456/1
MATHEMATICS
Paper 1
2024
$2\frac{1}{4}$ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

MATHEMATICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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

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

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

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

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

All *answers* **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

Answer **all** *items in this section.*

Item 1.

Your guardian has a budget of Shs700,000 for your school expenses. To get to the school where your guardian wishes to take you for A-level, your guardian drove 4 km east from your home to the stage and then 8 km north to reach there. However, you realized later that there was a direct route from home to school your guardian could have used.

On reaching the school, you found out that, the school fees, admission fees and uniform fees are Shs900,000, Shs100,000 and Shs350,000 respectively. The school also offers a bursary of; 60% off school fees, free admission and eighty-seven thousand five hundred shillings off uniform fees to those who got first grade and according to your results, you qualify for this bursary.

It also has **two** payment **plans** on school fees that the guardians can choose from and they are:

- Paying in two instalments that is to say; two thirds of the school fees at the beginning of the term and the balance at either visitation day or end of term.
- Paying in three equal instalments; at the beginning of the term, on visitation day and end of term respectively.

Task:

(a) How far is it from your home to school if you travel through the direct route?

(b) (i) Since you qualify for the bursary, how much will you pay?

(ii) Will your guardian afford the school expenses according to his budget?

(c) (i) How much will those who are to pay school fees of Shs900,000, pay per instalment, according to each of the payment plans?

(ii) Which payment plan would you recommend for them and why?

Item 2.

You have friends who rear cows and goats. During the festive season, they want to sell **at most** 10 of their cows and **at least** 8 of their goats. They also want to ensure that the number of goats they sell are less than twice the number of cows. They also **do not want to** sell more than 20 animals all together. They wish to **maximise** sales by selling each goat at Shs200,000/= and each cow at Shs1.5 millions but they do not know the number of goats and cows to sell to fulfil their wish.

Task:

(a) write mathematical statements that show the relation between the cows and goats.

(b) Show the feasible region of the relation on the Cartesian plane.

(c) Help your friends to determine the maximum amount of money they will possibly make from the sale of cows and goats.

SECTION B

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

Part I

Answer **one** *item from this part*

Item 3.

A day school holds a weekly assembly every Monday starting at 8:00 AM. The Head teacher has noticed a trend of learners arriving late for assembly. Since the school gates are opened at 7:30 AM, he decided to collect data from a sample of learners on their arrival times in minutes past 7:30 AM to make an informed decision about the assembly's start time. The collected data was as follows:

15, 18, 20, 22, 17, 25, 23, 28, 26, 21
30, 33, 35, 32, 36, 39, 42, 37, 41, 28
45, 48, 29, 31, 26, 27, 30, 33, 34, 31
28, 35, 40, 42, 37, 39, 36, 38, 29, 43
46, 47, 30, 32, 31, 45, 27, 44, 46, 49
52, 53, 55, 51, 50, 56, 57, 58, 59, 51

Task:

(a) Giving a reason, based on calculations using the data collected, suggest the time the assembly should always start.

(b) The deputy Head teacher advised the Head teacher to always start the assembly when at least 75% of the students are present. Based on the advise, determine the time the assembly should start.

(c) If you were the Head teacher, which of the two suggested assembly start times from (a) and (b) would you consider more appropriate and why?

Item 4.
The Ministry of Health in Uganda is conducting a survey about the existence of malaria in three districts: A, B and C. The ministry will then come up with control measures if the chance of a person testing positive having visited at least one of the districts is above 50%. The Ministry has intentionally selected a sample of people who visited the three districts and tested them for malaria. The test results have revealed that 50 people who visited district A, 60 people who visited district B and 40 people who visited district C tested positive for malaria. Additionally, 20 people who visited both districts A and B, 10 people who visited districts A and C, and 15 people who visited districts B and C tested positive for malaria. The Ministry has also discovered that 20 people who only visited district C tested positive for malaria and 40 people who visited the three districts tested negative for malaria.

Task:

(a) Determine the number of people that were tested for malaria by the ministry of health.
(b) Calculate the probability of a person testing positive having visited at least one of the three districts.
(c) Advise the Ministry of health, with a reason based on calculation, whether to come up with control measures or not.

Part II

Answer **one** *item from this part.*

Item 5.
Your uncle has offered to drive you to your friend's birthday party. He normally drives his car at an average speed of 50 km/h, so he requests you to get directions to the party reception and the time you are supposed to be there so that you decide on when you can leave home to reach on time. You were informed that the party will start at 2:00 PM and the directions are:

