

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

MATHEMATICS (SYLLABUS D) 4024/2

PAPER 2

Tuesday

6 NOVEMBER 2012

Additional materials:

Answer paper
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.

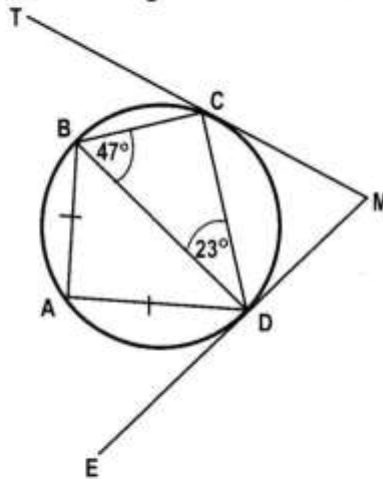
Section A [52 marks]

Answer **all** questions in this section

- 1 (a) Evaluate $2\frac{1}{3} - 2\frac{1}{4} + 1\frac{1}{2}$. [2]
- (b) Solve the equation $\frac{6}{x+2} = \frac{2}{3}$. [2]
- (c) Simplify $\frac{x+2}{x^2-4}$. [2]
- (d) A sugar cane stick has eleven equal segments. Given that one third of it is spoiled by stalk borers, calculate the number of the remaining segments giving your answer correct to 2 decimal places. [2]

- 2 (a) Given that $A = \begin{pmatrix} 2 & 3 \\ -1 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$, find the
- (i) determinant of A, [1]
- (ii) inverse of A, [1]
- (iii) value of AB. [2]
- (b) Express $\frac{4}{2x-1} - \frac{3}{x-1}$ as a single fraction in its simplest form. [3]
- (c) Solve the inequation $4b - 3 < 6b + 4$. [2]

- 3 (a) In the diagram below, A, B, C and D are points on the circumference of a circle. TCM and MDE are tangents to the circle at C and D respectively.

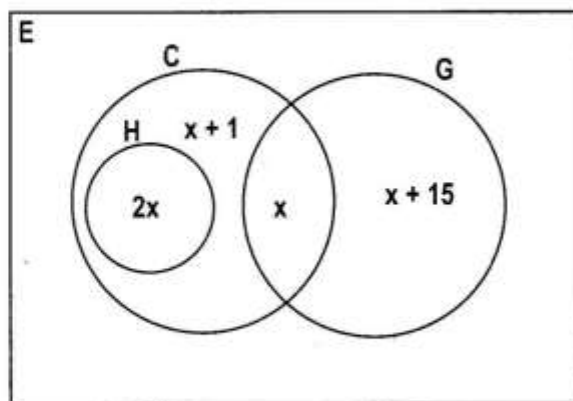


- Given that $AB = AD$, $\widehat{CBD} = 47^\circ$ and $\widehat{BDC} = 23^\circ$, calculate
- (i) \widehat{BCT} , [1]
- (ii) \widehat{BAD} , [1]
- (iii) \widehat{ABD} , [1]
- (iv) \widehat{DMC} . [2]
- (b) Solve the equation $2x^2 + 5x - 8 = 0$, giving your answers correct to 2 decimal places. [5]

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

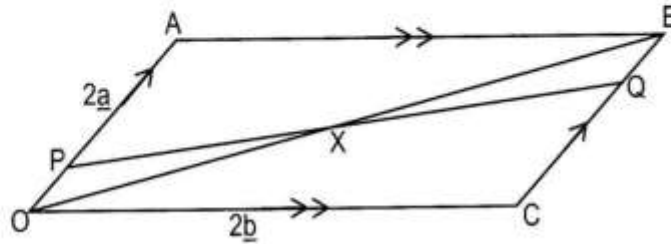
- (a) Construct triangle PQR in which $PQ = 10\text{cm}$, $PR = 7\text{cm}$ and $QR = 8\text{cm}$. [1]
- (b) Measure and write the size of \hat{PRQ} . [1]
- (c) On your diagram, draw the locus of points within the triangle which are
- (i) equidistant from Q and R, [1]
- (ii) 5cm from R. [1]
- (d) T is a point inside the triangle PQR such that it is 5cm from R and equidistant from Q and R. Label the point T. [2]
- (e) Another point B within the triangle PQR is nearer to Q than R and greater than or equal to 5cm from R. Indicate clearly, by shading, the region in which B must lie. [2]

- 5 (a) A class of 41 girls takes History (H), Commerce (C) and Geography (G) as optional subjects. The Venn diagram below shows their choice distribution.



