



7929775



EXAMINATIONS COUNCIL OF ZAMBIA



Examination for General Certificate of Education Ordinary Level

Mathematics

4024/2

Paper 2

Friday

9 AUGUST 2024

Additional materials:

- Answer Booklet
- Silent Electronic Calculator (non programmable)
- Geometrical instruments
- Graph paper (3 sheets)
- Plain paper (1 sheet)

Time: 2 hours 30 minutes

Marks: 100

Instructions to Candidates

- 1 Write the **centre number** and your **examination number** on **every page** of the separate **Answer Booklet** provided.
- 2 Write your answers and working in the separate **Answer Booklet** provided.
- 3 If you use more than one Answer Booklet, fasten the Answer Booklets together.
- 4 Omission of essential working will result in loss of marks.
- 5 There are **twelve** questions in this paper.
 - (i) **Section A**
Answer **all** questions.
 - (ii) **Section B**
Answer any **four** questions.
- 6 **Silent non programmable Calculators may be used.**

Information for Candidates

- 1 The number of marks is given in brackets [. .] at the end of each question or part question.
- 2 If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
- 3 Cell phones and other electronic devices are **not allowed** in the examination room.

Mathematical Formulae

1 ALGEBRA

Quadratic Equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2 SERIES

Geometric Progression

$$S_n = \frac{a(1-r^n)}{1-r}, (r < 1)$$

$$S_n = \frac{a(r^n - 1)}{r - 1}, (r > 1)$$

$$S_\infty = \frac{a}{1-r} \text{ for } |r| < 1$$

3 TRIGONOMETRY

Formula for Δ ABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A.$$

$$\Delta = \frac{1}{2} bc \sin A$$

4 STATISTICS

Mean and standard deviation

Ungrouped data

$$\text{Mean } (\bar{x}) = \frac{\sum x}{n}, \text{SD} = \sqrt{\left\{ \frac{\sum (x - \bar{x})^2}{n} \right\}} = \sqrt{\left\{ \frac{\sum x^2}{n} - (\bar{x})^2 \right\}}$$

Grouped data

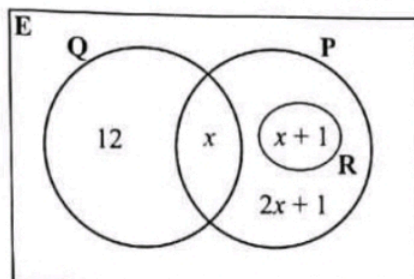
$$\text{Mean } (\bar{x}) = \frac{\sum fx}{\sum f}, \text{SD} = \sqrt{\left\{ \frac{\sum f(x - \bar{x})^2}{\sum f} \right\}} = \sqrt{\left\{ \frac{\sum fx^2}{\sum f} - (\bar{x})^2 \right\}}$$

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Section A (52 Marks)

Answer all questions in this section

- 1 (a) A box contains 6 identical beads, 2 of which are red and the rest are green. Two beads are selected at random from the box, one after the other without replacement.
- (i) Draw a tree diagram to illustrate this information. [2]
- (ii) Calculate the probability that the beads selected are of different colours. [3]
- (b) The Venn diagram shows the number of elements of sets P, Q and R.



Find

- (i) the value of x , such that $n(P) = 18$, [2]
- (ii) $n(R)'$, [1]
- (iii) $n(R \cup Q)$, [1]
- (iv) $n(P \cap Q)'$. [1]

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2 Answer the whole of this question on a sheet of plain paper.

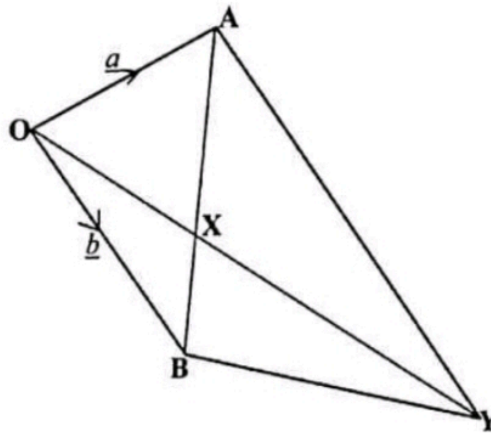
- (a) Construct a quadrilateral PQRS in which $PQ = 10\text{cm}$, angle $SPQ = 70^\circ$, $QR = 6.5\text{cm}$, $PS = 5\text{cm}$ and $SR = 7\text{cm}$. [1]
- (b) Measure and write the angle PQR. [1]
- (c) On your diagram, construct the locus of points within the quadrilateral PQRS which are
- (i) 3cm from PQ, [1]
- (ii) equidistant from PS and SR. [2]
- (d) L is a point inside quadrilateral PQRS such that it is 3cm from PQ and equidistant from PS and SR. Label the point L. [1]
- (e) M is another point inside quadrilateral PQRS such that it is less than or equal to 3cm from PQ and nearer to PS than to SR. Indicate clearly, by shading, the region in which M must lie. [2]

