

456/2
MATHEMATICS
PAPER 2
Oct./Nov. 2023
2½ hours



UGANDA NATIONAL EXAMINATIONS BOARD
Uganda Certificate of Education

MATHEMATICS

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- Answer *all* questions in section *A* and any *five* questions from section *B*.
- Any additional question(s) answered will not be marked.
- All necessary calculations **must** be done in the same answer booklet/sheets provided, with the rest of the answers. Therefore no paper should be given for rough work.
- Graph paper is provided.
- Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A (40 marks)

Answer **all** questions in this section

1. Express 1728 as a product of its prime factors, hence find its cube root. (04 marks)
2. Two sets A and B are such that $n(B) = 8$, $n(A \cap B) = 2$, $n(\epsilon) = 15$ and $n(A \cup B) = 4$.
Find (i) $n(A \cup B)$ (02 marks)
(ii) $n(A)$ (02 marks)
3. Given that $f^{-1}(x) = \frac{4x}{9+x}$, Find the value of x for which $f(x)$ is undefined. (04 marks)
4. A lorry covered 90 km at a speed of 45 km/hr and travelled the next 150 km in $1\frac{1}{2}$ hours. Determine the average speed of the lorry for the whole journey. (04 marks)
5. The position vectors of P and Q are $\overrightarrow{OP} = \begin{pmatrix} a \\ -5 \end{pmatrix}$ and $\overrightarrow{OQ} = \begin{pmatrix} 6 \\ c \end{pmatrix}$. If $\overrightarrow{PQ} = \begin{pmatrix} -1 \\ 13 \end{pmatrix}$
Find (i) the values of a and c . (03 marks)
(ii) $2|\overrightarrow{OQ}|$. (01 mark)
6. The volume of a big cylinder is 81 cm^3 and that of small cylinder is 3 cm^3 .
If the height of the big cylinder is 0.12 m, calculate the height of the small cylinder. (04 marks)
7. A man's gross income is Ugx 6 million per annum. He pays an income tax of 20% of his gross monthly income. Find his monthly net income. (04 marks)
8. Without using mathematical tables or calculator, evaluate; $2\log 6 - \log 3 - \log 1.2$. (04 marks)
9. A woman walks 10 km to a market at a speed of $x \text{ kmhr}^{-1}$ and she returns at a constant speed of $(x + 1) \text{ kmhr}^{-1}$. The return journey takes 30 minutes less than the first journey. Find x .
10. The quantity P is inversely proportional to the square of q. If $P = 5$ when $q = 2$, find the value of P when $q = 10$. (04 marks)

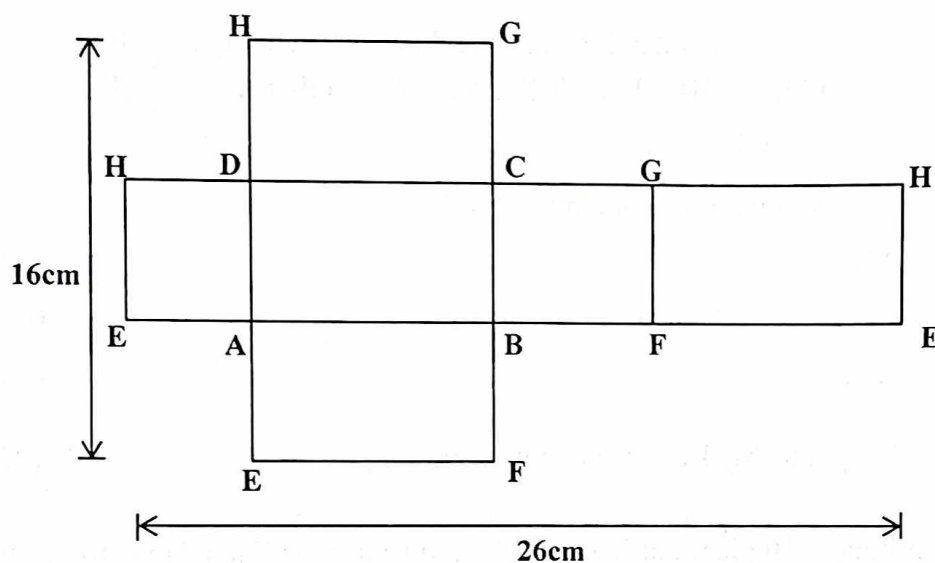
SECTION B (60 marks)

Answer any **five** questions from this section. All questions carry equal marks.

