



# ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

## MATHEMATICS

## 4004/1

PAPER 1

JUNE 2020 SESSION

2 hours 30 minutes

Candidates answer on the question paper

Additional materials:

Mathematical Instruments

**Allow candidates 5 minutes to count pages before the examination.**

**This booklet should not be punched or stapled and pages should not be removed.**

**Time** 2 hours 30 minutes

### INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces at the top of this page.

Write your centre and candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Answer **all** questions.

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

If working is needed for any question, it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators 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.

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Candidate Name

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2

**Answer all questions**  
**NEITHER MATHEMATICAL TABLES NOR SLIDE RULES NOR CALCULATORS**  
**MAY BE USED IN THIS PAPER**

**1** Express 208,9

(a) in standard form,

Answer (a) ..... [1]

(b) correct to 3 significant figures.

Answer (b) ..... [1]

(c) correct to the nearest hundred.

Answer (c) ..... [1]

**2** Evaluate

(a)  $-10^\circ$ ,

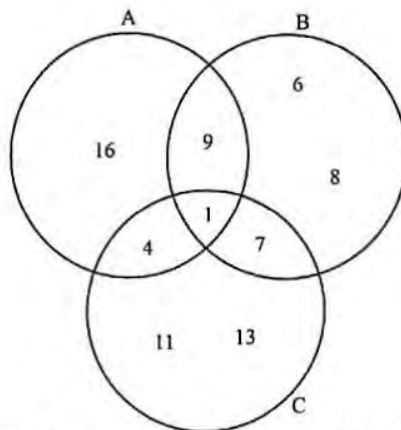
Answer (a) ..... [1]

(b)  $\left(\frac{4}{9}\right)^{\frac{3}{2}}$ .

Answer (b) ..... [2]

3

3



The Venn diagram shows three sets A, B and C with their respective elements.

(a) List all elements of

(i)  $A \cap B$ ,

Answer (a)(i) ..... [1]

(ii)  $(A \cup B)' \cap C$ .

Answer (a)(ii) ..... [1]

(b) Find  $n(A \cup C)$ .

Answer (b) ..... [1]

4 (a) Solve the inequality  $2 - y < 3y - 10$ .

Answer (a) ..... [2]

(b) The perfect square,  $y$ , satisfies both  $2 - y < 3y - 10$  and  $y \leq 9$   
Find the possible values of  $y$ .

Answer (b) ..... [1]

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4

5 Solve the simultaneous equations:

$$2x + y = 4$$

$$x - y = -2$$

Answer ..... [3]

6 (a) Convert  $301_4$  to a number in base 10.

Answer (a) ..... [1]

(b) Evaluate

(i)  $1101_2 + 111_2$ , giving the answer in base 2,

Answer (b)(i) ..... [1]

(ii)  $131_5 - 42_5$ , giving the answer in base 5.

Answer (b)(ii) ..... [1]

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5

- 7 The mean of 3 numbers is 7. Two of the numbers are 4 and  $-5$ .  
Find the third number.

Answer ..... [3]

- 8 Given that  $m = \frac{1}{2}$  and  $n = -2$ , evaluate

(a)  $m - n$ .

Answer (a) ..... [1]

(b)  $\frac{m n}{m + n}$ .

Answer (b) ..... [2]

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- 9 Express  $\frac{2}{2-3n} - \frac{1}{n}$  as a single fraction in its simplest terms.

Answer ..... [3]

- 10 The matrix  $\begin{pmatrix} (x+2) & 4 \\ 6 & x \end{pmatrix}$  is singular.  
Find the possible values of  $x$ .

Answer ..... [3]

- 11 Given that  $f(x) = \frac{k+x}{3x-2}$  and that  $f\left(-\frac{1}{3}\right) = \frac{1}{6}$ ,  
find the value of  $k$ .

Answer ..... [3]

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It is given that  $\mathbf{p} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ ,  $\mathbf{q} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$  and  $\mathbf{r} = \begin{pmatrix} x \\ y \end{pmatrix}$ .

