

# 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**

**1 NOVEMBER 2011**

**2 hours 30 minutes**

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.*

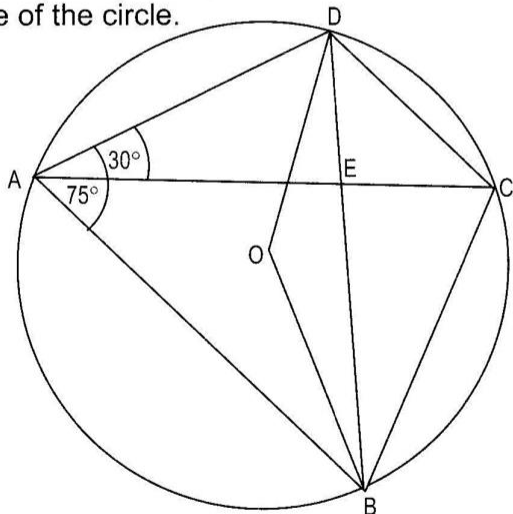
## Section A [52 marks]

Answer **all** questions in this section.

- 1 (a) Evaluate  $3\frac{1}{4} \div 5\frac{1}{5}$ . [1]
- (b) Simplify  $\frac{90 \times 0.32}{0.016 \times 4.5}$ . [2]
- (c) Express  $\frac{2}{5} + \frac{1}{4} \div \frac{1}{3}$  as a percentage. [3]
- (d) Factorise completely  $3x^2 - 3$ . [2]

- 2 (a) Express  $\frac{x+2}{3} - \frac{2x-3}{4}$  as a single fraction in its simplest form. [3]
- (b) Given that matrix  $A = \begin{pmatrix} 1 & x \\ -1 & 2 \end{pmatrix}$ ,
- (i) write an expression in terms of  $x$ , for the determinant of  $A$ , [1]
- (ii) find the value of  $x$ , given that the determinant of  $A$  is 5, [2]
- (iii) write  $A^{-1}$ . [1]
- (c) Solve the equation  $\frac{12}{x+2} = \frac{3}{5}$ . [2]

- 3 (a) In the diagram below, the diagonals of the cyclic quadrilateral  $ABCD$  meet at  $E$ ,  $O$  is the centre of the circle.



Given that  $\angle DAB = 75^\circ$  and  $\angle DAC = 30^\circ$ , calculate

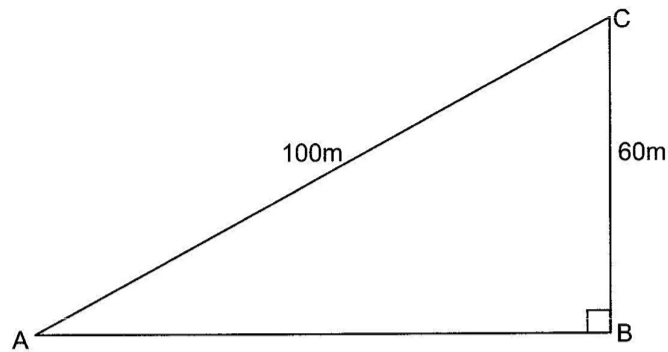
- (i)  $\hat{BAC}$ , [1]
- (ii)  $\hat{BCD}$ , [1]
- (iii)  $\hat{OBD}$ , [2]
- (iv)  $\hat{OBC}$ . [1]

- (b) The cost of baking a birthday cake is K48 000.
- (i) Ireen has an order for 15 such cakes. How much did she spend on baking the cakes? [1]
- (ii) Given that each cake was sold at K57 600, find the percentage profit. [2]
- (c) Solve the inequation  $7 - 2t < 9$ . [2]
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**Answer the whole of this question on a sheet of plain paper.**

