456/1
MATHEMATICS
Paper 1
Oct./Nov. 2025
2¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

MATHEMATICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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

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

Section **B** *has* **two** *Parts;* **I** *and* **II**. *Respond to* **one** *item from each part.*

Respond to **four** *examination items in all.*

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

All *responses* **must** *be written in the answer booklet(s) provided.*

Graph Paper is provided.

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

SECTION A

Respond to **both** *items in this section.*

Item 1

A parish agricultural officer has received 450 kilogrammes of fertilisers for maize and 120 litres of anti-tick vaccine for cattle. He intends to distribute fertilisers equally among the farmers and also distribute anti-tick vaccine equally among the same farmers. He wants to establish the number of farmers that will get the items.

Joseph is one of the farmers and his daily milk production is 180 litres. He sells sixty percent of the milk at Shs850 per litre and donates $\frac{1}{15}$ of the remaining milk to an orphanage. He has been advised to use the quantity of milk left after selling and donating, to make yoghurt and butter in the ratio 1:3. However, Joseph has a challenge of determining the amount of milk he should use to make butter.

Task

Help:

(a) the parish agricultural officer to establish the number of;
  (i) farmers that will receive the items.
  (ii) kilogrammes of fertilisers and litres of vaccine each farmer will get.

(b) Joseph to determine the amount of;
  (i) money he collects from the milk he sells.
  (ii) milk he should use to make butter.

Item 2

Jariah has a cattle section and goats section on her farm. She employed a farm manager.

According to the manager's records, each worker in the cattle section takes care of 50 heads of cattle and each worker in the goats' section takes care of 30 goats. The farm has a total of 310 animals in both sections.

Each worker in the cattle section is paid Shs150,000 per month and each worker in the goats' section is paid Shs100,000 per month. A total of Shs950,000 is spent on paying workers every month.

Jariah needs help to determine the number of workers in each section of the farm using the manager's records.

The records also show that for the past three months, the manager has been selling milk to customers at a constant wholesale price as indicated in table 1.

Table 1

Month	1	2	3
Milk (litres)	100	80	120
Amount paid(Shs)	150,000	120,000	180,000

The manager has informed her that the farm is likely to produce 135 litres for sale at wholesale price next month. Jariah needs assistance to use the sales records to

form an equation that she would use to determine the amount of money to be paid by any customer who buys any quantity of milk at wholesale price.

Task

Help Jariah to:

(a) determine the number of workers in each section of the farm.

(b) (i) form an equation she would use basing on the records and state the constant wholesale price of each litre of milk.

(ii) calculate the amount of money she is likely to receive from the sale of milk next month.

SECTION B

This Section has **two** *parts*; **I** *and* **II**

Part I

Respond to **one** *item from this part.*

Item 3

Elisheba employs two workers, Moses and Sarah, to sell soft drinks in a car park while she attends to her wholesale shop.

Moses has been given 12 bottles of soda, 15 bottles of juice and 20 bottles of water for sale.

Sarah has been given 12 bottles of juice, 18 bottles of soda and 15 bottles of water for sale.

The price of each bottle of soda, juice and water is Shs 1000, Shs 2000 and Shs 500 respectively.

Elisheba needs help to arrange the information about the drinks as well as their respective prices in rows and columns, so that she can easily determine how much money to expect from each worker.

Elisheba will be going for shopping tomorrow and has therefore decided to toss two similar coins at once as a fair way of selecting one of the workers to attend to the shop while the other one goes to the park.

The workers have agreed that if at least one head appears on top, then Moses will attend to the shop and if no head appears on top, then Sarah will attend to the shop.

Elisheba needs help to determine the worker with the highest chance of being selected to attend to the shop.

Task

Help Elisheba to;

(a) organise the information in rows and columns, clearly stating the order of the information you have organised for the drinks and that for the prices respectively.

(b) calculate the amount she should expect from each of the workers.