Find

- (a)  $|\mathbf{p}|$ , leaving the answer in surd form,

Answer (a) ..... [1]

- (b) the value of  $x$  and the value of  $y$  if  $\mathbf{p} - \mathbf{q} = 2\mathbf{r}$ .

Answer (b) .....  
..... [2]

13

A salesman's total monthly salary consists of a basic salary of \$200 and a 2% commission on his monthly sales.

In one month his total salary was \$560.

Calculate

- (a) his commission for that month,

Answer (a) ..... [1]

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8

(b) the sales he made for that month.

Answer (b) ..... [2]

14 It is given that  $\sin y = \frac{5}{13}$  and that  $y$  is an acute angle.

Find as a common fraction,

(a)  $\cos (180^\circ - y^\circ)$ .

Answer (a) ..... [2]

(b)  $\tan y^\circ$ .

Answer (b) ..... [1]

15 The table shows grades obtained by 150 candidates in a Mathematics test.

|           |   |    |    |    |    |    |
|-----------|---|----|----|----|----|----|
| Grade     | A | B  | C  | D  | E  | U  |
| Frequency | 5 | 25 | 30 | 29 | 21 | 40 |

(a) Find the median grade.

Answer (a) ..... [1]



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- (b) Calculate the probability that two candidates chosen at random from the 150 obtained grade A or B.

Answer (b) ..... [2]

- 16 (a) Point R(-3; -2) is mapped onto point  $R_1$  by a transformation represented by the matrix  $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ .  
Find the coordinates of  $R_1$ .

Answer (a) ..... [1]

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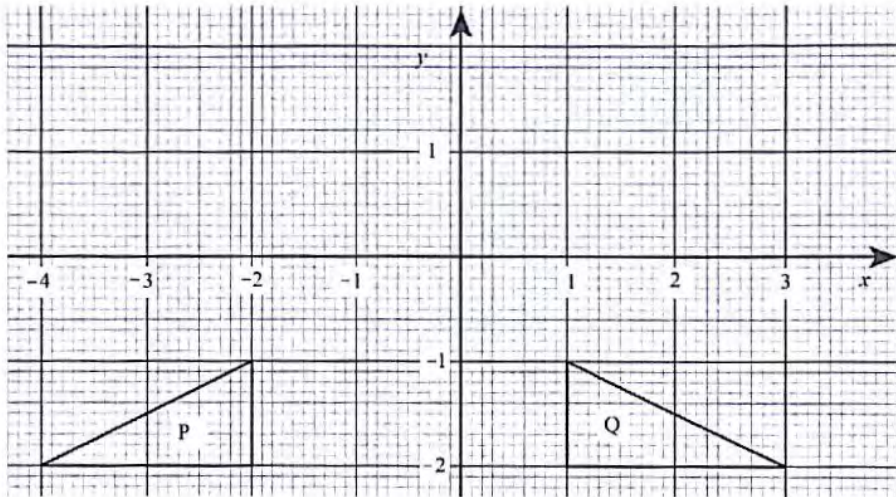
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- (b) In the diagram triangle P is the image of triangle Q under a certain transformation.

Describe fully the **single** transformation that maps triangle P onto triangle Q.



Answer (b) ..... [2]

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11

A

17

It is given that  $g \propto \frac{m}{r}$  and  $g = 1$  when  $m = 2$  and  $r = 3$ .

Find the

- (a) formula connecting  $g$ ,  $m$  and  $r$ ,

Answer (a) ..... [2]

- (b) numerical value of  $g$  when  $m = 10$  and  $r = 3$ .

