EXAMINATIONS COUNCIL OF ZAMBIA

Joint Examination for the School Certificate and General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D)

PAPER 2 **4024/2**

Tuesday **3 NOVEMBER 2009** **2 hours 30 minutes**

Additional materials:
Answer Booklet
Silent Electronic calculator (none programable)
Geometrical instruments
Graph paper (3 sheets)
Mathematical tables (optional)
Plan 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 are not allowed in 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 $3 + \frac{1}{2} \div \frac{1}{4}$. [2]

(b) Solve the inequation $1 - \frac{3}{5}x < 4$. [2]

(c) Simplify $\frac{a-2}{a^2-4}$. [3]

(d) Given that p = 7 and q = –3, find the value of $p^2 - q^3$. [2]

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2 **(a)** V varies directly as the square of x and inversely as y. Given that v = 9 when x = 3 and y = 4, find x when v = 50 and y = 2. [4]

(b) Given that $A = \begin{pmatrix} 3 & 7 \\ 2 & 5 \end{pmatrix}$, find the

(i) determinant of A, [1]

(ii) inverse of A, [2]

(iii) value of $A^{-1} \begin{pmatrix} -2 \\ 1 \end{pmatrix}$. [2]

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3 **(a)** Solve the equation $x^2 + x - 1 = 0$, giving your answer correct to 2 decimal places. [5]

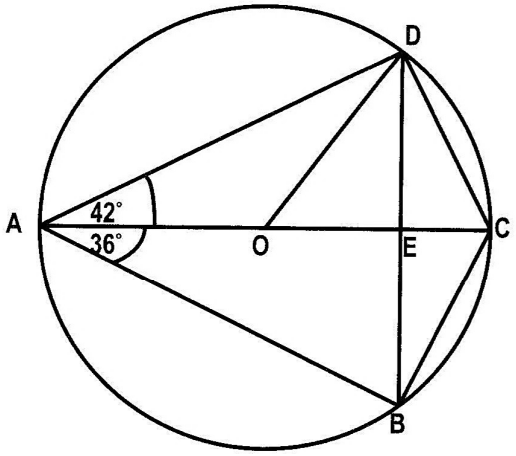
(b) Find the equation of line l passing through a point (0,5) whose gradient is 3. [2]

(c) If B is a point (6, –3) and C is (–2, 1), find

(i) the gradient of line BC, [2]

(ii) the equation of line BC. [2]

4 **(a)** In the diagram below, ABCD is a circle, with centre O. Given that $O\hat{A}D = 42^{o}$ and $O\hat{A}B = 36^{o}$,



calculate

(i) $A\hat{O}D$, [1]

(ii) $A\hat{B}C$, [1]

(iii) $O\hat{D}B$. [2]

(b) Express as a single fraction $\frac{5}{2x-1} - \frac{7}{3x-2}$. [3]

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

(a) **(i)** Construct a quadrilateral PQRS in which PQ = 8cm, QR = 6cm, $P\hat{Q}R = 110^{o}$, RS = 4cm and PS = 9cm. [1]

(ii) Measure and write down the size of $P\hat{S}R$. [1]

(b) On the same diagram and within quadrilateral PQRS, construct the locus of points

(i) equidistant from RS and RQ, [1]

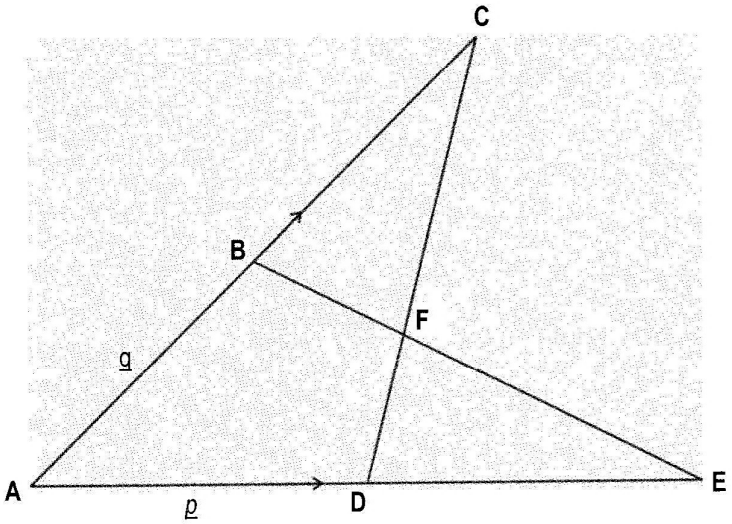
(ii) 3cm from PQ. [1]

