



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MATHEMATICS

PAPER 2

4004/2

NOVEMBER 2021 SESSION

2 hours 30 minutes

Additional materials:
Mathematical Instruments
Mathematical Tables
Non programmable Electronic Calculator
Plain Paper (1 sheet)
Graph Paper (4 sheets)
Answer Paper

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all questions** in Section A and **any four questions** from Section B.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown on the same sheet as the rest of the answer.

Omission of essential working will result in loss of marks.

If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given correct to three significant figures. Answers in degrees should be given correct to one decimal place.

INFORMATION FOR CANDIDATES

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

Mathematical tables and Non-programmable electronic calculators may be used to evaluate explicit numerical expressions.

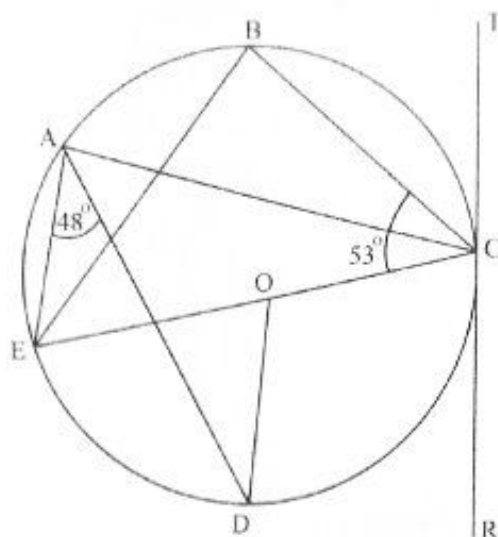
This question paper consists of 9 printed pages and 3 blank pages.

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Section A [52 Marks]

Answer all questions in this section

1



In the diagram above, ABCDE are points on the circumference of a circle centre O.
RCT is a tangent to the circle at C.

$\hat{BCE} = 53^\circ$ and $\hat{EAD} = 48^\circ$

(a) Name any two angles which are equal to \hat{ADE} . [2]

(b) Calculate

(i) \hat{BEC} . [2]

(ii) \hat{BAE} . [1]

(iii) \hat{DOC} . [2]

2 (a) Given the formula $V = \frac{7}{3}\pi r^2 h$,

(i) calculate V when $r = 3$, $\pi = \frac{22}{7}$ and $h = 2\frac{1}{2}$. [2]

(ii) make r the subject of the formula. [2]

(b) Given that matrix $A = \begin{pmatrix} 5 & -2 \\ -6 & 3 \end{pmatrix}$ and matrix $B = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$,

find

(i) AB . [2]



- (ii) A^{-1} the inverse of matrix A . [3]

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

Use ruler and compasses only for all constructions.

Show clearly all construction lines and arcs.

All constructions must be in a single diagram.

(a) Construct

- (i) triangle ABC with $AB = 8\text{cm}$, $AC = 7\text{cm}$ and $\hat{BAC} = 120^\circ$. [5]

- (ii) a perpendicular line from A to BC to meet BC at D, [2]

- (iii) the locus of points that are 3 cm from AB, [3]

(b) Measure and write down the length of side BC. [1]

(c) Mark the point X inside the triangle which is 3 cm from AB and on the line AD. [1]

- 4 (a) Calculate the simple interest obtained by investing \$800 for 10 months at a rate of 36% per annum. [2]

(b) If $f(x) = x^2 + 5x - 6$,
find

- (i) $f(2)$, [2]

- (ii) the values of x for which $f(x) = 0$. [3]

(c) It is given that $\xi = \{x : 1 \leq x \leq 12, x \in \mathbb{Z}\}$

Subsets P and Q are such that

$P = \{x : x \text{ is a perfect square}\}$ and

$Q = \{x : x \text{ is an even number}\}$

- (i) Draw a clearly labelled Venn diagram of ξ and its subsets P and Q. [3]

- (ii) List all elements of $P' \cap Q$. [2]

- 5 (a) Evaluate $3\frac{1}{2} - 6\frac{1}{4} \times \frac{2}{5}$ [2]
- (b) A lorry travels a distance of 123 km in $1\frac{1}{2}$ hours.
Find the average speed of the lorry. [2]
- (c) Solve the equation $\frac{a-2}{5} = 1\frac{1}{2}$. [3]
- (d) Factorise completely $3a - 2bc + 3c - 2ac$. [2]
- (e) Factorise completely $63 - 7p^2$. [3]

Section B (48 Marks)

Answer **any four** questions from this section.

Each question carries **12 marks**

- 6 (a) The table below shows the distribution of marks of 20 learners in a Mathematics test.