Answer (b) ..... [1]

Candidate Name

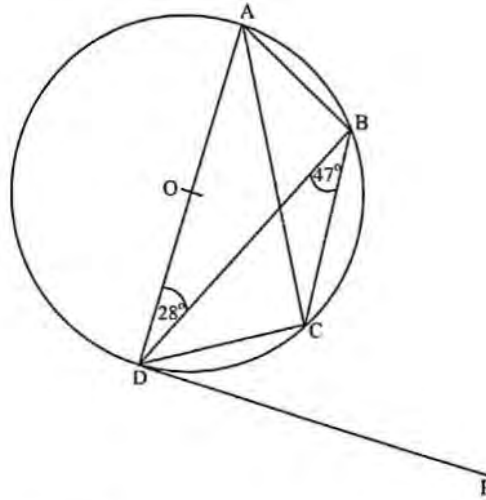
Centre Number

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18



In the diagram A, B, C and D are points on the circumference of a circle centre O.

PD is a tangent to the circle at D,  $\hat{A}DB = 28^\circ$  and  $\hat{C}BD = 47^\circ$ .

Calculate

(a)  $\hat{B}AD$

Answer (a) ..... [1]

(b)  $\hat{C}DP$

Answer (b) ..... [1]

(c)  $\hat{C}AB$

Answer (c) ..... [1]

(d)  $\hat{B}CD$

Answer (d) ..... [1]

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- 19 (a) Simplify  $4b - 3(4 - 2b)$ .

Answer (a) ..... [2]

- (b) Factorise completely  
 $x - y - xy + x^2$ .

Answer (b) ..... [2]

- 20 (a) Name the regular polygon which has rotational symmetry of order 5.

Answer (a) ..... [1]

- (b) The sum of the interior angles of a hexagon is  $720^\circ$ . Three of its interior angles are  $140^\circ$ ,  $120^\circ$  and  $160^\circ$ .  
The remaining angles are in the ratio 2 : 3 : 5.  
Calculate the size of the largest of the remaining angles.

Answer (b) ..... [3]

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14

- 21 It is given that  $\text{Log } x = 6$  and  $\text{Log } y = -2$ .  
Evaluate

(a)  $\text{Log } (xy)$ .

Answer (a) ..... [2]

(b)  $\text{Log}\left(\frac{1}{\sqrt{x}}\right)$ .

Answer (b) ..... [2]

- 22 On a certain map, a length of 2cm represents a distance of 5km.

(a) Express the scale of the map giving the answer in the form  $1 : n$ .

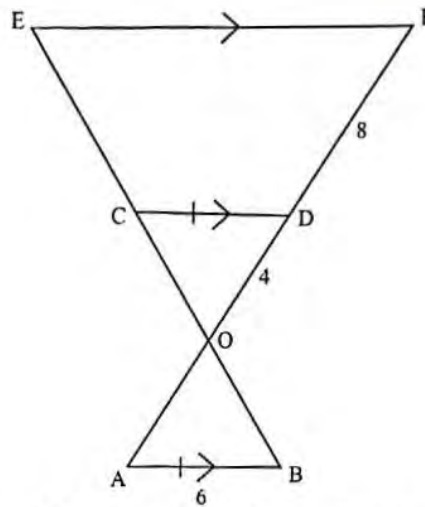
Answer (a) ..... [2]

(b) Calculate the area on the map in  $\text{cm}^2$  which represents an actual area of  $4\text{km}^2$ .

Answer (b) ..... [2]

15

23



In the diagram AODF and BOCE are straight lines intersecting at O. AB is parallel to CD and EF,  
 $AB = CD = 6\text{cm}$ ,  $OD = 4\text{cm}$  and  $DF = 8\text{cm}$ .

(a) Name

(i) the triangle which is congruent to triangle AOB,

Answer (a)(i) ..... [1]

(ii) two triangles which are similar to triangle AOB.

Answer (a)(ii) .....  
 ..... [2]

(b) Calculate the length EF.

Answer (b) ..... [2]

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- 24 (a) A straight line has gradient  $-1$  and passes through the point  $(3; 0)$ .  
Find the equation of the line in the form  $y = mx + c$ .