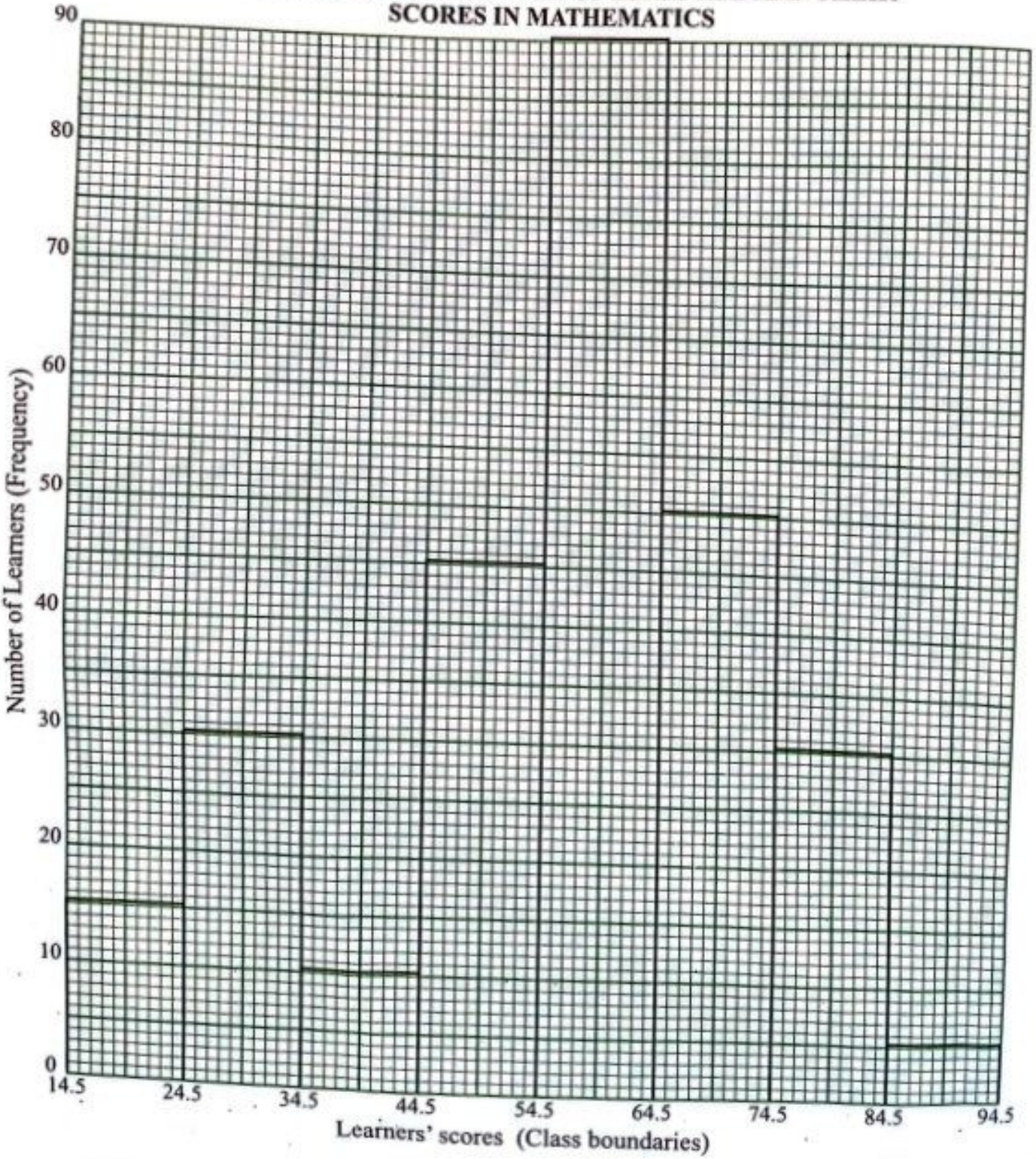
(c) determine the probability with which the worker with the highest chance will be selected, hence name the worker to attend to the shop.

Item 4

A certain school employed a new teacher of mathematics to help the senior four learners to improve on their performance. Before the new teacher was employed, the analysis showed that the learners' mean score was 54% and 38% of the learners scored below the pass mark of 55%.

The new teacher has taught for a full term and learners have been given an exam whose results are shown in graph **1**.

GRAPH 1 SHOWING NUMBER OF LEARNERS AND THEIR SCORES IN MATHEMATICS



The school needs help to analyse the results of the learners' performance shown on graph **1** and establish whether there is an improvement in the learners' performance basing on;

(i) the mean score of the results on graph **1** in comparison to the previous mean score and

(ii) the percentage of learners below the school pass mark of 55%.