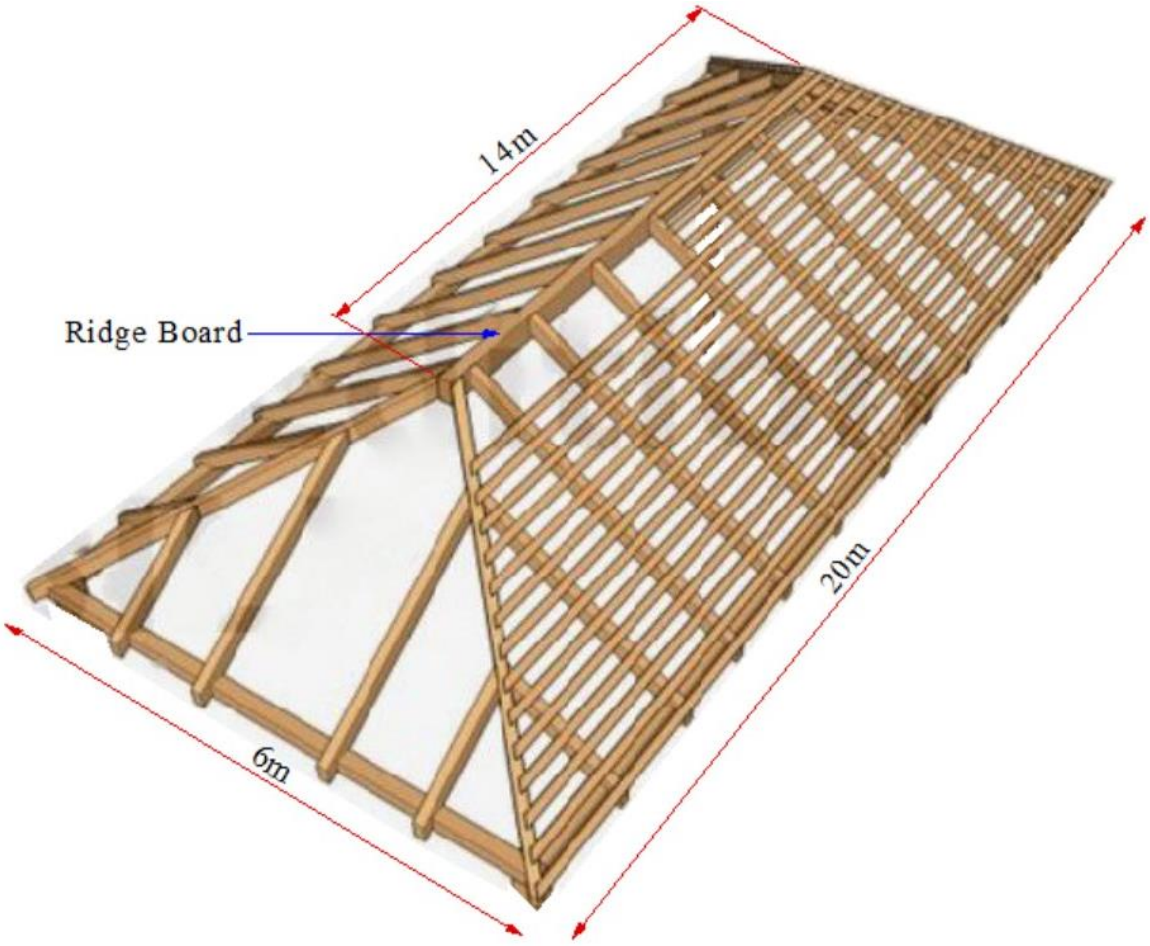
- From your home, take the north eastern direction and reach the supermarket that is 20 km away.
- Then take the road that is south of the supermarket and it will take you 45 minutes to reach the junction.
- From the junction, take the southwestern road and drive 25 km to reach the party reception.

On reaching the party reception using the given directions, your friend remembers that there is a direct route from your home to the reception that you could have used but does not know how long it is.

Task:

(a) (i) Describe the direction of your home from the party reception.
(ii) How far is the party reception from your home using the direct route?
(b) What time would you have to leave home for you to reach the party reception on time, if you used the direct route?

Item 6.
Your neighbour has a building structure that is at a roofing stage with the roof frame installed as shown below:



The roof frame has a rectangular base with dimensions of 20 m by 6 m and the ridge board of 14 m centrally placed. The triangular faces are equilateral.
She wants to use iron sheets that are available in two types; type **A** and type **B**. The iron sheet of type **A** costs Shs33,000 each and that of type **B** costs Shs42,000. Each iron sheet has a length of 10ft and usable width of 2.623 ft. (1ft = 0.3m)
The hardware shop from which she wants to buy the iron sheets gives a discount of 6% on the total cost of every fifty (50) iron sheets of type **A** bought and a discount of 10% on the total cost of every seventy (70) iron sheets of type **B** bought.

She intends to borrow money from a bank to buy the iron sheets but she is not so sure of the amount to borrow.

Task:

(a) Help your neighbour to estimate the amount of money to be borrowed from the bank for either type of iron sheets.

(b) Give your neighbour advice, with reason(s), on the type of iron sheets to buy.