Mark	10	11	12	13	14	15
Number of learners	0	6	5	4	3	2

- (i) Calculate the mean mark. [3]
- (ii) The information is to be shown in a pie chart.
Calculate the angle that represents learners who scored 11 marks. [2]
- (iii) Two learners are chosen at random from the group.
Calculate the probability that their marks are both less than 14. [2]

- (b) Solve the equation $3x^2 - 5x - 7 = 0$.
Give the answers to 2 decimal places. [5]

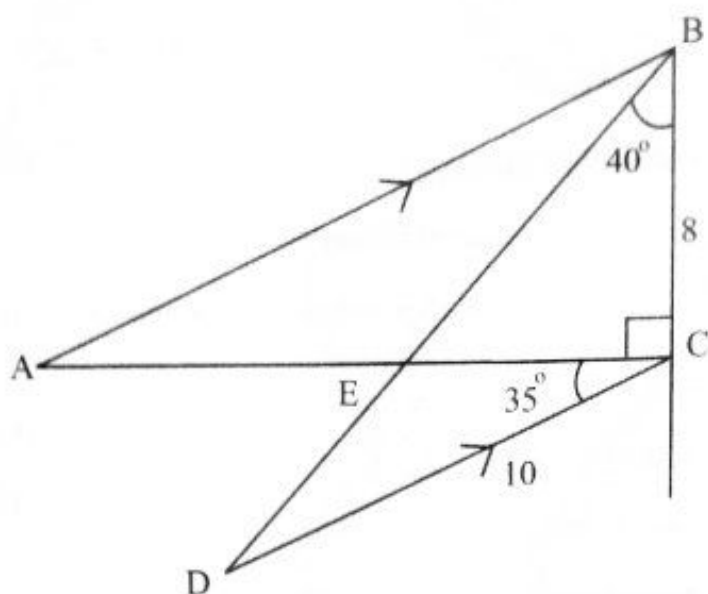
- 7 (a) Answer the whole of this question on a sheet of graph paper.
Use a scale of 2cm to 1 unit on both axes for
 $-5 \leq x \leq 3$ and $-8 \leq y \leq 3$

The table below shows corresponding values for the function
 $y = 1 - 2x - x^2$.

x	-4	-3	-2	-1	0	1	2
y	-7	-2	1	p	1	-2	q

- Calculate the values of p and q . [2]
- (b) Draw the graph of $y = 1 - 2x - x^2$. [4]
- (c) Use the graph to estimate the,
- (i) roots of the equation $1 - 2x - x^2 = 0$, [2]
- (ii) gradient of the curve at the point where $x = 1$, [2]
- (iii) area bounded by the curve and the x axis. [2]

8



In the diagram above BED is a straight line, AB is parallel to DC .
 $\hat{C}BD = 40^\circ$, $\hat{A}CB = 90^\circ$, $\hat{E}CD = 35^\circ$,
 $BC = 8\text{cm}$ and $CD = 10\text{cm}$.

- (a) Name the triangle similar to triangle CDE . [1]
- (b) Calculate [2]
- (i) $\hat{A}BE$. [2]
- (ii) EC . [2]
- (iii) BD . [3]
- (iv) area of triangle BCD . [2]
- (v) the shortest distance from D to AC . [2]

9 The table below shows the heights of 50 plants in a school tree nursery measured to the nearest centimetre.

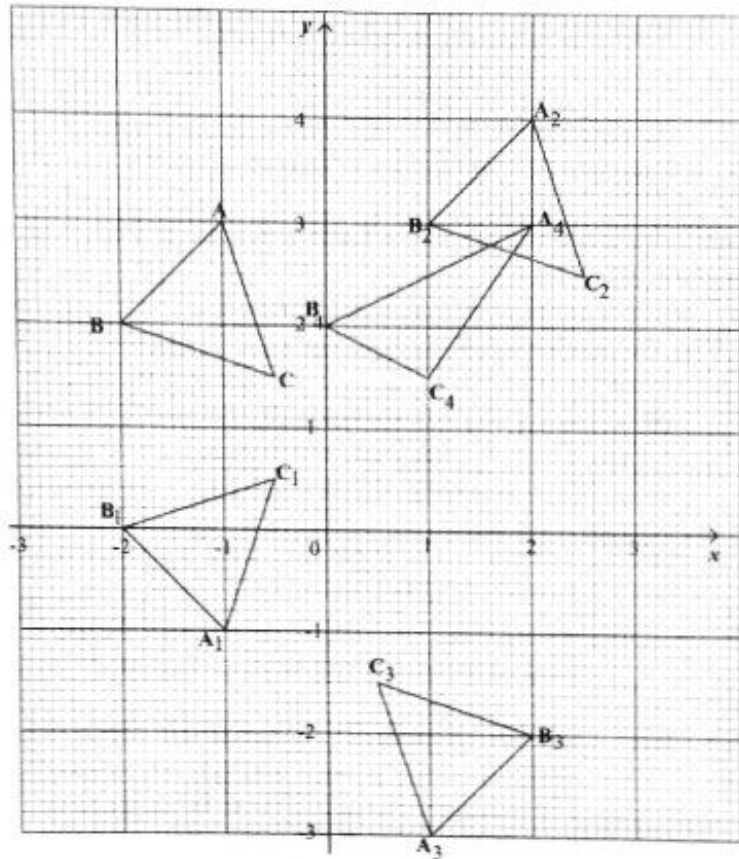
Height (h cm)	$10 < h \leq 15$	$15 < h \leq 20$	$20 < h \leq 30$	$30 < h \leq 35$	$35 < h \leq 50$
Frequency	10	15	m	2	9
Frequency Density	2	3	1, 4	n	0, 6

- (a) Find the values of m and n . [2]
- (b) State the modal class. [1]
- (c) Calculate an estimate of the mean height of the plants. [3]

- (d) Two plants are chosen at random, calculate the probability that the heights of both plants are greater than 30 cm. [2]
- (e) Answer this part of the question on a sheet of graph paper. Use a scale of 2cm to 10 units on the Height (h) axis and 4cm to 1 unit on the Frequency density axis [4]

Draw a histogram for the data given.