- (i) Calculate the value of x . [2]
- (ii) Find
- (a) $n(H \cup G)$, [1]
- (b) $n(G' \cap H')$. [1]
- (b) Express $3\frac{2}{5}\%$ as a decimal. [1]
- (c) The ratio of adults to children that bought tickets for a video show was 17:15 respectively.
The total number of tickets sold for the video show was 4 704.
- (i) How many more adults than children attended the video show? [2]
- (ii) If the tickets for adults were sold at K12 500 each and the tickets for children were sold at K8 500 each, calculate the total amount realised from the sell of tickets. [2]

- 6 (a) In the diagram below, OABC is a parallelogram in which $\vec{OA} = 2\mathbf{a}$ and $\vec{OC} = 2\mathbf{b}$. P is a point on OA such that $OP = \frac{1}{4}OA$ and Q is a point on CB such that $CQ : QB = 3 : 1$.

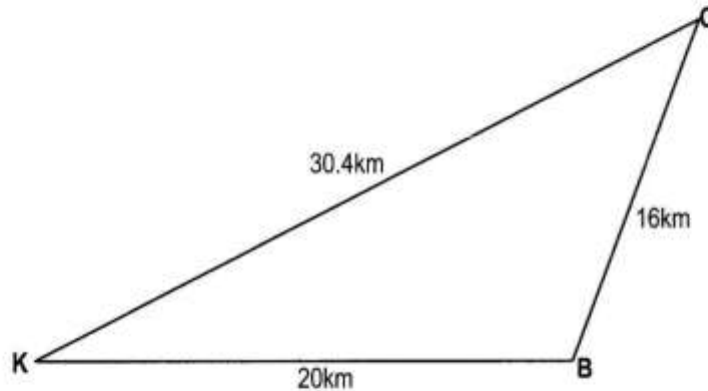


- (i) Express in terms of \mathbf{a} and / or \mathbf{b}
- (a) \vec{OB} , [1]
- (b) \vec{OP} , [1]
- (c) \vec{QC} . [1]
- (ii) Given that $\vec{OX} = h\vec{OB}$, express \vec{OX} in terms of \mathbf{a} , \mathbf{b} and h . [1]
- (b) Factorise completely $2xy + x - 10y - 5$. [2]
- (c) The width of a rectangle is 3m. If its diagonal is 8.5m long, calculate the length giving your answer correct to 2 decimal places. [2]

Section B [48 marks]Answer any **four** questions in this section

Each question in this section carries 12 marks.

- 7 (a) The diagram below shows Kapenta (K), Bream (B) and Chisense (C) fishing camps on lake Manzi. B is 20km due east of K, $BC = 16$ km and $KC = 30.4$ km.



- (i) Calculate
- (a) \widehat{KBC} to the nearest degree, [5]
- (b) the area of triangle KBC. [3]
- (ii) Another fishing camp Ndombe (N) is on KB produced, such that $\widehat{BNC} = 90^\circ$. Calculate the distance between C and N. [2]
- (b) Mrs Kongolani obtained a seasonal loan of K5 000 000 from a bank, payable over $1\frac{1}{2}$ years at the rate of 20% per annum. How much did she pay to the bank at the end of $1\frac{1}{2}$ years? [2]

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

In a Survey, 200 shoppers were asked how much they had spent at Gulani Super Market on a particular day. The results are shown in the table below.