END

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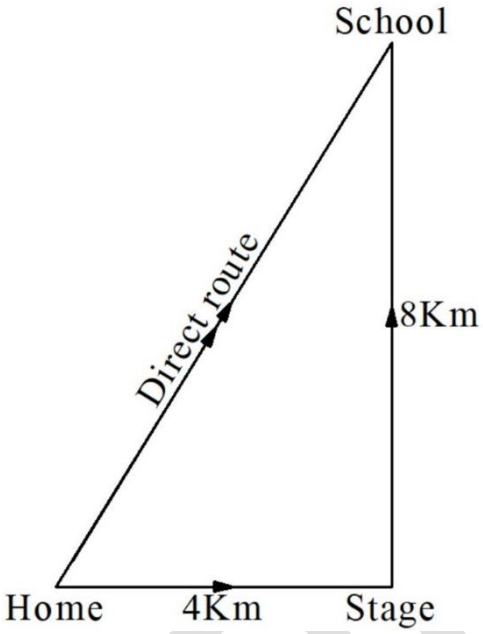
Paper 1

New Lower Secondary Curriculum

SCORING GUIDE

1(a) Distance from home to school using the direct route.



(Direct distance)$^2 = 4^2+8^2$

Direct distance $= \sqrt{(4^2+8^2)}$

$=\sqrt{(16+64)}$

$=\sqrt{(80)}$

$=8.94$km

(b)(i) school fees $= \frac{100-60}{100} \times 900{,}000/=$

$= \frac{40}{100} \times 900{,}000/=$

$= 360{,}000/=$

Uniform $= 350{,}000 - 87{,}500$

$= 262{,}500/=$

Total amount to be paid $= 360{,}000 + 262{,}500$

$= 622{,}500/=$

(b)(ii) Conclusion: yes, the guardian will afford the school since the total amount to be paid is less than the 700,000/= s/he has budgeted for school expenses.

(c)(i) Payment plan 1

First instalment = $\frac{2}{3} \times 900{,}000/=$

= 600,000/=

Second instalment =900,000 – 600,000

= 300,000/=

Payment plan 2

Each instalment =$\frac{1}{3} \times 900{,}000/=$

=300,000/=

(c)(ii) Recommended payment plan:

Reason:

