

EXAMINATIONS COUNCIL OF ZAMBIA
Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) 4024/2
PAPER 2

Thursday

10 OCTOBER 2013

Additional materials:
Answer Booklet
Silent Electronic Calculator (non programmable)
Geometrical Instruments
Graph paper (3 sheets)
Mathematical tables (optional)
Plain paper (1 sheet)

TIME: 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Answer Booklet.

Write your answers and working in the Answer Booklet provided.

If you use more than one Answer Booklet, fasten the Answer Booklets together.

Omission of essential working will result in loss of marks.

There are **twelve (12)** questions in this paper.

Section A

Answer **all** questions.

Section B

Answer any **four** questions.

Silent non programmable Calculators or Mathematical tables may be used.

Cell phones should not be brought into the examination room.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

The total marks for this paper is 100.

If the degree of accuracy is not specified in the question, and if the answer is not exact,

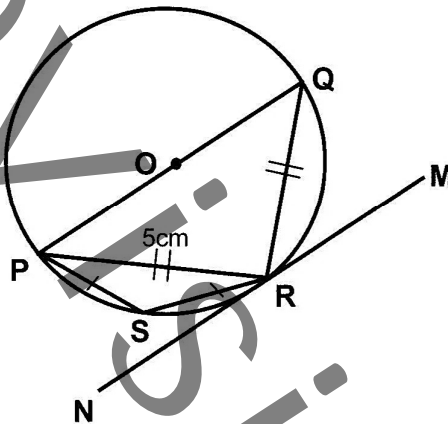
give the answer to three significant figures. Give answers in degrees to one decimal place.

Section A [52 marks]

Answer all questions in this section

- 1 (a) Evaluate $2\frac{5}{8} - 2\frac{1}{6} \div 1\frac{1}{12}$. [2]
- (b) Express 0.041 as a percentage. [1]
- (c) Factorise completely $3y^2 - 12$. [2]
- (d) Mrs Maketiya sold a pair of shoes at K220.00. She made a profit of 10%. Calculate the cost of the shoes. [3]

- 2 (a) In the diagram below, a circle with centre O passes through the points P, Q, R and S. MRN is a tangent to the circle at R. $PR = RQ$, $PS = SR$ and $PR = 5\text{cm}$.



- Find
- (i) $\angle PRQ$, [1]
- (ii) $\angle RSP$, [1]
- (iii) $\angle QRM$, [1]
- (iv) $\angle SRN$, [2]
- (v) the length of PQ correct to 3 decimal places. [2]
- (b) Express $\frac{2a}{x-1} - \frac{a}{x-2}$ as a single fraction in its simplest form. [3]

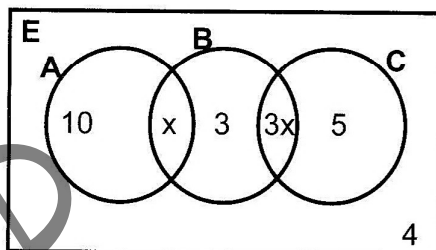
- 3 (a) Solve the equation $x^2 + 6x = -2$, giving your answers correct to 2 decimal places. [5]

- (b) Given that $A = \begin{pmatrix} 2 & 2 & -1 \end{pmatrix}$, $P = \begin{pmatrix} -1 & -1 \\ 4 & 2 \\ 2 & 0 \end{pmatrix}$ and $Q = \begin{pmatrix} 2 & -1 \\ 4 & 1 \end{pmatrix}$, find

- (i) $-2P$, [1]
- (ii) the determinant of Q, [1]
- (iii) AP. [2]

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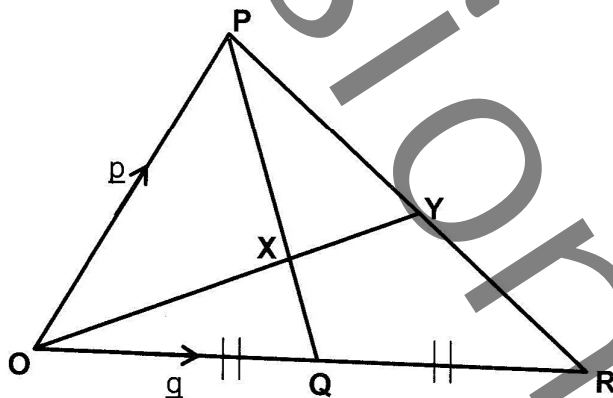
- 4 (a) The diagram below shows three sets A, B and C.