(c) X is a point inside quadrilateral PQRS such that X is 3cm from PQ and equidistant from RS and RQ. Mark and label the point X. [1]

(d) Another point Y, within quadrilateral PQRS, is such that it is equal to or more than 3cm from PQ and nearer to RQ than RS.

Shade clearly the region in which Y must lie. [2]

6 (a) In the diagram below, ABC and ADE are straight lines. CD and BE intersect at F so that BF : FE = 1 : 2. B is the midpoint of AC and D is the mid point of AE.



Given that $\overrightarrow{AB} = \underline{q}$ and $\overrightarrow{AD} = \underline{p}$,

(i) express as simply as possible in terms of $\underline{p}$ and/or $\underline{q}$

(a) $\overrightarrow{BE}$, [1]

(b) $\overrightarrow{FE}$, [1]

(c) $\overrightarrow{DF}$. [1]

(ii) Given also that $\overrightarrow{DC} = h\overrightarrow{DF}$, write down an expression for $\overrightarrow{DC}$, and hence show that $\overrightarrow{AC} = \left(1-\frac{h}{3}\right)\underline{p} + \frac{2h}{3}\underline{q}$. [2]

(b) During the 2008 FAZ elections, presidential candidates received the following votes:

Name of Candidate	Number of votes received
Kwesha	120
Naluba	45
Nkoshi	x

(i) Express as a ratio in its simplest form Naluba's votes to Kwesha's. [1]

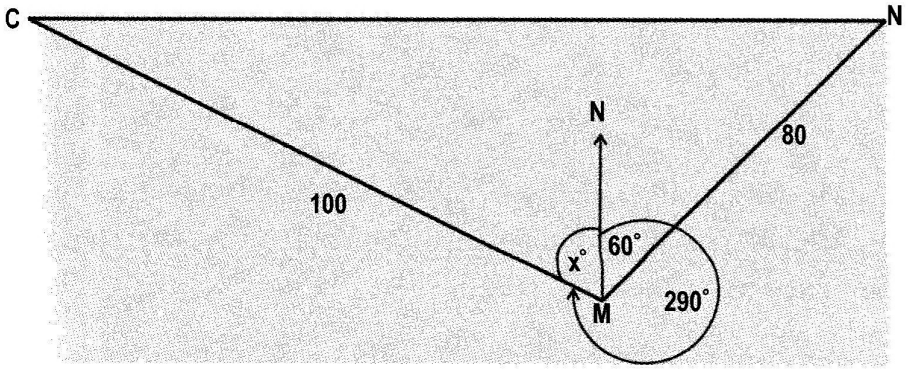
(ii) Given that Naluba got 25% of the total votes cast, calculate the total number of delegates who voted. [2]

(iii) Find the value of x. [1]

Section B [48 marks]

Answer any **four** questions in this section.
Each question in this section carries 12 marks.

7 Three towns Choma (C), Monze (M) and Namwala (N) are such that the distance from Monze to Choma is 100km and Monze to Namwala 80km. The bearing of Namwala from Monze is 060° and the bearing of Choma from Monze is 290°.



(a) Calculate the

(i) value of x, [1]

(ii) distance from Choma to Namwala correct to 2 decimal places, [5]

(iii) area covered by triangle CMN correct to 2 decimal places. [2]

(b) Given that Nikoh (H) is a bus station on the Choma-Namwala route such that MH is the shortest distance from Monze to Nikoh, calculate this shortest distance MH, correct to 2 decimal places. [2]

(c) Hence, find how far Nikoh is from Namwala, giving your answer correct to 2 decimal places. [2]

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

Triangle A has vertices (1, 6) (5, 4) and (3,2). Triangle B has vertices (–2, –6). (–4, –5) and (–3, –4).