2. Let x be the number of cows to be sold and y the number of goats to be sold.

$x \geq 0, y \geq 0$

$x \leq 10$

$y \geq 8$

$x + y \leq 20$

$y < 2x$

Sales =1,500,000x + 200,000y

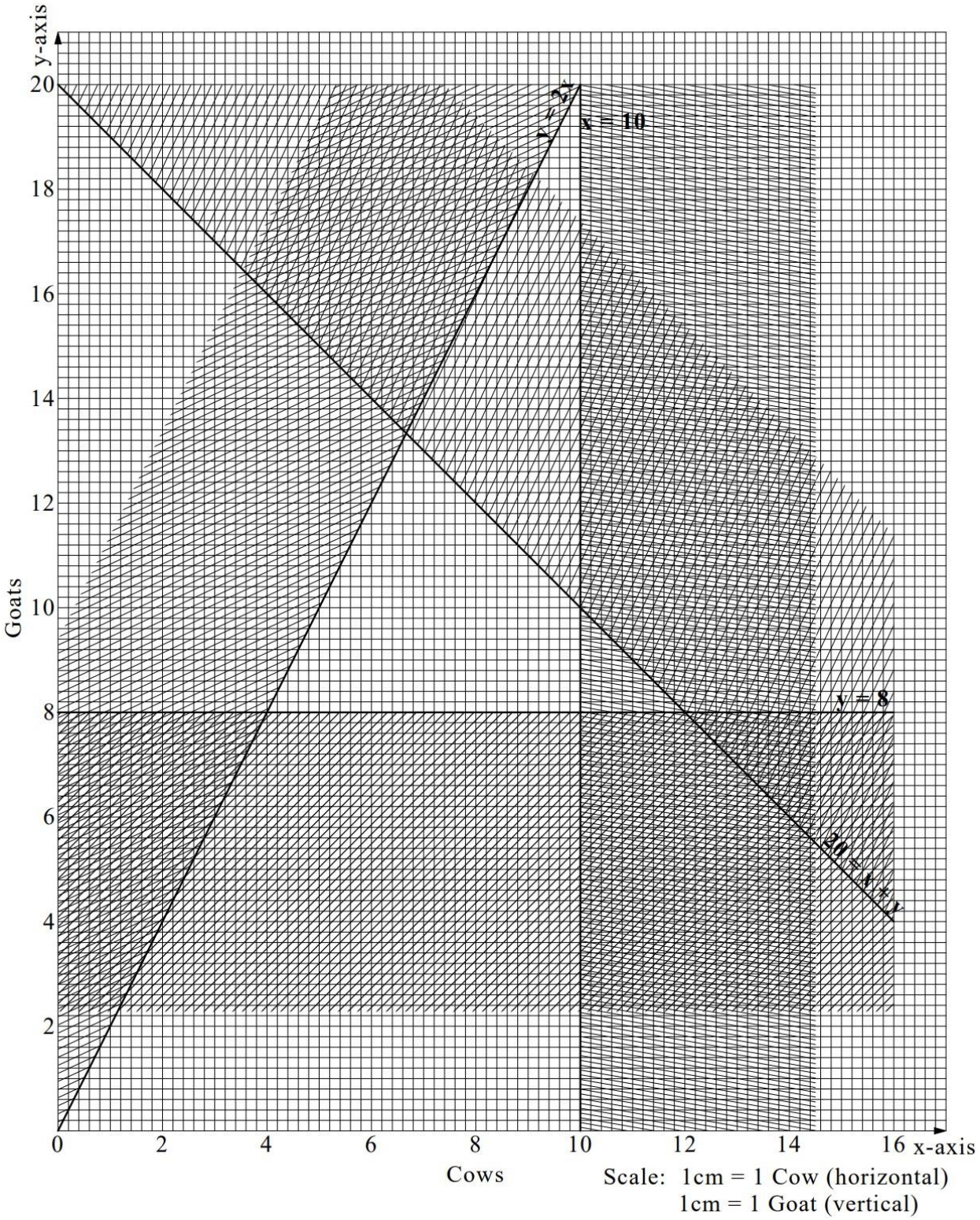
For y = 2x

x	0	1
y	0	2

For x + y = 20

x	0	20
y	20	0

A graph showing the feasible region



Maximisation of sales

Optimal points (x,y)	Sales =1,500,000x + 200,000y
(10,10)	17,000,000
(9,11)	15,700,000
(8,12)	14,000,000
(7,13)	13,100,000

(any other point(s) within the feasible region)

Conclusion: Chooses a combination that maximises sales (a combination that gives the highest amount of money).

That is,they should sell ten cows and ten goats to maximise sales and they will make 17,000,000/=.

OR

Accept any other correct method.

Qtn3.

Time(Min)	Tallies	Freq (f)	Cumm freq	Class boundary	Mid-point (x)	fx
15-19	///	3	3	14.5-19.5	17	51
20-24	////	4	7	19.5-24.5	22	88
25-29	~~////~~ ~~////~~	10	17	24.5-29.5	27	270
30-34	~~////~~ ~~////~~	11	28	29.5-34.5	32	352
35-39	~~////~~ ////	9	37	34.5-39.5	37	333
40-44	~~////~~ /	6	43	39.5-44.5	42	252
45-49	~~////~~ //	7	50	44.5-49.5	47	329
50-54	~~////~~	5	55	49.5-54.5	52	260
55-59	~~////~~	5	60	54.5-59.5	57	285
		∑f=60				**∑fx=2220**

(a) Mean time = $\frac{\sum fx}{\sum f} = \frac{2220}{60}$ = 37 minutes

The assemble start time should be 37 minutes from 7:30AM since the average time of arrival of the students after 7:30 AM is 37 minutes. That is, the assembly should start at 8:07 AM.

Note: Accept calculation of any measure of central tendency followed by a relevant/appropriate explanation.