Given that $n(A \cup B \cup C) = 50$, find

- (i) the value of x , [2]
 (ii) $n(A \cup B)$, [1]
 (iii) $n(B \cup C)$, [1]
 (iv) $n(A' \cap C')$. [2]
 (b) Solve $-5x - 9 \leq 16$. [2]

- 5 (a) In triangle OPR below, the line OX produced, meets PR at Y. PQ and OY meet at X such that $XQ = \frac{1}{3}PQ$. $\vec{OP} = p$, $\vec{OQ} = q$ and $OQ = QR$.



- (i) Express each of the following as simply as possible in terms of p and /or q
 (a) \vec{PQ} , [1]
 (b) \vec{OX} . [2]
 (ii) Given that $\vec{OY} = h\vec{OX}$, show that $\vec{PY} = \left(\frac{1}{3}h - 1\right)p + \frac{2}{3}hq$. [2]
 (b) Three liquids A, B and C are mixed in the ratio 1: 2: 3 to make a solution called elixir. Given that liquid B is 72 litres, find
 (i) the total number of litres for the solution elixir, [2]
 (ii) the difference in litres between liquid A and liquid B. [2]

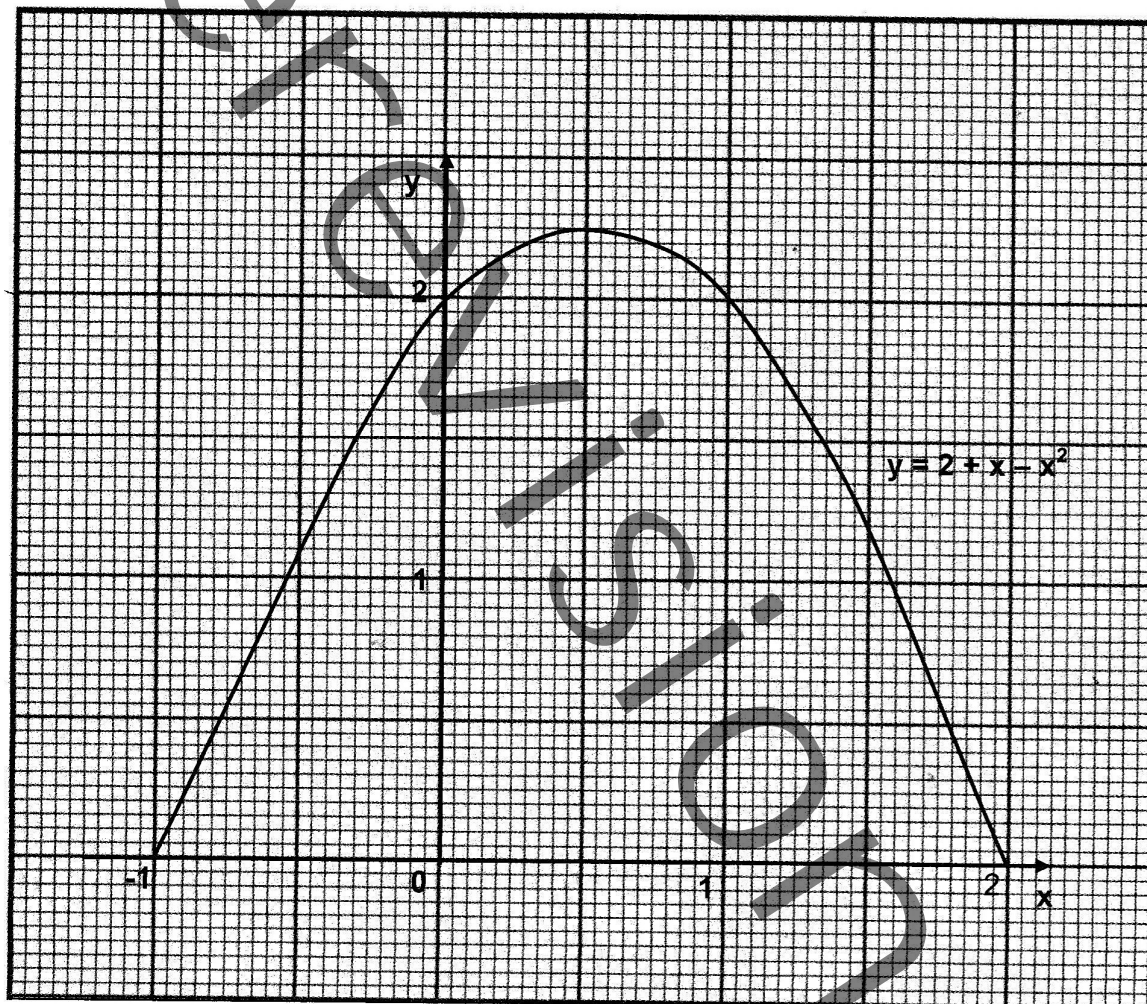
6 Answer the whole of this question on a sheet of plain paper.