(a) Using a scale of 2cm to represent 2 units on each axis, draw axes for values of x and y in the ranges $-10 \leq x \leq 8$ and $-8 \leq y \leq 8$. Draw and label triangles A and B. [2]

(b) Write down the centre and the scale factor of the enlargement which maps triangle B onto triangle A. [2]

(c) A translation $T = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ maps triangle A onto triangle E. Draw and label triangle E. [1]

(d) **(i)** Triangle A is mapped onto triangle C by a shear with invariant line the y-axis and shear factor –2.
Draw and label triangle C. [2]

(ii) Write down the matrix which represents this transformation. [2]

(e) Triangle A is mapped onto triangle D with vertices (–6, 1) (–4, 5) and (–2, 3). Draw and label triangle D. Describe this transformation fully. [3]

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

9 The amount of fees charged in 900 High Schools is shown in the table below.

Fees in '000 of Kwacha	$330 < x \leq 340$	$340 < x \leq 350$	$350 < x \leq 360$	$360 < x \leq 370$	$370 < x \leq 380$	$380 < x \leq 390$	$390 < x \leq 400$
Number of schools	20	70	150	180	300	160	20

(a) Copy and complete the following cumulative frequency table. [2]

Fees in '000 Kwacha	≤ 330	≤ 340	≤ 350	≤ 360	≤ 370	≤ 380	≤ 390	400
Frequency	0	20	90	240				900

(b) Using a horizontal scale of 2cm to represent K10 000 for values between K330 000 and K400 000 and a vertical scale of 2cm to represent 100 schools, draw a smooth cumulative frequency curve to illustrate this data. [3]

(c) Showing your method clearly, use your graph to estimate

(i) the median, [1]

(ii) the lower quartile, [1]

(iii) the interquartile range, [2]

(iv) the 70^{th} percentile. [1]

(d) Find the number of schools whose fees are more than or equal to K365 000. [2]

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

10 The variables x and y are connected by the equation

$$y = 3 + 13x - 4x^2.$$

Some corresponding values of *x* and *y* are given in the table below.

X	–2	–1	0	1	2	3	4	5
Y	–39	–14	3	12	13	6	–9	r

(a) Calculate the value of *r*. [1]

(b) Using a scale of 2cm to 1 unit on the x-axis and 2cm to 10 units on the y-axis for $-2 \leq x \leq 5$ and $-40 \leq y \leq 20$, draw the graph of $y = 3 + 13x - 4x^2$. [3]

(c) Use your graph to solve the equation

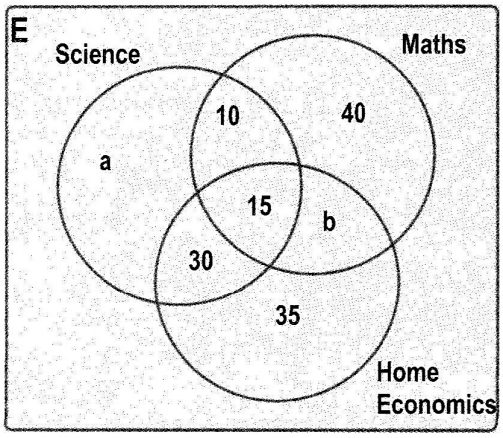
(i) $3 + 13x - 4x^2 = 0$, [2]

(ii) $13x - 4x^2 = -23$. [3]

(d) Estimate the area bounded by the curve, the y-axis, the lines $y = -10$ and $x = 3$. [2]

(e) Find the maximum value of $y = 3 + 13x - 4x^2$. [1]

11 **(a)** In a particular year, 150 candidates applied for training as teachers of Mathematics, *Science and Home Economics at COSETCO. The Venn diagram below illustrates* the number of candidates for each subject.