- 4 (a) (i) Construct parallelogram ABCD in which AB = 8cm, BC = 5.3cm and  $\angle ABC = 60^\circ$ . [1]
- (ii) Construct a perpendicular from A to meet CD at point Q and write down the length of AQ. [2]
- (b) On your diagram, draw the locus of points within the parallelogram ABCD which are
- (i) 2.5cm from AB, [1]
- (ii) 3cm from C, [1]
- (iii) equidistant from BC and CD. [1]
- (c) P is a point inside parallelogram ABCD such that P is:  
 nearer to BC than CD,  
 less than or equal to 3cm from C,  
 less than or equal to 2.5cm from AB.  
 Indicate clearly, by shading, the region in which P must lie. [2]
- 
- 5 (a) A box contains 3 green apples and 5 red apples. An apple is picked from the box and not replaced then a second apple is picked. Expressing the answer as a fraction in its simplest form, calculate
- (i) the probability that both apples picked are green, [2]
- (ii) the probability that the two apples picked are of different colours. [3]
- (b) Solve the equation  $(2x - 1)(3x - 2) = 3$ , giving your answers correct to 2 decimal places. [6]
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- 6 (a) The diagram below shows Mr Mayanda's piece of land for building a house. A, B and C are on level ground as shown below. B is due south of C and due east of A.



Given that  $AC = 100\text{m}$  and  $BC = 60\text{m}$ , calculate

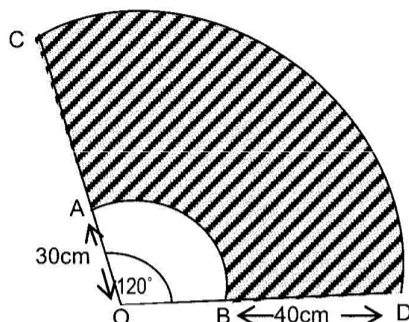
- (i) the length of AB, [2]
  - (ii) the angle BAC. [2]
- (b) Simplify  $3x - 4y - 2(x - 4y) - 2y$ . [2]
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**Section B [48 marks]**

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

- 7 (a) The shaded part of the diagram below is that of a path of a car windscreen wiper.

The wiper rotates through  $120^\circ$  about O. (Take  $\pi$  to be  $\frac{22}{7}$ )

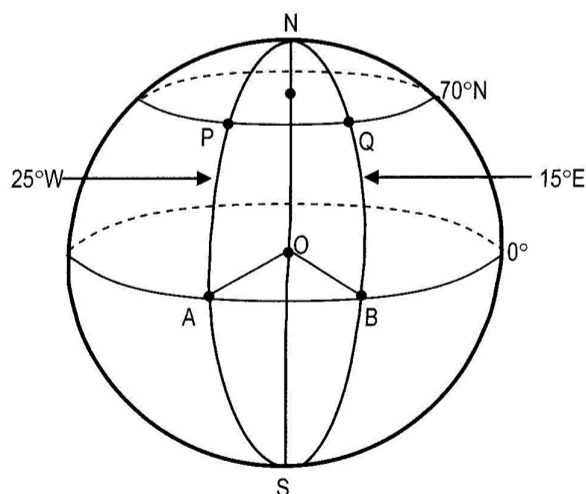


Given that  $OA = OB = 30\text{cm}$ ,  $AC = BD = 40\text{cm}$ , calculate

- (i) the perimeter of the sector OCD correct to 1 decimal place, [3]
- (ii) the area of the shaded region correct to 1 decimal place. [3]

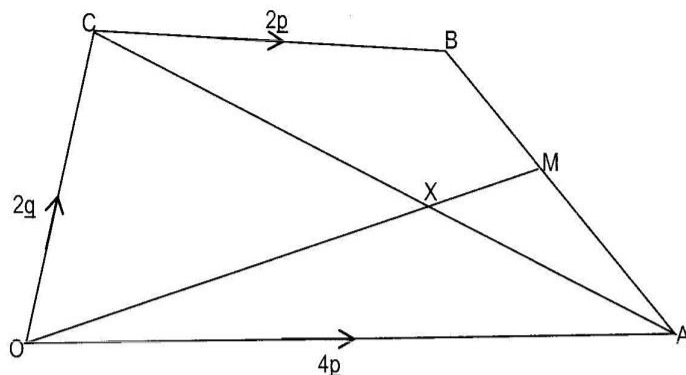
- (b) P and Q are points on the surface of the earth situated on the same parallel of latitude  $70^\circ\text{N}$  as shown below. The longitudes of P and Q are  $25^\circ\text{W}$  and  $15^\circ\text{E}$  respectively. A and B are two points on the equator such that A is due south of P and B is due south of Q.