2 0 2 4

[Turn over

3 (a) Express $\frac{2}{x+2} - \frac{5}{3x-1}$ as a single fraction in its simplest form. [3]

(b) In the following diagram, $\vec{OA} = \underline{a}$, $\vec{OB} = \underline{b}$ and $AX : AB = 2 : 3$.



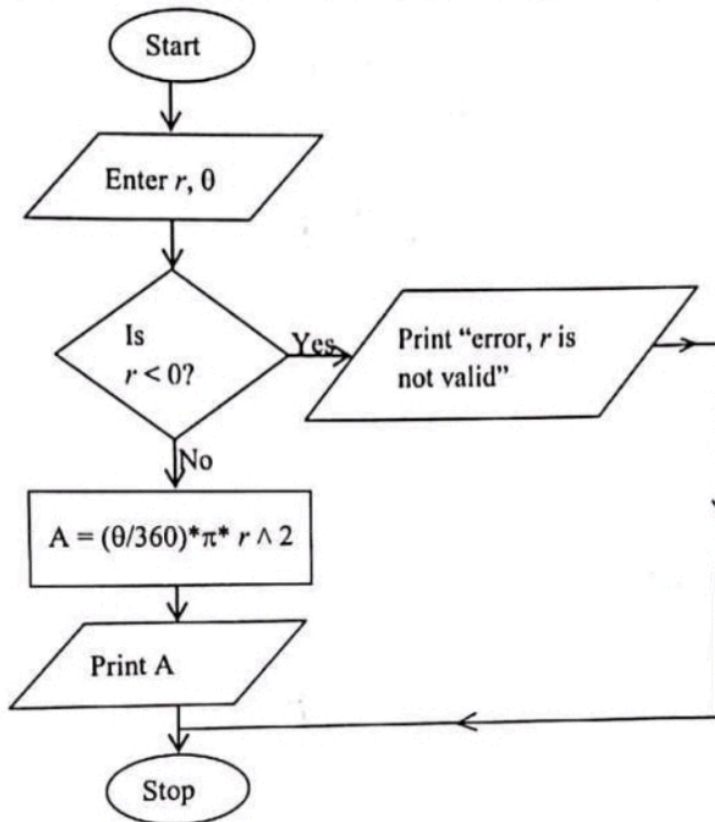
- (i) Express in terms of \underline{a} and/or \underline{b}
- (a) \vec{AB} , [1]
- (b) \vec{XB} , [1]
- (c) \vec{XO} . [1]
- (ii) Given also that $\vec{OY} = 3\vec{OX}$, show that $\vec{BY} = \underline{a} + \underline{b}$. [2]

4 (a) Solve the equation $7 - 2x^2 = x$, giving your answers correct to 2 decimal places. [5]

(b) Given that matrix $B = \begin{pmatrix} 4 & x \\ -1 & -3x \end{pmatrix}$,

- (i) find the value of x for which the determinant of B is 22, [2]
- (ii) hence, find the inverse of B . [2]

- 5 (a) Evaluate $\int_{-1}^2 (6x^5 - x^4 + 3x^2 - 1) dx$. [3]
- (b) The flowchart below shows the steps that are carried out in calculating and displaying the area (A) of a sector given its radius (r) and angle of the sector (θ).



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Write a pseudocode corresponding to the flowchart program above. [5]

- 6 (a) The first three terms of a geometric progression are $3w - 2$, $3w + 6$ and $3w + 30$. Find the
- (i) value of w , [3]
- (ii) n th term, [2]
- (iii) sum of the first 4 terms. [2]
- (b) Simplify $\frac{10a}{m^2 n^2} \div \frac{5a^3}{2m^2 n^2}$. [2]

[Turn over

Section B [48 marks]

Answer any four questions in this section.

Each question in this section carries 12 marks.