(b) EITHER

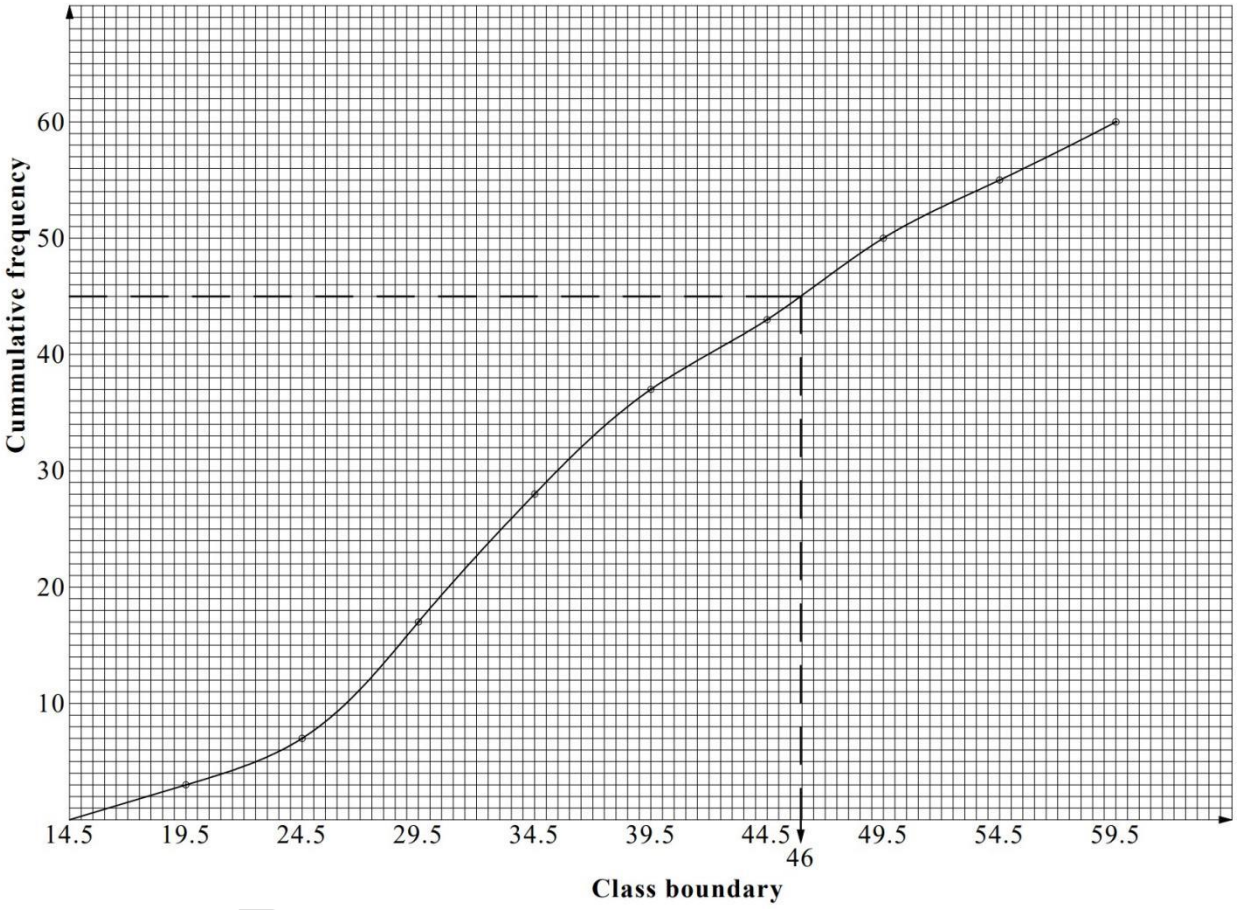
75% = 75th percentile, given by ($\frac{75}{100}$ x N)th position of cumulative frequency.

= ($\frac{75}{100}$ x 60)th position of cumulative frequency

= 45th position of cumulative frequency

From the Ogive, 75th percentile = 46 minutes. (see Ogive)

The assemble start time should be 46 minutes from 7:30AM since the arrival time of 75% of the students after 7:30AM is 46 minutes. That is, the assembly should start at 8:16AM.



OR

Note: Accept calculation of the 75th percentile using a formula.