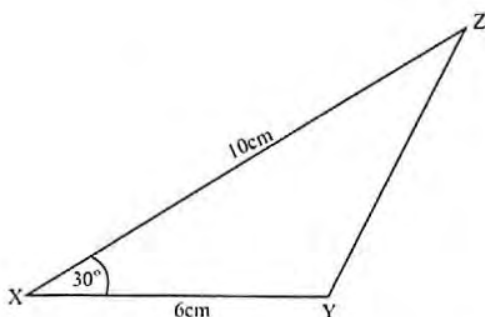
Answer (a) ..... [2]

- (b) The solutions of a quadratic equation are  $x = -1$  and  $x = 3$ .  
Write down the quadratic equation in the form  $ax^2 + bx + c = 0$   
where  $a$ ,  $b$  and  $c$  are integers.

Answer (b) ..... [3]



25



The diagram shows triangle XYZ with  $XY = 6\text{cm}$ ,  $XZ = 10\text{cm}$  and  $\hat{YXZ} = 30^\circ$ .

Use as much of the information given below as is necessary.

$[\sin 30^\circ = 0,50 : \cos 30^\circ = 0,87 : \tan 30^\circ = 0,58]$

Calculate the

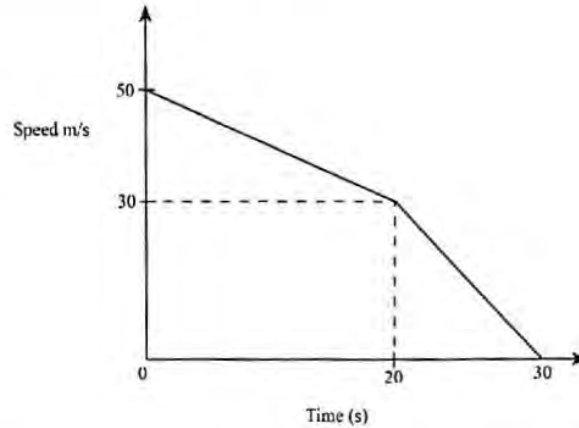
- (a) area of the triangle XYZ,

Answer (a) ..... [2]

- (b) length of YZ leaving the answer in surd form.

Answer (b) ..... [3]

26



The diagram is a speed-time graph of an object which decelerates uniformly from a speed of 50 m/s to a speed of 30 m/s in 20 seconds. It further decelerates uniformly for 10 seconds until it comes to rest.

- (a) Find the speed when  $t = 5$  seconds.

Answer (a) ..... [2]

- (b) Calculate the

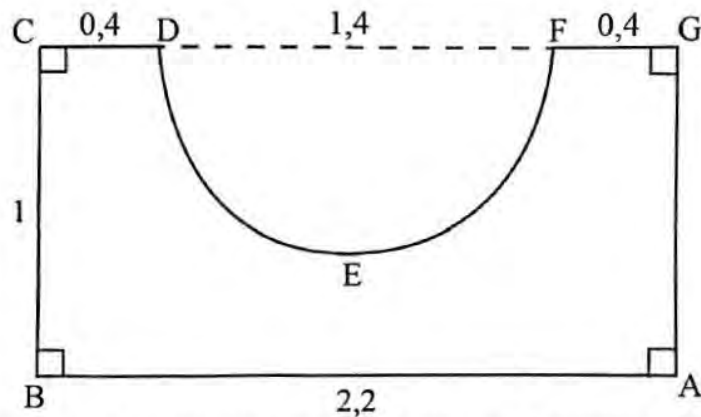
- (i) acceleration of the object during the last 10 seconds.

Answer (b)(i) ..... [2]

(ii) distance travelled during the 30 seconds.

Answer (b)(ii) ..... [2]

27



The diagram shows the cross-section of a concrete drinking trough which is 3m long.  $AB = 2,2\text{m}$ ,  $BC = AG = 1\text{m}$  and  $CD = FG = 0,4\text{m}$ .

$DF$  the diameter of the drinking trough is  $1,4\text{m}$ . Take  $\pi$  to be  $\frac{22}{7}$ .