(i) Given that that 70 candidates applied for Science, find the value of a and b.[3]

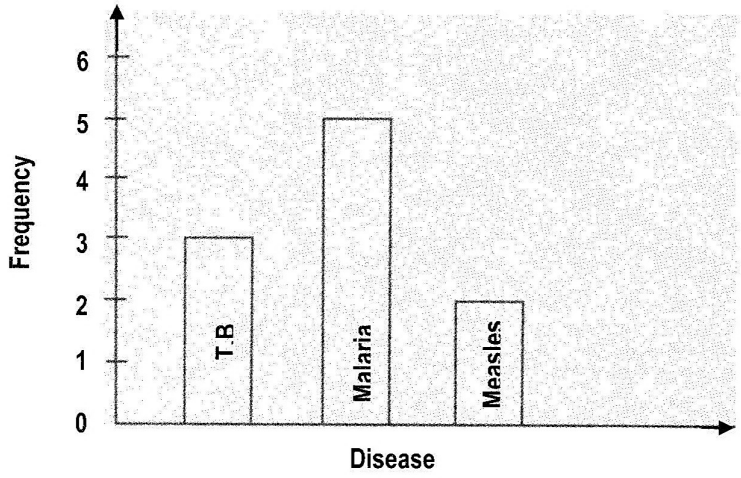
(ii) How many candidates applied for two different subjects only? [1]

(iii) How many candidates did not apply for Science or Mathematics? [1]

(iv) How many candidates applied for either Science or Home Economics but not Mathematics? [1]

(v) If a candidate is selected at random from the group, what is the probability that the candidate applied for one subject only? [2]

(b) The bar chart below shows the number of people who were treated for Malaria , Measles and Tuberculosis (T.B) at an urban clinic in one week.

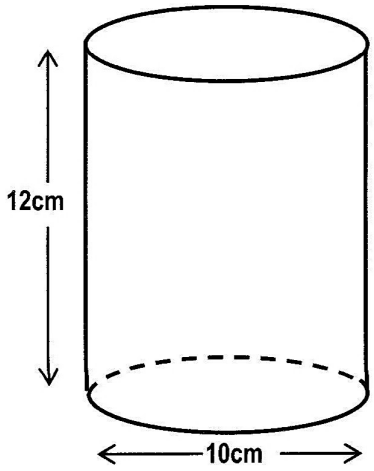


(i) If 120 people were treated for Malaria, how many were treated for Measles? [2]

(ii) Calculate the total number of people treated for the three diseases at the clinic. [2]

[Turn over

12 (a) The diagram below represents a glass of water of uniform cross section and thickness.

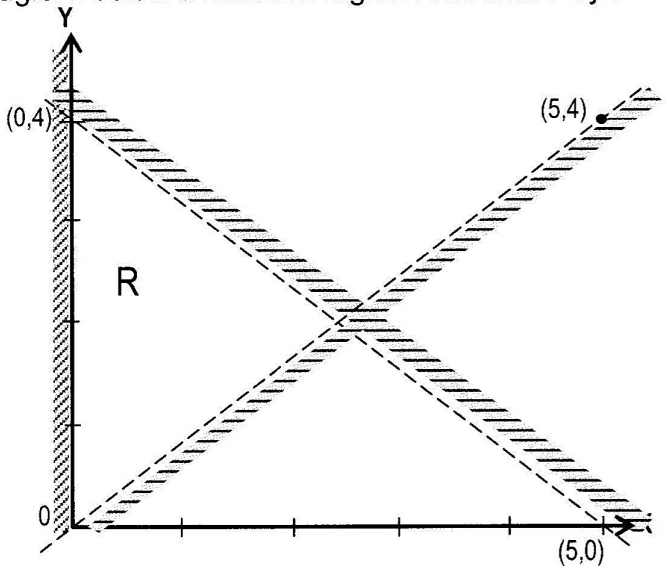


Given that its height is 12cm, diameter is 10cm and taking $\pi = 3.142$,

(i) calculate the outer surface area of the glass correct to 2 decimal places. [3]

(ii) given that the thickness of the glass of water is 2mm, calculate the volume of water that the glass can hold when completely full, giving your answer correct to 2 decimal places. [4]

(b) The diagram below shows the region R bounded by three lines.



Write the three inequalities describing the unshaded region marked R. [5]