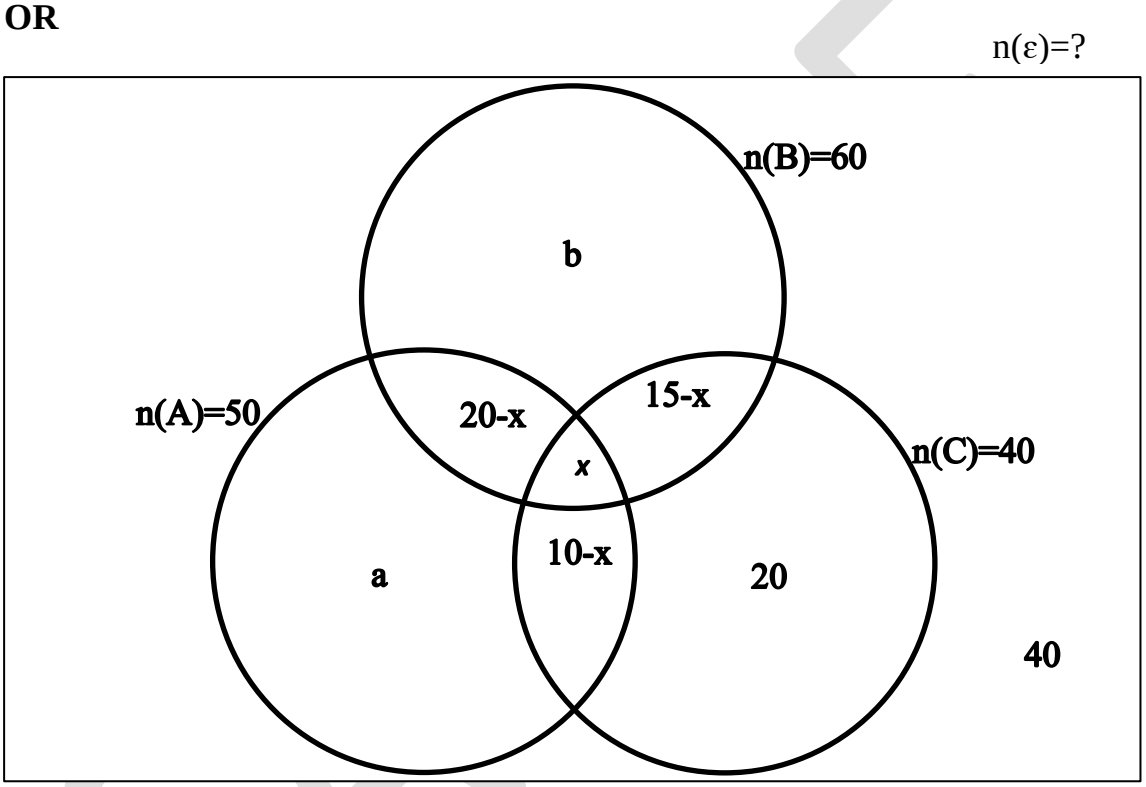
Question 4

SOLUTION

EITHER

$n(\varepsilon)=?$, $n(A)=50$, $n(B)=60$, $n(C)=40$, $n(A\cap B)=20$, $n(A\cap C)=10$, $n(B\cap C)=15$, $n(C)_{only}=20$, $n(A\cap B\cap C)=x$, $n(A\cap B)_{only}=20-x$, $n(A\cap C)_{only}=10-x$, $n(B\cap C)_{only}=15-x$, $n(A)_{only}=?$, $n(B)_{only}=?$, $n(AUBUC)'=40$.

OR



Using the people who visited district C and tested positive gives;

$x + 15- x + 10- x + 20 = 40$

$45- x = 40$

$x = 5$

Therefore, 5 people who had visited all the three districts tested positive for malaria.

The number of people who visited district A only and tested positive is given by;

$50- (x + 20- x + 10- x) = 50- 30 + x = 20+5 =25$

The number of people who visited district B only and tested positive is given by;
$60- (x + 20- x + 15- x) = 60- 35 + x = 25+5 =30$

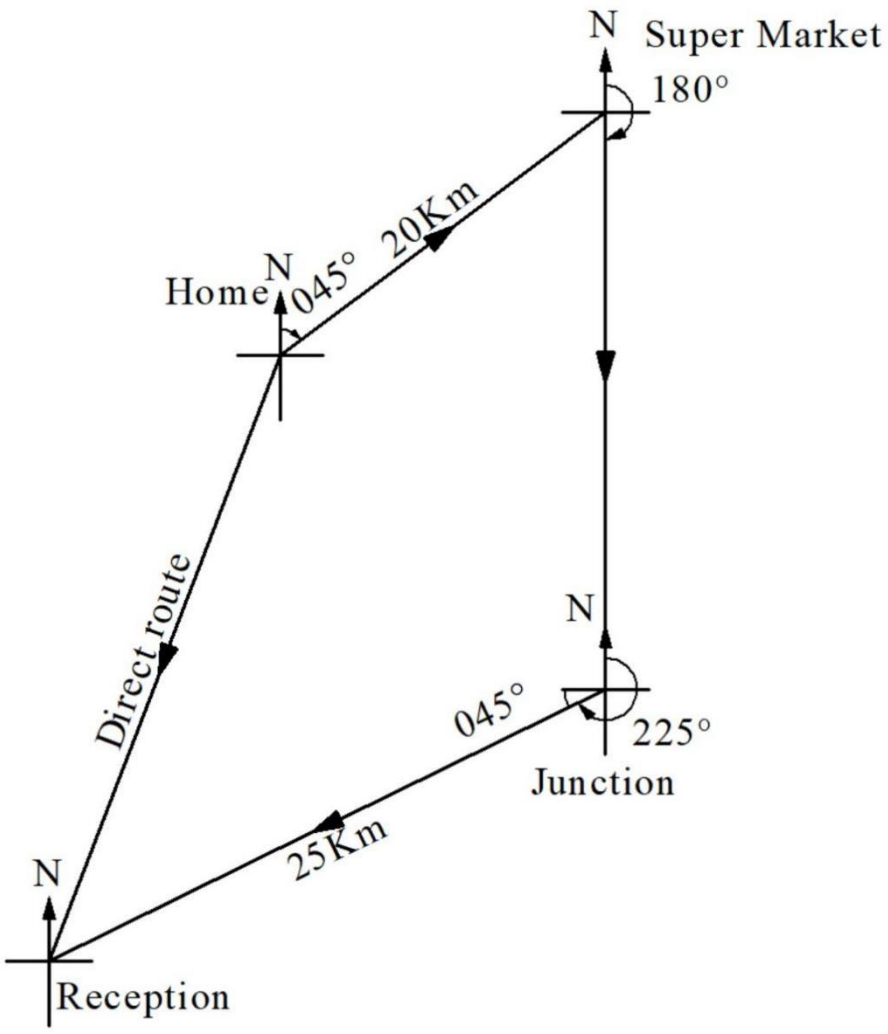
The number of people who visited at least one district and tested positive is given by;
60+ 25+ (10-*x*) + 20 = 115- *x* = 115-5 =110

The sample that was purposively selected n(ε) = 110 + 40 = 150

Therefore the chance of testing positive for malaria having visited at least one district is given by; P(positive having visited at least one district)= $\frac{110}{150}$ =0.733=73.3%

The ministry should come up with interventions since the chance of testing positive having visited at least one district is high (73.3%).

