 300 \end{pmatrix} = \begin{pmatrix} 8\times 8,500 + 8\times 800 + 12\times 300 \\ 7\times 8,500 + 6\times 800 + 8\times 300 \\ 11\times 8,500 + 5\times 800 + 9\times 300 \end{pmatrix}$$

$$= \begin{pmatrix} 68,000 + 6,400 + 3,600 \\ 59,500 + 4,800 + 2,400 \\ 93,500 + 4,000 + 2,700 \end{pmatrix}$$

$$= \begin{pmatrix} 78,000 \\ 66,700 \\ 100,200 \end{pmatrix}$$

Total amount for three (3) girls.

78,000
66,700
100,200
Shs. 244,200

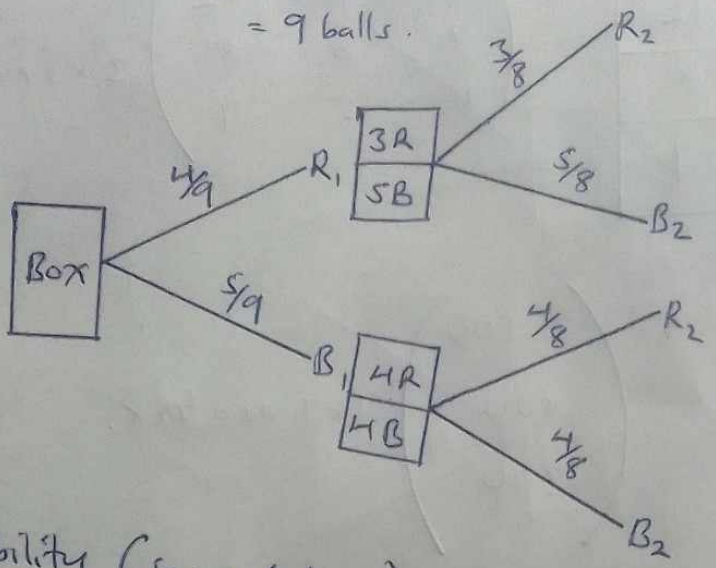
Yes, the money is enough for the bill because it is greater than shs. 244,200 for the three girls spent.

(b)

Let R represents for red and B represents for blue.

Total balls = 4 + 5

= 9 balls.



probability (same colour) = $R_1R_2 + B_1B_2$

$= \left(\frac{4}{9} \times \frac{3}{8}\right) + \left(\frac{5}{9} \times \frac{4}{8}\right)$

$= \frac{1}{6} + \frac{5}{18}$

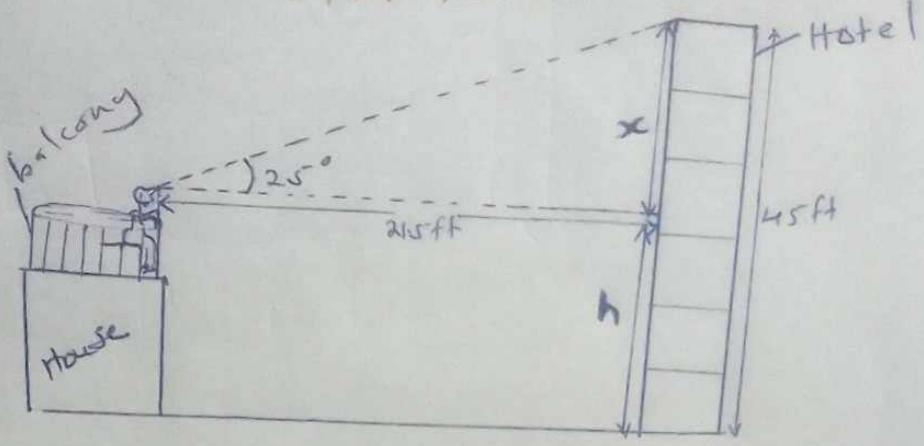
$= \frac{18+30}{108}$

$= \frac{4}{9}$

$= 0.4444$ (4 d.p).

ITEM 5 BY NAKABAALE SAMUEL
0701070806

(a)



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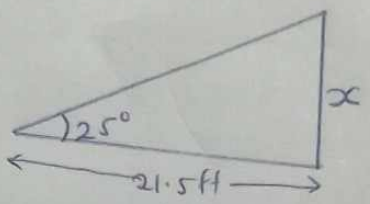


$\frac{\tan 25°}{1} = \frac{x}{21.5}$

$x = 21.5 \tan 25°$

$h = 45 - x.$

$h = 45 - 21.5 \tan 25°$

$h = 35.0\,ft.$

∴ Hassan is to build 35.0ft of the height of the balcony.

(b) Let 10m = 1cm

$36m = \frac{1}{10} \times 36$

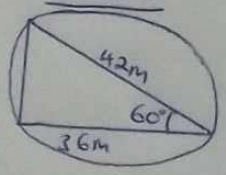
$= 3.6cm.$

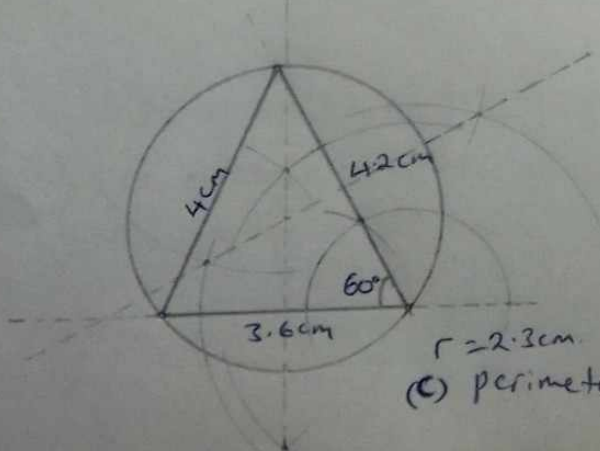
10m = 1cm

$42m = \frac{1}{10} \times 42$

$= 4.2cm.$

Sketch.





$r = 2.3cm$

$\times P = 5 + 5 + 5$

$= 3.6 + 4.2 + 4$

$= 11.8cm$

$\times 1cm = 10m$

$11.8cm = 10 \times 11.8$

$= 118m$ of the garden.

(c) perimeter of the fence $= 2\pi r = 2 \times \frac{22}{7} \times 2.3$

$= 14.5cm$

$= 145m.$

∴ The perimeter of the fence is 145m.

ITEM 6 BY MAKABAALE SAMUEL
0701070806

(a) Net income = Gross income − Income tax.

Income (shs)	Income tax (shs)
100,000	$\frac{5}{100} \times 100,000 = 5000$
100,000	$\frac{10}{100} \times 100,000 = 10,000$
120,000	$\frac{15}{100} \times 120,000 = 18,000$
180,000	$\frac{20}{100} \times 180,000 = 36,000$
250,000	$\frac{30}{100} \times 250,000 = 75,000$

Income tax = 5,000 + 10,000 + 18,000 + 36,000 + 75,000
= Shs. 144,000

Net income = 517,000 − 144,000
= shs. 373,000

Phionah's net income is shs. 373,000.

(b)(i) Money to borrow = 900,000 − 373,000
= shs. 527,000.

∴ She will borrow shs. 527,000.

(ii) $A = P\left(1 + \frac{r}{100}\right)^n$

$A = 527,000\left(1 + \frac{8}{100}\right)^3$

$= 527,000 \times (1.08)^3$

$= 527,000 \times 1.1664$

= shs. 614,692.8

$I = A - P$

= 614,692.8 − 527,000

= shs. 87,692.8.

∴ She will return the interest of shs. 87,692.8.

xx END xx