( $\pi = 3.142$ ,  $R = 3437\text{nm}$ )



- (i) State the position of the point Q. [1]
- (ii) Find the distance between A and B. [2]
- (iii) Calculate the circumference of the small circle at  $70^\circ\text{N}$ . [1]
- (iv) Find the distance along the parallel of latitude between P and Q, correct to 2 decimal places. [2]

- 8 (a) The diagram below is a trapezium OABC. M is the midpoint of AB, OM and CA meet at X.  $\vec{OA} = 4\mathbf{p}$ ,  $\vec{OC} = 2\mathbf{q}$  and  $\vec{CB} = 2\mathbf{p}$ .



- (i) Express as simply as possible, in terms of  $\mathbf{p}$  and/or  $\mathbf{q}$
- (a)  $\vec{CA}$ , [1]
- (b)  $\vec{BA}$ , [1]
- (c)  $\vec{OM}$ . [1]
- (ii) Given that  $CX = hCA$ , express  $\vec{CX}$  in terms of  $\mathbf{p}$ ,  $\mathbf{q}$  and  $h$ . [1]
- (iii) Hence, show that  $\vec{OX} = 4h\mathbf{p} + 2(1-h)\mathbf{q}$ . [2]

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

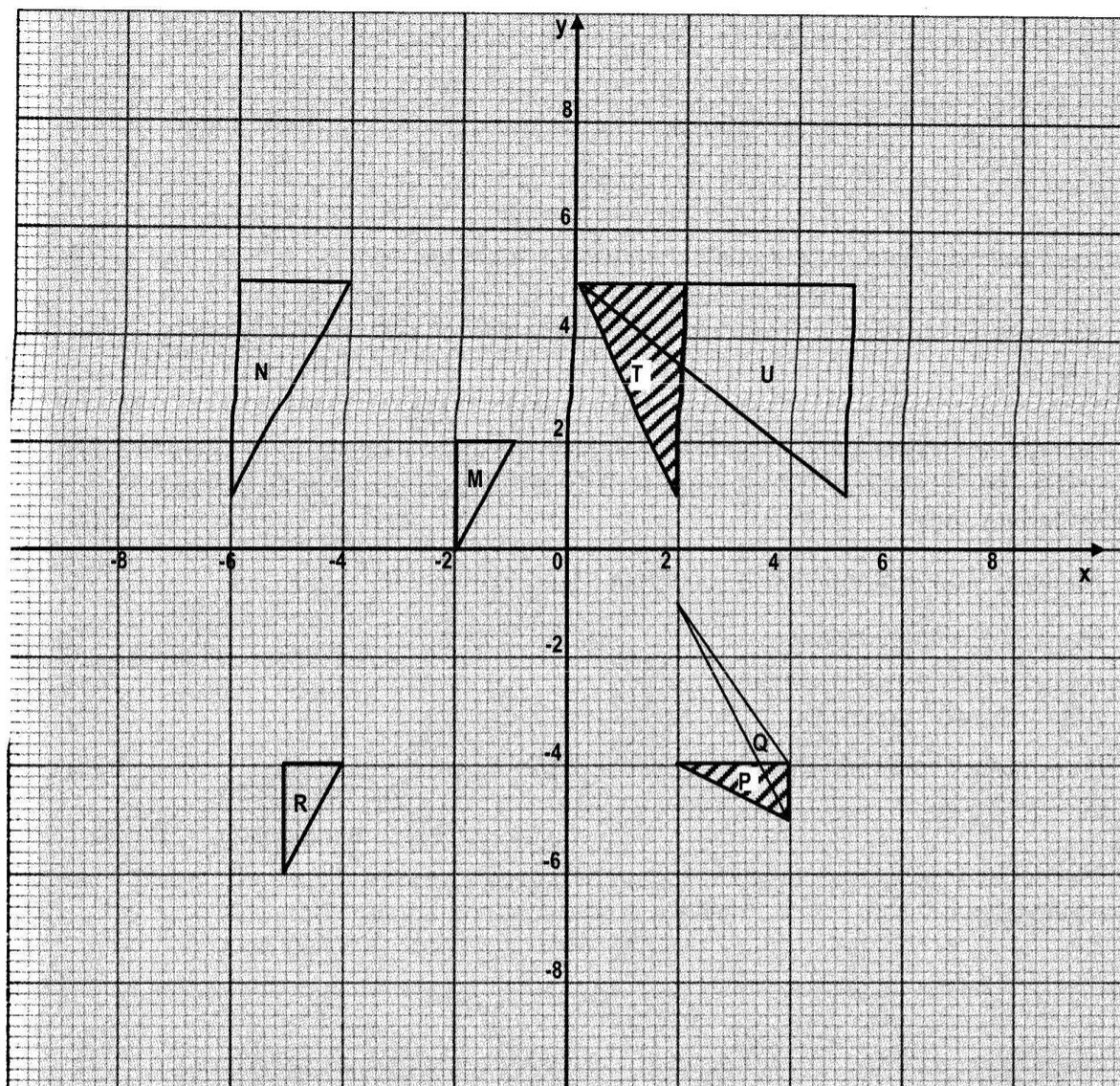
- (b) The variables  $x$  and  $y$  are connected by the equation  $y = 6 + 3x - 2x^2$ .