Calculate the

(a) perimeter of the cross-section,

Answer (a) ..... [3]

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(b) area of the cross-section,

Answer (b) ..... [3]

(c) volume of the concrete used to make the drinking trough.

Answer (c) ..... [2]

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**ZIMBABWE SCHOOL EXAMINATIONS COUNCIL**  
General Certificate of Education Ordinary Level

**MATHEMATICS**  
PAPER 2

**4004/2**

**JUNE 2020 SESSION**

**2 hours 30 minutes**

Candidates answer on the question paper

Additional materials:  
Mathematical Instruments  
Mathematical Tables  
Non programmable Electronic Calculator

**Allow candidates 5 minutes to count pages before the examination.**

**This booklet should not be punched or stapled and pages should not be removed.**

**Time 2 hours 30 minutes**

**INSTRUCTIONS TO CANDIDATES**

Write your Name, Centre number and candidate number in the spaces at the top of this page.  
Write your Centre and Candidate number in the box on the top right corner of every page of this paper.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

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

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

If working is needed for any question, it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Decimal answers in degrees should be given correct to one decimal place.

Mathematical tables and Electronic calculators may be used to evaluate explicit numerical expressions.

**INFORMATION FOR CANDIDATES**

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

**This question paper consists of 26 printed pages and 2 blank page(s).**

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**SECTION A (52 Marks)**

Answer all questions in this section

- 1 (a) The difference between two fractions is  $3\frac{2}{3}$ . The smaller fraction is  $2\frac{1}{4}$ .  
Find the other fraction.

Answer (a) ..... [2]

- (b) The population of a certain country is 24,9 million.  
Express this population in standard form.

Answer (b) ..... [2]

- (c) Increase \$40,00 in the ratio 8:5.

Answer (c) ..... [2]

- (d) Evaluate  $(7\sqrt{5})^2$ .

Answer (d) ..... [1]



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- (e) Simplify  $11011_2 + 243_5$ , giving the answer in base five.

Answer (e) ..... [3]

- 2 (a) Two similar cups have diameters of 6 cm and 10 cm.

- (i) Write down the ratio of their volumes.

Answer (a)(i) ..... [2]

- (ii) Given that the volume of the smaller cup is  $100 \text{ cm}^3$ , calculate the volume of the larger cup.

Answer (a)(ii) ..... [2]

- (b) A wooden block is in the form of a prism whose cross-section is a parallelogram with base 35 cm, perpendicular height 20 cm and length 1.2 m. Calculate the

- (i) surface area of the cross-section of the block.

Answer(b)(i) ..... [2]



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(ii) volume of the block,

Answer (b)(ii) ..... [2]

(iii) mass of the block if  $3 \text{ cm}^3$  of the block weigh 2,5 g.

Answer (b)(iii) ..... [2]

3 (a) Find the value of  $y$  for which  $(y - 4) \begin{pmatrix} -2 \\ 3 \end{pmatrix} = (-2)$

Answer (a) ..... [2]





- (b) Find the matrix  $P$  such that  $P \begin{pmatrix} 3 & -4 \\ 2 & 0 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ .

Answer (b) ..... [3]

- (c) The equation of a straight line is  $y + 3x = -4$   
Find the

- (i) coordinates of the point where the line crosses the y-axis,

Answer (c)(i) ..... [2]

- (ii) gradient of the line,

Answer (c)(ii) ..... [1]

- (iii) equation of a line parallel to the line  $y + 3x = -4$  and passing through the point (3; 5).

Answer (c)(iii) ..... [2]



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6

4 Answer the whole of this question on the blank space below.

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.

All constructions should be done on a single diagram.

(a) Construct

(i) triangle ABC in which  $AB = 7 \text{ cm}$ ,  $\hat{BAC} = 45^\circ$ ,  $BC = 8 \text{ cm}$ ,  
Answer (a)(i) on the diagram ..... [4]

(ii) the locus of points equidistant from B and C,  
Answer (a)(ii) on the diagram ..... [2]



7

(iii) the locus of points 5 cm from C.