11. (a) Given that $h(x) = x^2 + 3$ and $g(x) = x - 1$, find the value of, a , for which $hg(a) = gh(a)$. (05 marks)
- (b) Given that $h(x) = x^2 - 5x - 14$, find;
(i) $h^{-1}(x)$
(ii) $h^{-1}(4.75)$ (07 marks)

12. A class of 100 students were asked whether they had ever visited the cities; Arua (A) Jinja (J) or Mbale (M). The number that had visited Jinja only is twice the number which had visited Mbale only. 55 had visited Arua, 14 had visited J and M only, 7 had visited A and M only, 20 had visited A and J only. If those who visited Arua only were 25 and 10 had not visited any of the three cities.
- Represent the given information on a venn diagram. (06 marks)
 - How many students had;
 - visited Jinja? (02 marks)
 - not visited Arua? (02 marks)
 - A student is selected at random from the group, What is the probability that he had visited atmost two cities?. (02 marks)
13. In a triangle ABC, points M and N lie on AB and BC respectively such that $AM : MB = 1 : 2$ and $\overrightarrow{BN} = 3\overrightarrow{NC}$. Point T lies on \overrightarrow{AN} such that $\overrightarrow{AT} = \frac{2}{3}\overrightarrow{AN}$. Given that $\overrightarrow{AM} = \underline{x}$ and $\overrightarrow{AC} = \underline{y}$,
- Express the following vectors in terms of \underline{x} and \underline{y} .
 - \overrightarrow{AB} (02 marks)
 - \overrightarrow{BC} (02 marks)
 - \overrightarrow{AN} . (03 marks)
 - Show that points M, T and C are collinear. (05 marks)
14. A land dealer bought 10 pieces of land at 4,000,000 shillings Each. He is to sell them on cash and hire purchase terms. A piece of land is sold at 5,000,000 shillings on cash terms and on hire purchase one makes an initial deposit of 25% of the cost price and then pays equal monthly installments for $1\frac{1}{4}$ years totaling to 4,800,000/=.
- Calculate the amount one pays as monthly installment if he buys on hire purchase. (02 marks)
 - If the dealer sold $\frac{1}{5}$ of the pieces of land on cash terms and the rest on hire purchase terms, calculate the total profit after selling all the pieces of land. (10 marks)
15. (a) Solve for t:
- $$3^t + 3^t = 162$$
- (04 marks)
- (b) Find the values of x and y in the equations below.
- $$\log_{10}(x+y)=1 \text{ and } \log_2 x + \log_2 y = 4$$
- (08 marks)

16. The cities Kampala and Mbarara via Masaka are 240 km apart. One day a cyclist started riding from Kampala at 9:45 am towards Mbarara at a steady speed of 60 kmhr^{-1} . On the same day a motorist started from Mbarara at 10:50 am towards Kampala at 80 kmhr^{-1} . Calculate the;
- distance from Kampala where they by passed each other. (05 marks)
 - time when they by passed each other. (02 marks)
 - difference in their time of arrival. (05 marks)
17. Below is a net of a cuboid ABCDEFGH, where the base dimensions AB and BC are 8cm and 6cm respectively.



- Sketch the solid formed and find the height of the solid. (05 marks)
- Calculate the;
 - volume of the solid. (03marks)
 - Total surface Area. (04 marks)

END