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

$x$	-2	-1	0	1	2	3	4	5
$y$	-8	1	6	7	4	-3	-14	$p$

- (i) Calculate the value of  $p$ . [1]
- (ii) Using a scale of 2cm to represent 1 unit on the  $x$ -axis and 2cm to represent 5 units on the  $y$ -axis for  $-2 \leq x \leq 5$  and  $-30 \leq y \leq 10$ , draw the graph of  $y = 6 + 3x - 2x^2$ . [3]
- (iii) Showing your method clearly, use your graph to solve the equation  $-2x^2 + 3x = -2$ . [2]

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



- (a) Triangle M is mapped onto triangle R by a translation. Write the translation vector. [1]
- (b) Triangle N is mapped onto shaded triangle T by a single transformation. Describe this transformation fully. [2]
- (c) An enlargement maps triangle M onto triangle N. Find
- (i) the centre of enlargement, [1]
  - (ii) the scale factor. [2]
- (d) Shaded triangle P is mapped onto triangle Q with vertices (2, -1), (4, -4) and (4, -5) by a single transformation. Describe this transformation fully. [3]
- (e) Shaded triangle T is mapped onto triangle U with vertices (0, 5), (5, 5) and (5, 1) by a stretch. Find the matrix of this transformation. [3]



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

The table below shows the masses of 100 babies at birth, recorded at a hospital.

Mass (x kg)	$1.5 < x \leq 2.0$	$2.0 < x \leq 2.5$	$2.5 < x \leq 3.0$	$3.0 < x \leq 3.5$	$3.5 < x \leq 4.0$	$4.0 < x \leq 4.5$	$4.5 < x \leq 5.0$
No. of babies	3	12	20	24	25	14	2