Task

Provide the school with the help they need.

Part II

Respond to **one** *item from this part.*

Item 5

A tourist travelled from the U.S to Kenya. While in Kenya, she exchanged US dollars $1250 to Kenya Shillings at a rate of $0.0077 = KShs 1. She spent 30% of the exchanged money.

She has arrived in Uganda with the remainder of the of Kenya shillings which she wants to exchange to Uganda shillings (UgShs). The forex bureau in Town **A**, where she is now, buys and sells foreign currency as shown in table **2**.

Table 2

Currency	Buying (UgShs)	Selling (UgShs)
KShs 1	27.47	28.50
$1	3490	3600

The tourist is not sure of how much she will get in Uganda Shillings.

After exchanging the money, she intends to set off from town **A** to visit a game park for a few hours and then return to town **A**. The driver of the travel company she is going to use has informed her that the direct route they were supposed to use is closed due to road repairs.

They will have to take an alternative route in a direction 210° from town **A** for 10 km up to a junction. From the junction, they will turn West and drive at an average speed of 72 km/h and this will take them 5 minutes to reach the game park from the junction.

The tourist is supposed to pay UgShs12,500 per kilometre travelled and she wishes to know the extra amount of money she will pay when using the alternative route instead of the direct one to travel from town **A** to the game park and back to town **A**.

She has planned to spend a total of UgShs1,141,500 while in Uganda. This will include her transport from town **A** to the game park and back to town **A**, plus all other expenses.

On getting back to town **A**, she intends to exchange the remaining Uganda Shillings to U.S dollars but needs help on how many dollars she will get.

Task

(a) How much money in Uganda shillings will the tourist get on arrival in Uganda?

(b) Determine the extra amount of money the tourist will pay for using the alternative route.

(c) Calculate the amount of money in U.S dollars the tourist will get after exchanging the remaining Uganda shillings.

Item 6

A head teacher of a school with 500 students has been receiving reports of some students missing porridge in the morning. In defence the caterer claims that the students are many and use big cups, yet the container in which the caterer keeps porridge to be served is small.

The container has a surface area of 96,000 cm^2 and a volume of 128,000 cm^3. The caterer has requested the head teacher to buy a similar larger container of surface area 150,000 cm^2 so that the volume of porridge to be served to each student increases when the larger container is filled to capacity.

As a way of improving the services at the kitchen, the head teacher has employed another cook who will earn a gross monthly income of Shs853,500. This income includes a transport allowance of Shs115,500, housing allowance of Shs81,150, lunch allowance which is 10% of the gross monthly income and utilities allowance of Shs35,500.

The cook is supposed to pay income tax according to the structure in table **3**, but all the allowances are free of tax.

Table 3

Taxable income(Shs)	Tax rate (%)
0-105,000	free
105,001-250,000	13
250,001- 350,000	20
350,001- 450,000	30
450,001- 550,000	40
550,001 and above	45

The cook is interested in knowing his net income.

Task

(a) Determine the quantity of porridge, in litres, that will be served to each of the 500 students if the caterer gets the larger container and each student is to receive the same quantity.

(b) Compute the net income for the cook.

END

ITEM 1

Task part (a)

(i)

The greatest common factor (GCF) of 450 and 120

	450	120
2	225	60
3	75	20
5	15	4

The GCF of 450 *and* 120

$= 2 \times 3 \times 5$

$= 6 \times 5$

$= 30$

Therefore, 30 farmers will receive the items.

(ii)

Amount of fertilizers received by each farmer.

$= \frac{450}{30}$

$= 15$ Kilograms

Volume of vaccine received by each farmer

$= \frac{120}{30}$

$= 4$ Litres

Therefore, each farmer will get 15 Kilograms of fertilizers and 4 litres of vaccine

Task part (b)

(i)

Volume of the milk sold

$= \frac{60}{100} \times 180$ Litres

$= 0.6 \times 180$ Litres

$= 108$ Litres

Amount of money earned from the sale of the milk

$= 108 \times Shs\ 850$

$= Shs\ 91{,}800$

Therefore, Joseph collects *Shs* 91,800 from the milk he sells.