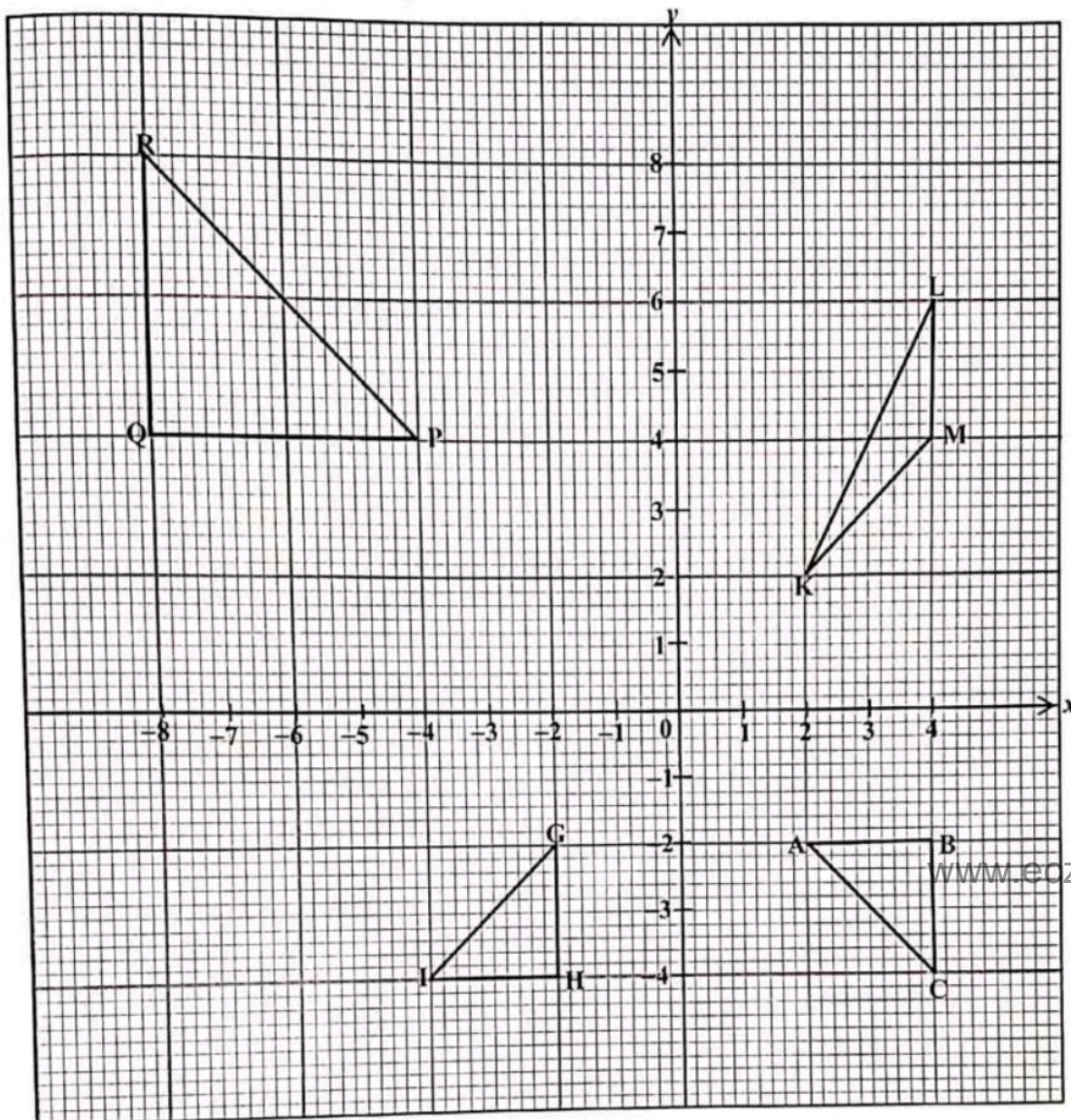
7 Answer the whole of this question on a sheet of graph paper.

Mapulanga's carpentry shop makes two types of chairs, type A and type B for sale. The cost of making one chair of each type is K2 000.00. The shop has K140 000.00 available for making chairs. The number of chairs of type A must be at least 20 while that of type B must be at least 10.