- (a) Construct a quadrilateral KFML in which $KL = 8\text{cm}$, $KF = 4\text{cm}$, $LM = 9\text{cm}$, $\angle FKL = 62^\circ$ and $\angle KLM = 118^\circ$. Measure and write the length FM. [2]
- (b) Inside the quadrilateral KFML, draw the locus of points which are:
- (i) 4cm from L, [1]
 - (ii) 3cm from KL, [1]
 - (iii) equidistant from MF and ML. [1]
- (c) Given that P is a point inside the quadrilateral such that it is 4cm from L, more than 3cm from KL and equidistant from MF and ML, label point P. [1]
- (d) Another point Q inside the quadrilateral is such that it is more than 3cm from KL, less than 4cm from L and nearer to MF than to ML. Indicate, by shading, the region in which Q must lie. [2]
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Section B [48 marks]Answer any **four** questions in this section

Each question in this section carries 12 marks.

- 7 (a) The diagram shows the graph of $y = 2 + x - x^2$.



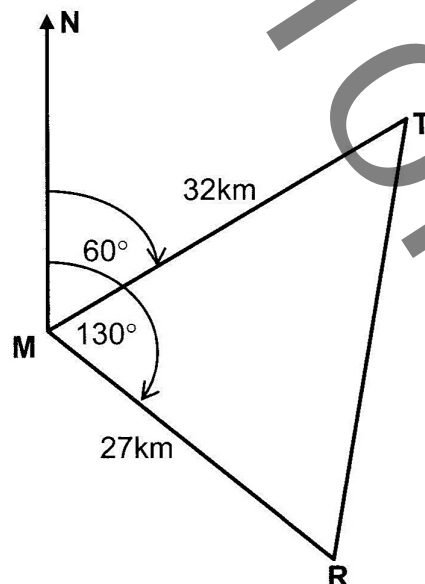
- (i) Use the graph to find the solutions of the equations
- (a) $0 = 2 + x - x^2$, [2]
 - (b) $x - x^2 = -1$. [2]
- (ii) Calculate an estimate of
- (a) the gradient of the curve at the point $(1, 2)$, [2]
 - (b) the area bounded by the curve, $y = 1$, $x = 0$ and $x = 1$. [3]
- (b) Solve $3\left(\frac{x}{5} - 4\right) = 6 - 3x$. [3]

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

Triangle S has vertices (1, 1), (2, 1) and (1, 2) while triangle R has vertices (2, 3), (3, 3) and (2, 4).

- (a) Using a scale of 2cm to represent 1 unit on each axis, draw axes for values of x and y in the range $-5 \leq x \leq 5$ and $-5 \leq y \leq 4$. Draw and label triangles S and R. [2]
- (b) Describe fully a single transformation that maps triangle S onto triangle R. [2]
- (c) (i) Triangle T has vertices $(-2, -2)$, $(-4, -2)$ and $(-2, -4)$. Draw and label triangle T. [1]
- (ii) Write the matrix of the transformation that maps triangle S onto triangle T. [3]
- (d) Triangle S is mapped onto triangle W with vertices (3, 1), (4, 1) and (5, 2). Draw triangle W and describe this transformation fully. [4]

- 9 (a) Mr Kafola earns a monthly salary of K2 500.00. The employer gives him a $10\frac{1}{2}\%$ increase. How much more does he earn? [2]
- (b) M, T and R are Food Reserve Agency Maize buying points in a given district. T is 32km from M on a bearing of 060° and R is 27km from M on a bearing of 130° as shown in the diagram below.



Calculate

- (i) angle RMT, [1]
- (ii) the area of triangle MTR, [2]
- (iii) RT to the nearest kilometre, [5]
- (iv) MS, given that there is a shopping centre S along RT such that MS is the shortest distance from M. [2]

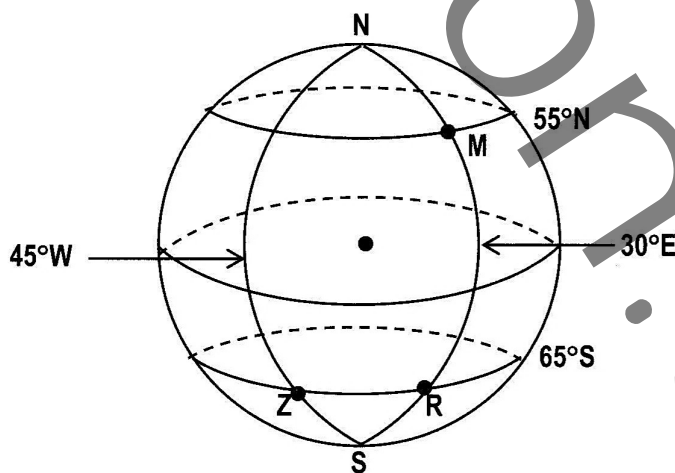
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10 (a) Answer the whole of this question on a sheet of graph paper.