(ii)

Remainder of the milk

$= \frac{40}{100} \times 180$ Litres

$= 0.4 \times 180$ Litres

$= 72$ Litres

Volume of milk donated to the orphanage

$= \frac{1}{15} \times 72$ Litres

$= \frac{72}{15}$ Litres

$= 4.8$ Litres

Quantity of milk left after selling and donating

$= \frac{14}{15} \times 72$ Litres

$= \frac{14 \times 72}{15}$ Litres

$= 67.2$ Litres

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Total ratio

$= 1 + 3$

$= 4$ Parts

Volume of milk used to make butter

$= \frac{3}{4} \times 67.2$ Litres

$= \frac{3 \times 67.2}{4}$ Litres

$= 50.4$ Litres

Therefore, Joseph should use 50.4 Litres of milk to make butter.

ITEM 2

Task part (a)

Let x represent the number of workers in the cattle section

And

Let y represent the number of workers in the goats' section

Number of cattle in the farm $= 50\,x$

Number of goats in the farm $= 30\,y$

Using the total number of animals in the farm,

$50\,x + 30y = 310$

$\frac{50x}{10} + \frac{30y}{10} = \frac{310}{10}$

$5\,x + 3y = 31$..... Equation 1

Amount spent on workers in the cattle section every month $= Shs\ 150{,}000\,x$

Amount spent on workers in the goats' section every month $= Shs\ 100{,}000\,y$

Using the total amount spent on paying workers every month

$Shs\ 150{,}000\ x + Shs\ 100{,}000\ y = Shs\ 950{,}000$

$$\frac{Shs\ 150{,}000\ x}{Shs\ 10{,}000} + \frac{Shs\ 100{,}000\ y}{Shs\ 10{,}000} = \frac{Shs\ 950{,}000}{Shs\ 10{,}000}$$

$$15\ x + 10y = 95$$

$$\frac{15\ x}{5} + \frac{10y}{5} = \frac{95}{5}$$

$3\ x + 2y = 19$..... Equation 2

Solving equation 1 and equation 2 simultaneously,

$$\left|\begin{matrix} 5\ x + 3y = 31 \\ 3\ x + 2y = 19 \end{matrix}\right| \begin{matrix} 2 \\ 3 \end{matrix}$$

$$\begin{array}{r} 10\ x + 6y = 62 \\ -\ 9\ x + 6y = 57 \\ \hline x \quad = 5 \\ \hline \end{array}$$

$3(5) + 2y = 19$

$15 + 2y = 19$

$2y = 19 - 15$

$2y = 4$

$$\frac{2y}{2} = \frac{4}{2}$$

$y = 2$

Therefore, there are 5 workers in the cattle section and 2 workers in the goats' section of the farm

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Task part (b)

(i)

Let y represent the amount of money paid by a customer in *Shs*

And

Let x represent the amount of milk in litres.

Using the equation of a straight line,

$y = mx + c$

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

$m = \frac{120{,}000 - 150{,}000}{80 - 100}$

$m = \frac{-30{,}000}{-20}$

$m = 1{,}500$

Using $(120, 180{,}000)$

$180{,}000 = 1500(120) + c$

$180{,}000 = 180{,}000 + c$

$c = 180{,}000 - 180{,}000$

$c = 0$

$y = 1{,}500x$

For $x = 1$

$y = 1{,}500(1)$

$y = 1{,}500$

Therefore, the equation she would use basing on the records is $y = 1{,}500x$ and the constant wholesale price of each litre of milk is Shs 1,500.

(ii)

Using $y = 1{,}500x$

For next month when $x = 135$ Litres

$y = 1{,}500(135)$

$y = 202{,}500$

Therefore, she is likely to receive Shs 202,500 from the sale of milk next month.

ITEM 3

Task part (a)

Summary of information in the scenario.

	Bottles of Soda	Bottles of Juice	Bottles of Water
Moses	12	15	20
Sarah	18	12	15
Cost per bottle (Shs)	1,000	2,000	500

A matrix showing the drinks sold by each of the two workers.

$$\begin{pmatrix} 12 & 15 & 20 \\ 18 & 12 & 15 \end{pmatrix}$$

This is a 2×3 matrix

A matrix showing the cost per bottle of drinks sold by the workers.

$$\begin{pmatrix} Shs\ 1{,}000 \\ Shs\ 2{,}000 \\ Shs\ 500 \end{pmatrix}$$

This is a 3×1 matrix

Task part (b)