- (a) If x is the number of chairs of type A and y the number of chairs of type B, write three inequalities which represent these conditions. [4]
- (b) Using a scale of 2cm to represent 10 chairs on each axis, draw x and y axes for $0 \leq x \leq 70$ and $0 \leq y \leq 70$ respectively and shade the unwanted region to show clearly the region where the solution of the inequalities lie. [4]
- (c) Given that the profit on a type A chair is K60.00 and on a type B is K30.00, how many chairs of each type should be made for maximum profit? [2]
- (d) Calculate the maximum profit. [2]

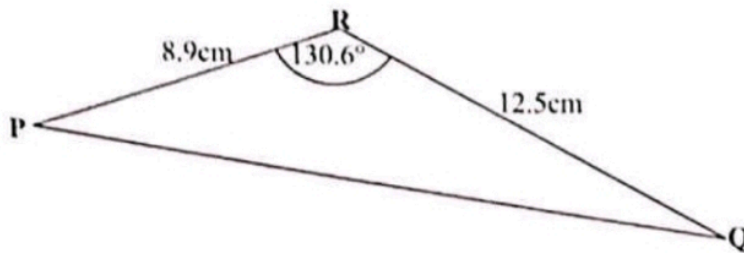
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8 Study the diagram below and answer the questions that follow.



- (a) Describe fully the single transformation which maps triangle ABC onto triangle GHI. [3]
- (b) Triangle ABC is mapped onto triangle PQR by an enlargement. Find the matrix representing this transformation. [3]
- (c) A stretch represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ maps triangle ABC onto triangle DEF (not in the diagram). Find the coordinates of D, E and F. [3]
- (d) Triangle KLM is the image of triangle ABC under a shear. Find the shear factor and invariant line. [3]

- 9 (a) The diagram shows a triangle PQR in which $PR = 8.9\text{cm}$, $QR = 12.5\text{cm}$ and $\hat{P}RQ = 130.6^\circ$.



Calculate

- (i) PQ , [5]
 (ii) the area of triangle PQR, [2]
 (iii) the shortest distance from R to PQ. [2]
- (b) Solve the equation $2\sin x = 1$ for $90^\circ \leq x \leq 270^\circ$. [1]
- (c) Simplify $\frac{3x^3 - 6x^2}{x^2 - 2x}$. [2]

- 10 (a) Answer this part of the question on a sheet of graph paper. www.eczpastpapers.com

The values of x and y are connected by the equation $y = -x^3 + x^2 + 6x$. Some corresponding values of x and y are given in the table below.

x	-3	-2	-1	0	1	2	3	4
y	18	0	-4	0	6	8	0	q

- (i) Calculate the value of q . [1]
- (ii) Using a scale of 2cm to represent 1 unit on the x -axis for $-3 \leq x \leq 4$ and 2cm to represent 10 units on the y -axis for $-30 \leq y \leq 20$, draw the graph of $y = -x^3 + x^2 + 6x$. [3]
- (iii) Use your graph to
- (a) solve the equation $-x^3 + x^2 + 5x = 4 - x$, [3]
 (b) estimate the gradient of the curve at the point where $x = 1$. [2]
- (b) Find the equation of the normal to the curve $y = x^2 + x + 2$ at the point (1, 4). [3]

- 11 The frequency table shows the distribution of marks obtained by 50 learners in a Mathematics test.

Marks (x)	$10 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$	$60 < x \leq 70$	$70 < x \leq 80$
Frequency	3	7	12	15	8	3	2

(a) Calculate the standard deviation. [6]

(b) Answer this part of the question on a sheet of graph paper.

(i) Using the information in the table above, copy and complete the cumulative frequency table below. [1]

Marks (x)	≤ 10	≤ 20	≤ 30	≤ 40	≤ 50	≤ 60	≤ 70	≤ 80
Cumulative frequency	0	3	10	22				50

(ii) Using a scale of 2cm to represent 10 marks on the x -axis for $0 \leq x \leq 80$ and 2cm to represent 5 units on the y -axis for $0 \leq y \leq 50$, draw a smooth cumulative frequency curve. [3]

(iii) Showing your method clearly, use your graph to estimate the 70th percentile. [2]

- 12 (a) The points P(80°N , 50°W), Q(80°N , 80°E), R(50°N , 80°E) and T(50°N , 50°W) are on the surface of the earth. [$\pi = 3.142$ and $R = 6\,370\text{km}$]

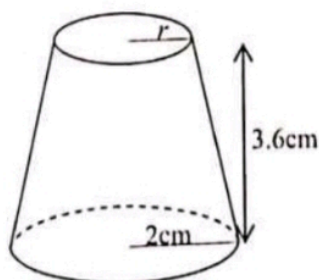
(i) Draw a sketch to represent the above information. [2]

(ii) Calculate the distance

(a) QR along longitude 80°E in kilometres, [2]

(b) RT along latitude 50°N in kilometres. [2]

- (b) The figure below is a frustum of a cone. The base radius is 2cm, top radius is r cm and the height is 3.6cm. [Take π as 3.142]



Calculate the

(i) value of r if the height of the cone from which the frustum was made was 6cm, [2]

(ii) volume of the frustum. [4]