A farmer wants to buy some hoes and shovels for use at his farm. He decides to buy at least 5 hoes and not more than 14 hoes and shovels altogether. The number of hoes should not be more than twice the number of shovels.

- (i) Taking x to represent the number of hoes and y the number of shovels, write three inequalities which satisfy the above conditions. [3]
 - (ii) The point (x, y) represents x hoes and y shovels. Using a scale of 1cm to represent 1 unit on both axes, draw the x and y axes for $-1 \leq x \leq 15$ and $-1 \leq y \leq 15$ and shade the unwanted region to indicate clearly the region where (x, y) must lie. [3]
 - (iii) Find the largest number of shovels that can be bought. [1]
- (b)** Kapofu bought three oranges and two apples which she put in a bag. Later on she picked one fruit at random from the bag and ate it. After some time she picked another fruit at random and ate it.
- (i) Construct a tree diagram to represent this information. [2]
 - (ii) Hence or otherwise, find the probability that the two fruits picked were of different types. [3]

- 11 (a)** M, R and Z are points on the surface of the earth as shown in the diagram below. M is on the parallel of latitude 55°N , Z and R are on the same parallel of latitude 65°S , M and R are on the same longitude 30°E and Z is on longitude 45°W [$\pi = 3.142$, $R = 6\,370\text{km}$].

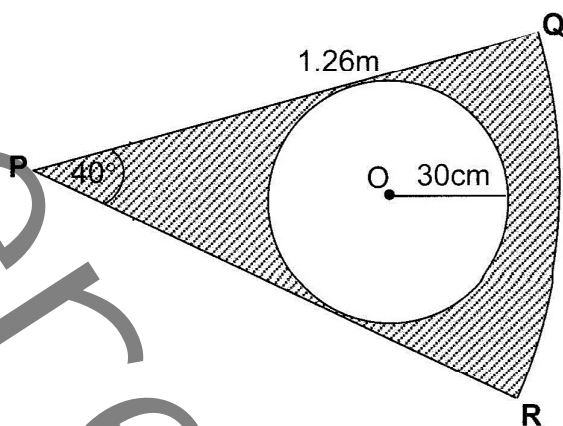


- (i) Find the difference in latitude between points M and R. [1]
- (ii) Calculate the distance MR along the same longitude, giving your answer to the nearest kilometre. [2]
- (iii) If the local time at Z is 08 00 hours, what is the time at R? [1]
- (iv) Find the distance ZR in kilometres, along the same latitude, giving

your answer to the nearest kilometre.

[2]

- (b) The diagram below shows part of a flag of an organisation which is in a form of a sector PQR. The circle centre O inside the sector is of radius 30cm.



Given that $PQ = PR = 1.26\text{m}$, $\angle RPQ = 40^\circ$ and taking $\pi = 3.142$, calculate

- (i) the perimeter of sector PQR, [3]
 (ii) the area of the shaded part, giving your answer in square centimetres. [3]

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

The table shows the number of litres of water that 80 pupils at Tapasa Primary School drank on two cold days.

Litres of water (x)	$0 < x \leq 0.5$	$0.5 < x \leq 1$	$1 < x \leq 1.5$	$1.5 < x \leq 2$	$2 < x \leq 2.5$	$2.5 < x \leq 3$	$3 < x \leq 3.5$	$3.5 < x \leq 4$
Number of pupils	2	2	7	19	30	14	5	1

- (a) Calculate the estimated mean litres of water drank. [3]
 (b) Copy and complete the cumulative frequency distribution. [2]

Litres of water (x)	≤ 0	≤ 0.5	≤ 1	≤ 1.5	≤ 2	≤ 2.5	≤ 3	≤ 3.5	≤ 4
Frequency	0	2	4	11	30				

- (c) Using a horizontal scale of 4cm to represent 1 litre of water on the x-axis and a vertical scale of 2cm to represent 10 pupils on the y-axis, draw a smooth cumulative frequency curve. [3]
 (d) Showing your method clearly, use your graph to estimate
 (i) the median, [1]
 (ii) the interquartile range, [2]
 (iii) the 80th percentile. [1]

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