5. Sketch drawing



Distance (D) from super market to junction?

Speed = 50km/h

Time = 45minutes

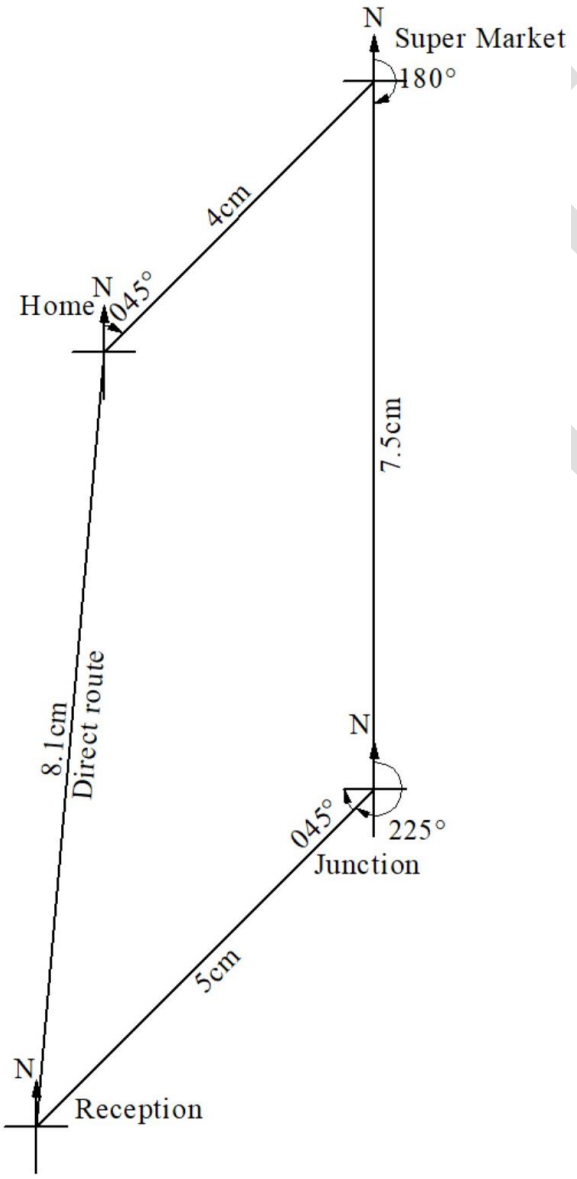
= $\frac{45}{60}$ hours **or** Time= $\frac{3}{4}$ hours **or** Time= 0.75hours

D = Speed × Time

D = 50 × 0.75

D = 37.5km

Accurate drawing



(a)(i) State the bearing of the Home from the Reception.

(a)(ii)Direct route distance= 8.1 cm

= (8.1×5) km

= 40.5 km

(ii) Distance = 40.5 km

Speed = 50 km/h

Time = $\frac{Distance}{Speed}$

Time = $\frac{40.5}{50}$

Time = 0.81hours

Time = (0.81×60) minutes

Time = 48.6 minutes

Time ≈ 49minutes

We will leave home 49 minutes to 2:00 PM to reach the party venue on time.

OR

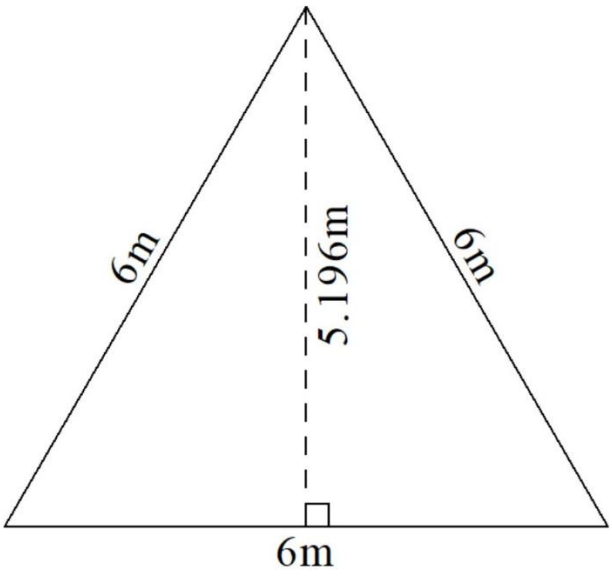
We will leave home at 1:11PM =(2:00PM – 49 Minute) to reach the party venue on time.