Expected amount

$$= \begin{pmatrix} 12 & 15 & 20 \\ 18 & 12 & 15 \end{pmatrix} \begin{pmatrix} Shs\ 1{,}000 \\ Shs\ 2{,}000 \\ Shs\ 500 \end{pmatrix}$$

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$$= \begin{pmatrix} (12 \times Shs\ 1{,}000) + (15 \times Shs\ 2{,}000) + (20 \times Shs\ 500) \\ (18 \times Shs\ 1{,}000) + (12 \times Shs\ 2{,}000) + (15 \times Shs\ 500) \end{pmatrix}$$

$$= \begin{pmatrix} (12 \times Shs\ 1{,}000) + (15 \times Shs\ 2{,}000) + (20 \times Shs\ 500) \\ (18 \times Shs\ 1{,}000) + (12 \times Shs\ 2{,}000) + (15 \times Shs\ 500) \end{pmatrix}$$

$$= \begin{pmatrix} (Shs\ 12{,}000) + (Shs\ 30{,}000) + (Shs\ 10{,}000) \\ (Shs\ 18{,}000) + (Shs\ 24{,}000) + (Shs\ 7{,}500) \end{pmatrix}$$

$$= \begin{pmatrix} Shs\ 52{,}000 \\ Shs\ 49{,}500 \end{pmatrix}$$

Therefore, Elisheba should expect *Shs* 52,000 from Moses and *Shs* 49,500 from Sarah.

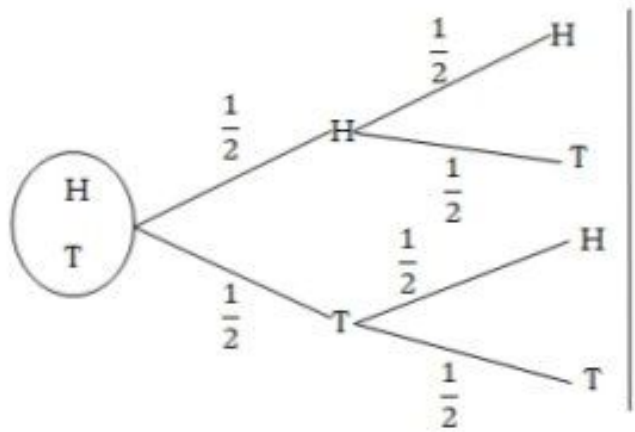
Task part (c)

Let H represent the event that a head appears on top.

And

Let T represent the event that a tail appears on top.

A probability tree diagram showing the sample space of the experimen



$$P(HnH) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$P(HnT) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$P(TnH) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$P(TnT) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Probability of at least one head appearing on top

$= P(HnH) + P(HnT) + P(TnH)$

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

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$= \frac{3}{4} = 0.75$

Therefore, probability that Moses will attend to the shop is 0.75

Probability of no head appearing on top

$= P(TnT)$

$= \frac{1}{4} = 0.25$

Therefore, probability that Sarah will attend to the shop is 0.25

The worker with the highest chance will be selected with a probability of 0.75 , hence Moses will attend to the shop.

ITEM 4

A frequency distribution table showing the scores of S.4 learners in a mathematics exam in a certain school.

Scores	f	F	x	fx
14.5 – 24.5	15	15	19.5	292.5
24.5 – 34.5	30	45	29.5	885
34.5 – 44.5	10	55	39.5	395
44.5 – 54.5	45	100	49.5	2227.5
54.5 – 64.5	90	190	59.5	5355
64.5 – 74.5	50	240	69.5	3475
74.5 – 84.5	30	270	79.5	2385
84.5 – 94.5	5	275	89.5	447.5
	$\sum f = 275$			$\sum fx = 15462.5$

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(i)

Mean score of the results.

$$= \frac{\sum fx}{\sum f}$$

$$= \frac{15462.5}{275}$$

$$= 56.2273\ \%$$

Difference between the new mean score and the previous mean score.

$$= 56.2273\ \% - 54\ \%$$

$$= 2.2273\ \%$$

The mean score of the results on the graph is 56.2273 % *and it is higher than the previous mean score by* 2.2273 %

(ii)

Let the number of learners who scored below the schools' pass mark of 55% be represented by x

100	x	190
54.5	55	64.5

$$\frac{190 - 100}{64.5 - 54.5} = \frac{x - 100}{55 - 54.5}$$

$$\frac{90}{10} = \frac{x - 100}{0.5}$$

$$10(x - 100) = 90 \times 0.5$$

$$10(x - 100) = 45$$

$$10(x) - 1000 = 45$$

$$10(x) = 1000 + 45$$

$$10(x) = 1045$$

$$\frac{10x}{10} = \frac{1045}{10}$$

$x = 104.5$

Since humans can't be in decimals, 105 learners scored below the schools' pass mark.