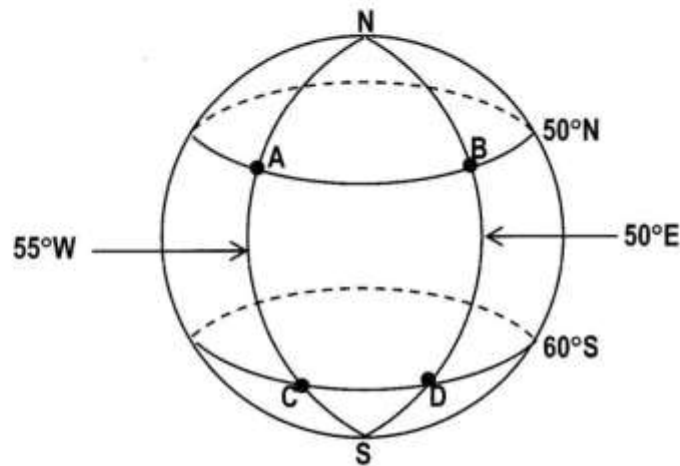
Amount in '000 of Kwacha	$0 < x \leq 20$	$20 < x \leq 40$	$40 < x \leq 60$	$60 < x \leq 80$	$80 < x \leq 100$	$100 < x \leq 140$
Number of shoppers	10	32	48	54	36	20

- (a) Write the modal class. [1]
 (b) Estimate the mean amount spent. [3]
 (c) Copy and complete the following cumulative frequency table. [1]

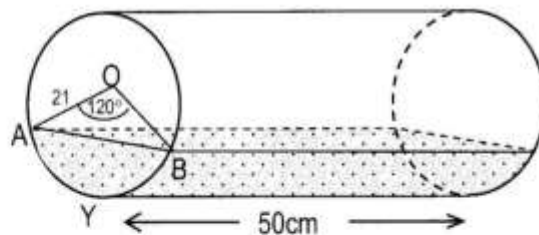
Amount in '000 of Kwacha	≤ 0	≤ 20	≤ 40	≤ 60	≤ 80	≤ 100	≤ 140
Number of shoppers	0	10	42	90			

- (d) Using a scale of 2cm to represent K20 000 on the horizontal axis and 2cm to represent 20 shoppers on the vertical axis, draw a smooth cumulative frequency curve. [3]
 (e) Showing your method clearly, use your graph to estimate the interquartile range. [2]
 (f) Given that shoppers who spent at least K110 000 qualified for entry into a raffle draw, estimate the number of those who qualified. [2]

- 9 (a) The diagram below shows a wire model of the earth. The circle of latitude in the north is 50°N and the circle of latitude in the south is 60°S . A and C are on longitude 55°W while B and D are on longitude 50°E .
(Take $\pi = 3.142$ and $R = 3437\text{nm}$)



- (i) Write the positions, using longitudes and latitudes, of the points A and D. [2]
 (ii) Calculate the difference in longitudes between A and B. [1]
 (iii) Given that the time at town D is 09 20 hours, what would be the time at town C? [1]
 (iv) Calculate the distance BD along the longitude 50°E in **nautical miles**. [2]
- (b) A cylindrical geyser of radius 21cm and length 50cm is placed with its curved surface on a horizontal ground. It is filled partially with water and the segment ABY in the diagram shows the cross section of water in the geyser. O is the centre of the circular end of the geyser, Y is vertically below O and $\hat{AOB} = 120^\circ$. (Take $\pi = \frac{22}{7}$).



Calculate

- (i) the curved surface area of the geyser, [2]
 (ii) the volume of water in the geyser correct to the nearest whole number. [4]

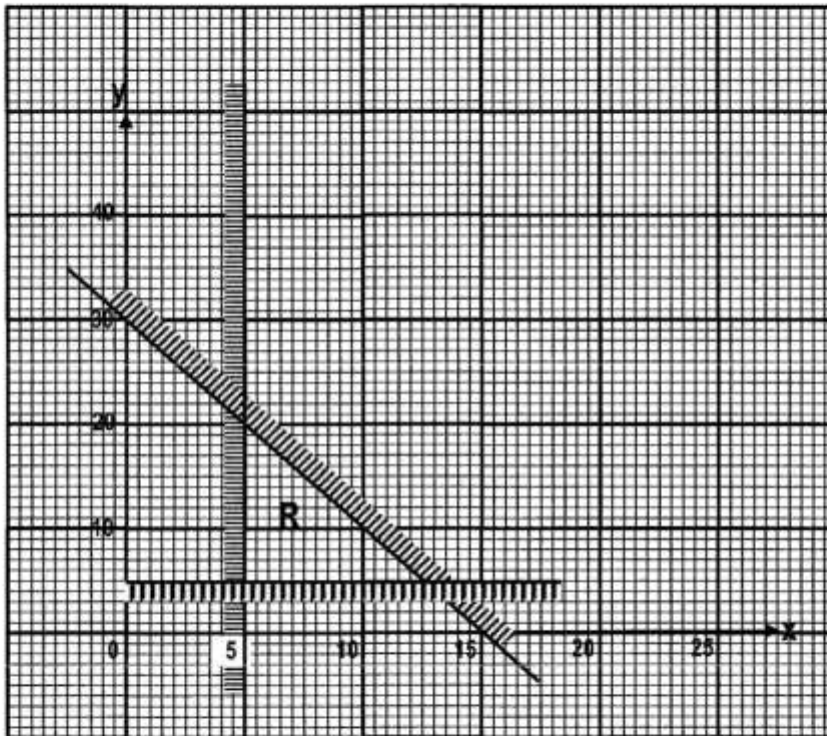
10 (a) Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation $y = 42 - x - x^2$. The table below shows some corresponding values of x and y .

