

456/1
MATHEMATICS
PAPER 1
July/August 2023
2 ½ hours



MASAKA DIOCESAN EXAMINATIONS BOARD
Uganda Certificate of Education
Joint Mock Examinations 2023
MATHEMATICS
Paper 1
2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

*Answer **all** questions in section A and any **five** questions from section B.*

*Additional question(s) answered will **not** be marked.*

*All necessary calculations **must** be shown clearly 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: (40 Marks)
Answer *all* questions in this section

1. Given that $b = 14$, $d = 4$ and $\frac{(b-d)}{5e} + \frac{12}{e} = b$, find the value of e . (4 marks)
2. Determine the area of a regular polygon with 10 sides inscribed in a circle of radius 7.2cm. Give your answer to 2 decimal places. (4 marks)
3. Given the matrices, $A = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} -7 & 4 \\ 9 & 2 \end{pmatrix}$, find matrix R such $R - 2I = A + B$, where I is an identity matrix of order 2. (4 marks)

4. Use substitution method to solve these simultaneous equations:

$$\begin{aligned} 7x + 2y &= 17 \\ x - 3y &= 9 \end{aligned}$$

(4 marks)

5. In Figure 1, ABCD is a trapezium with \overline{AB} parallel to \overline{DC} . If $AB = 14\text{cm}$, $AD = BC = 5\text{cm}$ and angle $DAB = \text{angle } CBA = 60^\circ$.

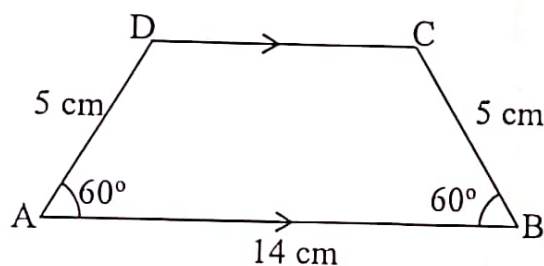


Figure 1

- Calculate the length of CD. (4 marks)
6. Factorise $r^2 - s^2$ completely. Hence evaluate $4.75^2 - 2.25^2$. (4 marks)
 7. Solve the inequality $-2(y - 3) \leq y + 3 \leq 10$. Show your answer on the number line. (4 marks)
 8. A two hundred Uganda shilling coin is tossed at once together with a fair die whose faces are numbered from 1 up to 6.
 - (a) Construct a table showing all the possible outcomes.
 - (b) What is the probability of getting a triangular number appearing on top with a fish? (4 marks)
 9. The ages of a man and his son are 37 years and 8 years respectively. How many years ago was the product of their ages 96? (4 marks)

$$\frac{40}{20}$$

10. The mean of four numbers is 20. If two other numbers $(y + 3)$ and $(y + 2)$ are added to the numbers, the new mean is 30. Determine the value of y . (4 marks)

$$\frac{4131412}{20} = 30 \quad \frac{2413}{20} = 30$$

SECTION B: (60 Marks)

Answer any five questions from this section

11. The following results were obtained in an experiment to measure the lengths of leaves from the stalk to the apex (to the nearest one decimal place).

Length(cm)	6.0 - 6.9	7.0 - 7.9	8.0 - 8.9	9.0 - 9.9	10.0 - 10.9	11.0 - 11.9	12.0 - 12.9
Frequency (f)	6	8	10	a	4	2	3

- (a) Find the value of a using an assumed mean of 9.45 and the mean length of 8.775. (8 marks)
- (b) Calculate the;
- modal length
 - median length
- (4 marks)
12. Using a ruler, pencil and pair of compasses only,
- Construct triangle ABC such that $\overline{AB} = 5.2\text{cm}$, $\overline{BC} = 6.5\text{cm}$ and angle $ABC = 135^\circ$. Measure and record the:
 - length of AC
 - size of angle BAC.
 (6 marks)
 - Draw a circle circumscribing triangle ABC and hence state its radius. (2 marks)
 - Construct a perpendicular from point B to meet line AC at N. Measure the length of BN and use it to calculate the area of triangle ABC. (4 marks)
13. (a) Two equal circles of radius 10cm intersect at right angles. Find the distance between the two centres of the circles. (4 marks)
- (b) A speed hump is built on a horizontal road HR as in Figure 2. Its cross section is in the shape of a segment of a circle which has a radius of 45cm. if O is the centre of the circle, then angle HOR would be 110° .

Turn over

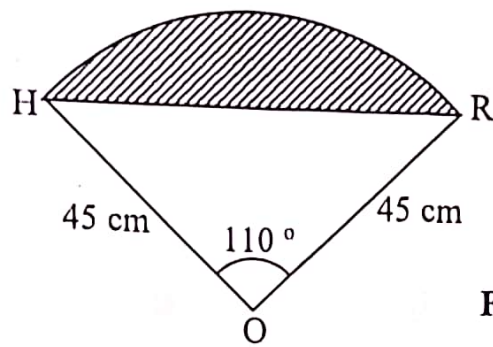


Figure 2

Calculate the;

- (i) length over the speed hump from H to R.
- (ii) area of the cross-section of speed hump $\pi = \frac{22}{7}$ (8 marks)

14. (a) (i) Copy and complete the table below of the graphs of $y = 3 - x$ and $y = \frac{3x+1}{2}$ for $-3 \leq x \leq 3$.

x	-3	-2	-1	0	1	2	3
$3 - x$			4		2		
$\frac{3x+1}{2}$			-1		2		

- (ii) Using a scale of 2cm to represent 1 unit on both axes, draw the graphs of $y = 3 - x$ and $y = \frac{3x+1}{2}$ for $-3 \leq x \leq 3$. Hence solve the simultaneous equations $x + y = 3$ and $3x - 2y + 1 = 0$ (9 marks)

- (b) After an enlargement, point A (3, 3) is mapped onto A'(3, 6) using a scale factor of 2 and about centre of enlargement, C. Determine the coordinates of C. (3 marks)

15. A bag contains 5 red balls, 6 blue balls and 4 green balls. Two balls are picked at random from the bag, one after the other without replacement of the first one.

- (a) Draw a probability tree diagram to represent this information. (6 marks)

- (b) Find the probability that:

- (i) the second ball is green
- (ii) the first ball is blue.

(6 marks)

16. (a) A unit square whose vertices are O(0, 0), i(1, 0), j(0, 1) and k(1, 1) is transformed by rotating through a positive three-quarter turn about the origin. Find the matrix for this transformation. (1 mark)

(b) Given matrices $M = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ and $N = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$.

Find;

- (i) the coordinates of the points $P(4, 1)$ and $Q(2, -1)$ under the transformation NM . (8 marks)
- (ii) the matrix of transformation which will map the images of P and Q back to their original positions. (3 marks)

17. At a certain factory 150 employees are to be transported to work every day. The factory has 5 coasters and 6 minibuses. There are 8 qualified drivers. Each coaster can carry a maximum of 24 employees. Each minibus can carry not more than 30 employees. If x represents the number of coasters used and y represents the number of minibuses used.

- (a) Write down six inequalities representing the above information.
- (b) Represent the inequalities on a graph taking 1cm to represent 1 unit on both axes.
- (c) If the costs of fuel each day for a coaster and minibus are shs 200,000 and shs 170,000 respectively. Find the number of coasters and minibuses which should be used to minimum the cost on fuel, hence the cost of fuel used per day.

$$\begin{aligned} x &\leq 0 \\ y &\leq 0 \\ x &\leq 5 \\ y &\leq 6 \end{aligned}$$

END