Percentage of those who scored below the schools' pass mark.

$$= \frac{105}{275} \times 100\%$$

$$= 38.1818\%$$

Difference between the new percentage failure and the previous percentage failure.

$= 38.1818\% - 38\%$

$= 0.1818\%$

The percentage failure of the results on the graph is 38.1818% and it is higher than the previous mean score by 0.1818 %

Since the average performance of the learners slightly higher, then there is an improvement in the learners' performance.

ITEM 5

Task (a)

Amount the tourist had in Kenya shillings.

$KShs\ 1 = \$\ 0.0077$

$KShs\ x = \$\ 1250$

$0.0077x = 1250$

$$x = KShs\ \frac{1250}{0.0077}$$

$= KShs\ 162{,}337.6623$

Amount of money spent after exchanging to KShs,

$= \frac{30}{100} \times KShs\ 162{,}337.6623$

$= KShs\ 48{,}701.2987$

A mount she arrived with in Uganda.

$= \frac{70}{100} \times KShs\ 162{,}337.6623$

$= KShs\ 113{,}636.3636$

$KShs\ 1 = UgShs\ 27.47$

$KShs\ 113{,}636.3636 = UgShs\ x$

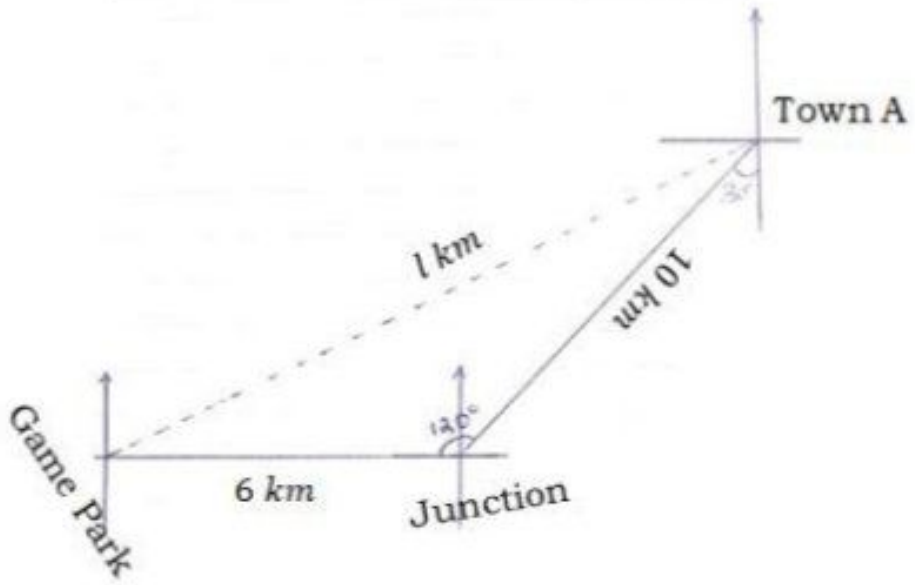
$x = UgShs\ 27.47 \times 113{,}636.3636$

$= UgShs\ 3{,}121{,}590.908$

Therefore, the tourist will get *UgShs* 3,121,590.908 on arrival in Uganda.

Task part (b)

A drawing showing the alternative route to the game park.



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Distance between the junction to the game park

From $speed = \frac{distance}{time}$

$Distance = speed \times time$

$Distance = 72 \times \frac{5}{60}$

$Distance = \frac{72 \times 5}{60}$

$Distance = \frac{360}{60}$

$Distance = 6\ km$

The length of the direct route

From cosine rule;

$c^2 = a^2 + b^2 - 2abcos\theta$

$l^2 = 10^2 + 6^2 - 2 \times 6 \times 10 \times \cos 120$

$l^2 = 100 + 36 - (-60)$

$l^2 = 100 + 36 + 60$

$l^2 = 196$

$l = \sqrt{196}$

$l = 14\ km$

Therefore, the length of the direct route is $14\ km$

The length of the alternative route

$= 10\ km + 6\ km$

$= 16\ km$

Additional distance to travel when using the alternative route.