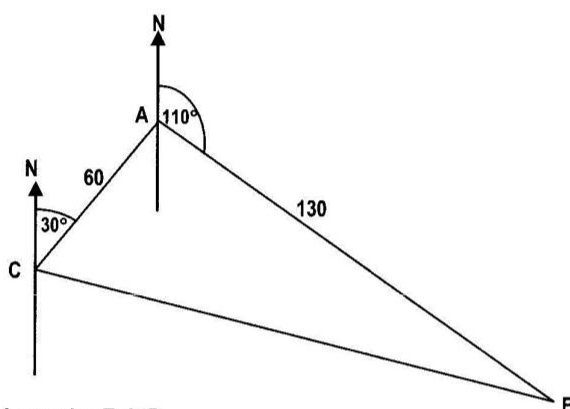
- (a) Copy and complete the cumulative frequency table below. [2]

Mass (x kg)	$\leq 1.5$	$\leq 2.0$	$\leq 2.5$	$\leq 3.0$	$\leq 3.5$	$\leq 4.0$	$\leq 4.5$	$\leq 5.0$
Frequency	0	3	15					100

- (b) Using a horizontal scale of 2cm to represent 0.5kg for masses from 1.5kg to 5.0kg and a vertical scale of 2cm to represent 10 babies, draw a smooth cumulative frequency curve. [3]
- (c) Showing your method clearly, use your graph to estimate
- (i) the median mass, [1]
  - (ii) the interquartile range, [2]
  - (iii) the 40<sup>th</sup> percentile. [1]
- (d) How many babies weighed more than 4.3kg? [3]
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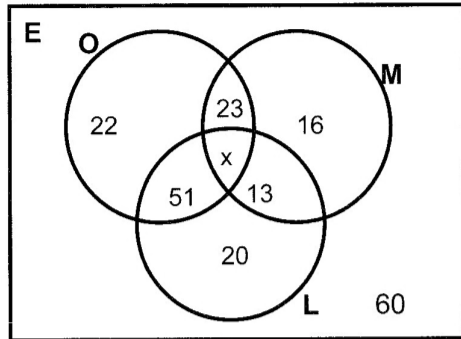
- 11 (a) Three candidates A, B and C took part in a student's union presidential elections. Candidate A received 12 600 votes and candidates B and C followed each other respectively.
- (i) Given that the ratio of the votes of candidate A to that of Candidate B is 3:2, calculate the number of votes received by Candidate B, [2]
- (ii) Given also that candidate B received 600 more votes than candidate C, calculate the number of votes for candidate C. [2]
- (b) A Girls' High School has been built in such a way that the Administration block (A), dormitories (B) and classes (C) are connected by straight corridors. A is 60m from C and 130m from B. The bearing of B from A is  $110^\circ$  and the bearing of A from C is  $030^\circ$  as shown below.



- (i) Find angle BAC. [1]
- (ii) Calculate the distance BC. [5]
- (iii) The Administration decided to build a tuckshop at a point T along BC such that T is the shortest distance from A. Given that the area of triangle ABC is  $3\,840.75\text{m}^2$ , calculate AT. [2]

- 12 (a) A small scale farmer wishes to keep sheep and goats. Let  $x$  represent the number of sheep and  $y$  represent the number of goats.
- (i) Write the inequalities which represent each of the following conditions:
- (a) The number of sheep should not be more than 4. [1]
- (b) A goat feeds on 4kg of food while a sheep feeds on 2kg of food per day. The total amount of food should be at least 8kg per day. [2]
- (c) The number of sheep should be more than the number of goats. [1]
- (ii) Using a scale of 2cm to represent 1 unit on both axes, draw the  $x$  and  $y$  axes for  $0 \leq x \leq 5$  and  $0 \leq y \leq 5$  and shade the unwanted region to indicate clearly the region where the solution of the inequalities lies. [3]

- (b) In a certain month, a survey was conducted on 250 High School pupils to find out the number of pupils that bought oranges (O), mangoes (M) and lemons (L). Their responses were as shown in the Venn diagram below.



- (i) Find the value of  $x$ . [2]
- (ii) How many pupils bought Mangoes and Lemons but not Oranges? [2]
- (iii) How many pupils bought one type of fruit only? [1]
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