10



The graph shows triangles ABC , $A_1B_1C_1$, $A_2B_2C_2$, $A_3B_3C_3$ and $A_4B_4C_4$. Use the graph to answer the following questions.

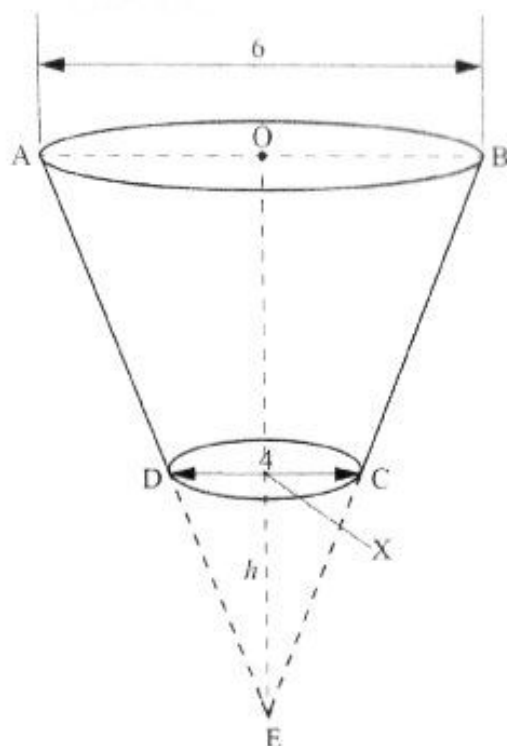
- (a) Triangle ABC is mapped into triangle $A_1B_1C_1$ by a reflection. Find the equation of the axis of reflection. [1]
- (b) Triangle ABC is mapped onto triangle $A_2B_2C_2$ by a certain single transformation. Describe fully the single transformation. [2]



- (c) Triangle ABC is mapped onto triangle $A_3 B_3 C_3$ by an enlargement.
Find the
- (i) scale factor of enlargement, [1]
- (ii) matrix which represents the enlargement. [2]
- (d) Describe fully the single transformation which maps triangle ABC onto triangle $A_4 B_4 C_4$. [3]
- (e) A transformation represented by matrix $\begin{pmatrix} -2 & 0 \\ 0 & 3 \end{pmatrix}$ maps triangle ABC onto triangle $A_5 B_5 C_5$ (not drawn on the graph).
Calculate the coordinates of triangle $A_5 B_5 C_5$. [3]
- 11 A publisher wishes to produce a book in two sizes, a small pocket size edition and a medium size edition.
Let x be the number of pocket size edition copies.
Let y be the number of medium size edition copies.
- (a) (i) The publisher wishes to print at most 100 pocket size edition copies.
The publisher wishes to print at least 30 medium size edition copies.
Find two inequalities which satisfy these conditions. [2]
- (ii) The number of copies of medium size edition copies should be at most $\frac{3}{5}$ of pocket size edition copies.
Find an inequality that satisfies this condition. [1]
- (iii) The cost of producing a pocket size edition copy is \$8, 00.
The cost of producing a medium size edition copy is \$10, 00.
The publisher has only \$1000, 00 to spend on printing the copies.
Find an inequality that satisfies this condition.
Show that it reduces to $4x + 5y \leq 500$ [2]
- (b) **Answer this part of question on a sheet of graph paper.**
Use a scale of 2cm to 20 copies on both axes for the ranges
 $0 \leq x \leq 130$
and $0 \leq y \leq 100$
- The point $(x; y)$ represents x pocket size edition copies and y medium size edition copies.
Show by shading the **unwanted** region the region in which $(x; y)$ must lie. [5]
- (c) Use the graph to determine the maximum number of copies of each book that the publisher will produce. [2]



12



The diagram above shows a tumbler in the form of a frustum of a cone ABCD with base diameter of 4cm, top diameter of 6cm and a height OX of 12 cm. O is the centre of the top circle and X is the centre of the bottom circle. E is the vertex of the cone where $XE = h$ cm.

In this question take π to be $\frac{22}{7}$.

- (a) Calculate the circumference of the base circle. [2]
- (b) The frustum is extended to E with a height EX of h cm.
Calculate h . [2]
- (c) Calculate the volume of the tumbler (frustum). [6]
- (d) Express the volume of the tumbler in litres. [2]