x	-8	-6	-4	-2	-1	0	3	5
y	q	12	30	40	42	42	30	12

- (i) Calculate the value of q . [1]
- (ii) Using a scale of 1cm to represent 1 unit on the x -axis for $-8 \leq x \leq 6$ and a scale of 2cm to represent 10 units on the y -axis for $-20 \leq y \leq 50$, draw the graph of $y = 42 - x - x^2$. [3]
- (iii) By drawing the line $7y - 20x = 140$ on the same graph, solve the equation $42 - x - x^2 = \frac{20x}{7} + 20$. [3]
- (iv) Estimate the area under the curve between $x = 0$, $y = 0$ and $x = 4$. [2]
- (b) Given that $x = 2$ and $y = -3$, find the value of $x^2 - 6xy + 3y - 3x$. [3]

- 11 (a) The graph below shows three inequalities that satisfy Kashita's intentions to purchase Science and Mathematics text books.



- (i) Given that x represents the number of Science text books and y represents Mathematics text books, write the three inequalities that represent the unshaded region R. [4]
- (ii) Given that a Science textbook costs K25 000 and a Mathematics textbook K10 000, find the largest number of Science and Mathematics textbooks that can be bought. Hence calculate the total cost of the textbooks. [3]
- (b) A box has 7 identical sweets. 3 of these are green and the rest are red. Kamwanga picks one sweet at random and eats it. After sometime, he picks another one and eats it.
- (i) Construct a tree diagram to illustrate the outcomes of the two sweets taken. [3]
- (ii) Calculate the probability that the first sweet was red and the second was green. [2]

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

Using a scale of 2cm to represent 10 units on each axis, draw x and y axes for $-30 \leq x \leq 40$ and $-30 \leq y \leq 30$.

- (a) $\triangle ABC$ has vertices $A(-30, 10)$, $B(-30, 20)$ and $C(-10, 20)$. $\triangle A_1B_1C_1$ has vertices $A_1(10, -30)$, $B_1(20, -30)$ and $C_1(20, -10)$.
- (i) Draw and label $\triangle ABC$ and $\triangle A_1B_1C_1$. [1]
- (ii) Describe fully a single transformation that maps $\triangle ABC$ onto $\triangle A_1B_1C_1$. [2]
- (b) An enlargement centre $(10, -30)$ and scale factor 2 maps $\triangle A_1B_1C_1$ onto $\triangle A_2B_2C_2$. Draw and label $\triangle A_2B_2C_2$. [1]
- (c) A reflection in the line $y = 0$ maps $\triangle ABC$ onto $\triangle A_3B_3C_3$. Draw and label $\triangle A_3B_3C_3$. [1]
- (d) $\triangle A_4B_4C_4$ is the image of $\triangle A_1B_1C_1$ under a translation. Given that A_4 is the point $(10, 10)$,
- (i) write the column vector representing this translation. [1]
- (ii) draw and label $\triangle A_4B_4C_4$. [1]
- (e) The matrix $\begin{pmatrix} 1 & \frac{1}{2} \\ 0 & 1 \end{pmatrix}$ maps $\triangle A_4B_4C_4$ onto $\triangle A_5B_5C_5$.
- (i) Draw and label $\triangle A_5B_5C_5$. [2]
- (ii) Describe fully the single transformation represented by this matrix. [2]