$= 16\ km - 14km$

$= 2\ km$

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Extra amount she will pay along the alternative route to and from the game park.

$= 2(UgShs\ 12{,}500 \times 2)$

$= 2(UgShs\ 25{,}000)$

$= UgShs\ 50{,}000$

Therefore, she will pay an extra amount of $UgShs\ 50{,}000$ for using the alternative route.

Task part (c)

Total amount that she remains with after visiting the game park in Uganda.

$= UgShs\ 3{,}121{,}590.908 - UgShs\ 1{,}141{,}500$

$= UgShs\ 1{,}980{,}090.908$

$\$1 = UgShs\ 3490$

$\$x = UgShs\ 1{,}980{,}090.908$

$3490x = 1{,}980{,}090.908$

$$\frac{3490x}{3490} = \frac{1{,}980{,}090.908}{3490}$$

$x = \$567.3613$

Therefore, the tourist will get $\$567.3613$ after exchanging the remaining Uganda shillings.

ITEM 6

Task part (a)

Area scale factor

$$A.S.F = \frac{A_L}{A_S}$$

$$A.S.F = \frac{150{,}000}{96{,}000}$$

$$A.S.F = \frac{150}{96}$$

$$A.S.F = 1.5625$$

Linear scale factor.

$$A.S.F = (L.S.F)^2$$

$$1.5625 = (L.S.F)^2$$

$$L.S.F = \sqrt{1.5625}$$

$$L.S.F = 1.25$$

Volume scale factor.

$$V.S.F = (L.S.F)^3$$

$$V.S.F = (1.25)^3$$

But $V.S.F = \frac{V_L}{V_s}$

$$(1.25)^3 = \frac{V_L}{128{,}000}$$

$$V_L = 128{,}000 \times (1.25)^3$$

$$V_L = 250{,}000\ cm^3$$

The volume of the larger container is $250{,}000\ cm^3$

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Quantity of porridge to be received by each student.

$= \frac{250,000}{500}\ cm^3$

$= 500\ cm^3$

$1,000,000\ cm^3 = 1m^3$

$500\ cm^3 = x$

$1,000,000\ x = 500m^3$

$\frac{1,000,000\ x}{1,000,000} = \frac{500}{1,000,000}$

$x = 0.0005\ m^3$

Each student will receive $0.0005\ m^3$ of porridge.

But

$1000\ litres = 1m^3$

$x = 0.0005\ m^3$

$x = 1000 \times 0.0005$ Litres

$x = 0.5$ Litres.

Therefore, 0.5 litres of porridge will be served to each of the 500 students if the caterer gets the larger container provided each student is to receive the same quantity.

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Task part (b)

The total allowance offered to the cook

Allowance	Amount (Shs)
Transport	115,500
Housing	81,150
Lunch	$(\frac{10}{100} \times 853{,}500) = 85350$
Utilities	35,500
Total allowance.	317,500

Taxable income

$T.I = gross\ income - total\ allowances.$

$T.I = Shs\ 853{,}500 - Shs\ 317{,}500$

$T.I = Shs\ 536{,}000$

Income tax.

Taxable income (Shs)	Rate (%)	Amount (Shs)	Income tax (Shs)
0-105,000	free	105,000	$\frac{0}{100} \times 105{,}000 = 0$
105,000 - 250,000	13	145,000	$\frac{13}{100} \times 145{,}000 = 18{,}850$
250,000 - 350,000	20	100,000	$\frac{20}{100} \times 100{,}000 = 20{,}000$
350,000 - 450,000	30	100,000	$\frac{30}{100} \times 100{,}000 = 30{,}000$
450,000 – 536,000	40	86,000	$\frac{40}{100} \times 86{,}000 = 34{,}400$
Total income tax			103,250

Net income

$N.I = gross\ income - total\ income\ tax$

$N.I = Shs\ 853{,}500 - Shs\ 103{,}250$

$N.I = Shs\ 750{,}250$

Therefore, the net income for the cook is *Shs* 750,250