QUESTION 6

Area of the triangular sides

Height (h) of the triangular side = $\sqrt{(6^2 - 3^2)}$

= 5.196m **or** ($\sqrt{27}$)m **or** ($3\sqrt{3}$)m



Area of one triangular side $= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 6 \times 5.196$

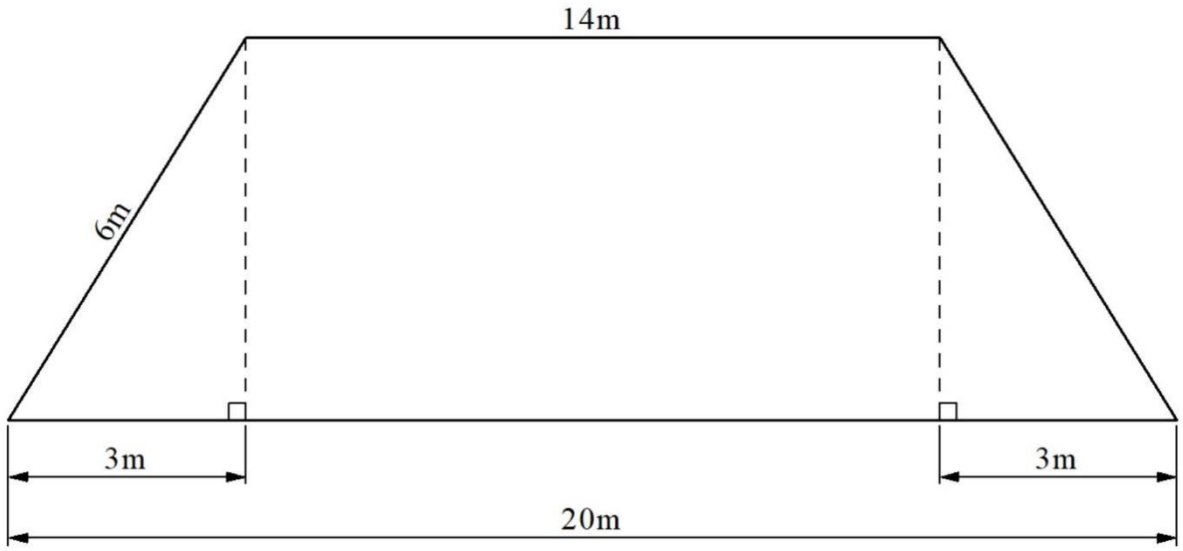
$= 15.588\text{m}^2$

Area of the two triangular sides = 2× 15.588

$= 31.176\text{m}^2$

Note: Accept any method of finding the area of the triangular side.

Area of the trapezium sides



Height(h)of the trapezium $= \sqrt{(6^2 - 3^2)}$

$= 5.196\text{m}$ **or** $(\sqrt{27})\text{m}$ **or** $(3\sqrt{3})\text{m}$

Area of one trapezium side $= \frac{1}{2} \times \text{h}\,(\text{a} + \text{b})$

$= \frac{1}{2} \times 5.196\,(14 + 20)$

$= 88.332\text{m}^2$

Area of the two trapezium sides = 2× 88.332

$= 176.664\text{m}^2$

Total area of the roof = 31.176 + 176.664

$= 207.84\text{m}^2$

Usable area of each iron sheet = (10×0.3)×(2.623×0.3)

= 2.3607m^2

Number of iron sheets = $\frac{\square\square\square\square\square\ \square\square\square\square\ \square\square\ \square\square\square\ \square\square\square\square}{\square\square\square\square\square\square\ \square\square\square\square\ \square\square\ \square\square\square\square\ \square\square\square\square\ \square\square\square\square\square}$

$= \frac{\mathbf{207.84}}{\mathbf{2.3607}}$

= 88.042

≈ 89

Cost of iron sheets

Type A	**Type B**
A discount of 6% on every 50 iron sheets	A discount of 10% on every 70 iron sheets
$(\frac{100-6}{100} \times 33{,}000 \times 50) + (89\text{-}50) \times 33{,}000$ =2,838,000/=	$(\frac{100-10}{100} \times 42{,}000 \times 70) + (89\text{-}70) \times 42{,}000$ =3,444,000/=

Advise: My neighbour should buy Type A iron sheets.

Reason: They are cheaper and she will minimise costs.

OR

Advise: My neighbour should buy Type B iron sheets.

Reason: Since they are expensive, they are likely to be of a better quality than Type A.

			SCORE
1	**TOTAL AREA OF THE ROOF**		
(a)	**Area of the triangular side**		**Subtotal- 04**
(i)	Height		01
(ii)	Substitution for Area		01
(iii)	Area	value	01
		unit	01
(b)	**Area of the trapezium side**		**Subtotal-04**
	Height		02
	Area	Use of formula	01
		Value	01
(c)	**Total area of the roof**	operation	01
		Correct value	01
2	**Usable area of the iron sheet**	Correct Value	01
3	**Conversion of units**	Correct value	01
4	**Number of iron sheets**	operation	01
		Correct value	01
		Actual number	01
5	**Cost of the iron sheets**		**Subtotal-03**
	Correct total cost without discount		01
	Discounted cost	operation	01
		Correct value (for either)	01
			Subtotal-02
6	**Advice/Justification**	Type of iron sheet	01
		Reason	01
TOTAL SCORE			**20**