Answer (a)(iii) on the diagram ..... [1]

(b) A point R in triangle ABC is such that it is nearer B than C and is less than 5 cm from C.

Show by shading, the region in which R must lie.

Answer (b) on the diagram ..... [2]

(c) Measure and write down the size of  $\hat{A}BC$ .

Answer (c) ..... [1]

5

(a) Show that the equation  $x - 3 = \frac{5}{3x}$  reduces to  $3x^2 - 9x - 5 = 0$ .

Answer (a).

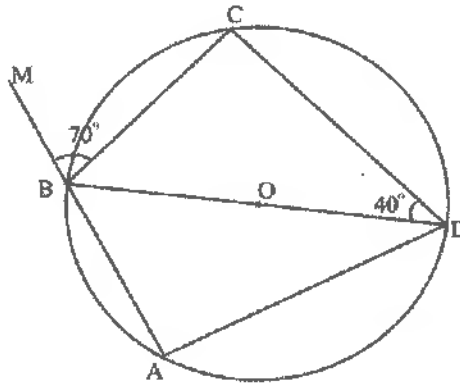
..... [2]

(b) Solve the equation  $3x^2 - 9x - 5 = 0$ .  
Give the answers correct to 2 decimal places.

Answer (b) ..... [5]



(c)



In the diagram, ABCD is a cyclic quadrilateral with centre O. AB is produced to M.

$$\hat{MBC} = 70^\circ \text{ and } \hat{BDC} = 40^\circ$$

Find

(i)  $\hat{BCD}$  :

Answer (c)(i) ..... [1]

(ii)  $\hat{ABD}$

Answer (c)(ii) ..... [2]



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(iii)  $A\hat{D}O$

Answer (c)(iii) ..... [2]

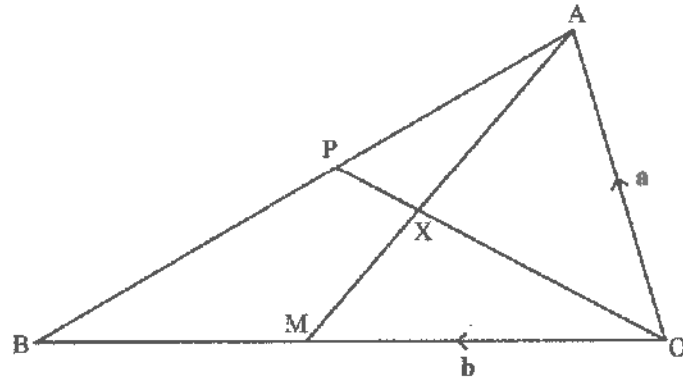


## SECTION B (48 Marks)

Answer any four questions from this section.

Each question carries 12 marks

6



In the diagram, ABO is a triangle in which M is the mid-point of OB and N lies on AB such that  $AN = \frac{1}{5}AB$ . ON and AM intersect at X.

$$\vec{OA} = a \text{ and } \vec{OB} = b.$$

(a) Express, in terms of  $a$  and/or  $b$

(i)  $\vec{OX}$ ,

Answer (a)(i) ..... [1]

(ii)  $\vec{AN}$ ,

Answer (a)(ii) ..... [1]



(iii)  $\vec{ON}$ ,

Answer (a)(iii) ..... [2]

(iv)  $\vec{AM}$ .

Answer (a)(iv) ..... [1]

(b) Given that  $\vec{AX} = h \vec{AM}$ , show that  $\vec{OX} = (1-h)\vec{a} + \frac{1}{2}hb$ 

Answer (b) ..... [2]

(c) If  $\vec{OX} = k \vec{ON}$ , express  $\vec{OX}$  in terms of  $a$ ,  $b$  and  $k$ .

Answer (c) ..... [1]



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- (d) Use the results of (b) and (c) to find the numerical values of  $h$  and  $k$ .

Answer (d) .....  
..... [3]

- (e) Hence, or otherwise find the ratio of area of triangle  $OAX$  to area of triangle  $OAM$ .

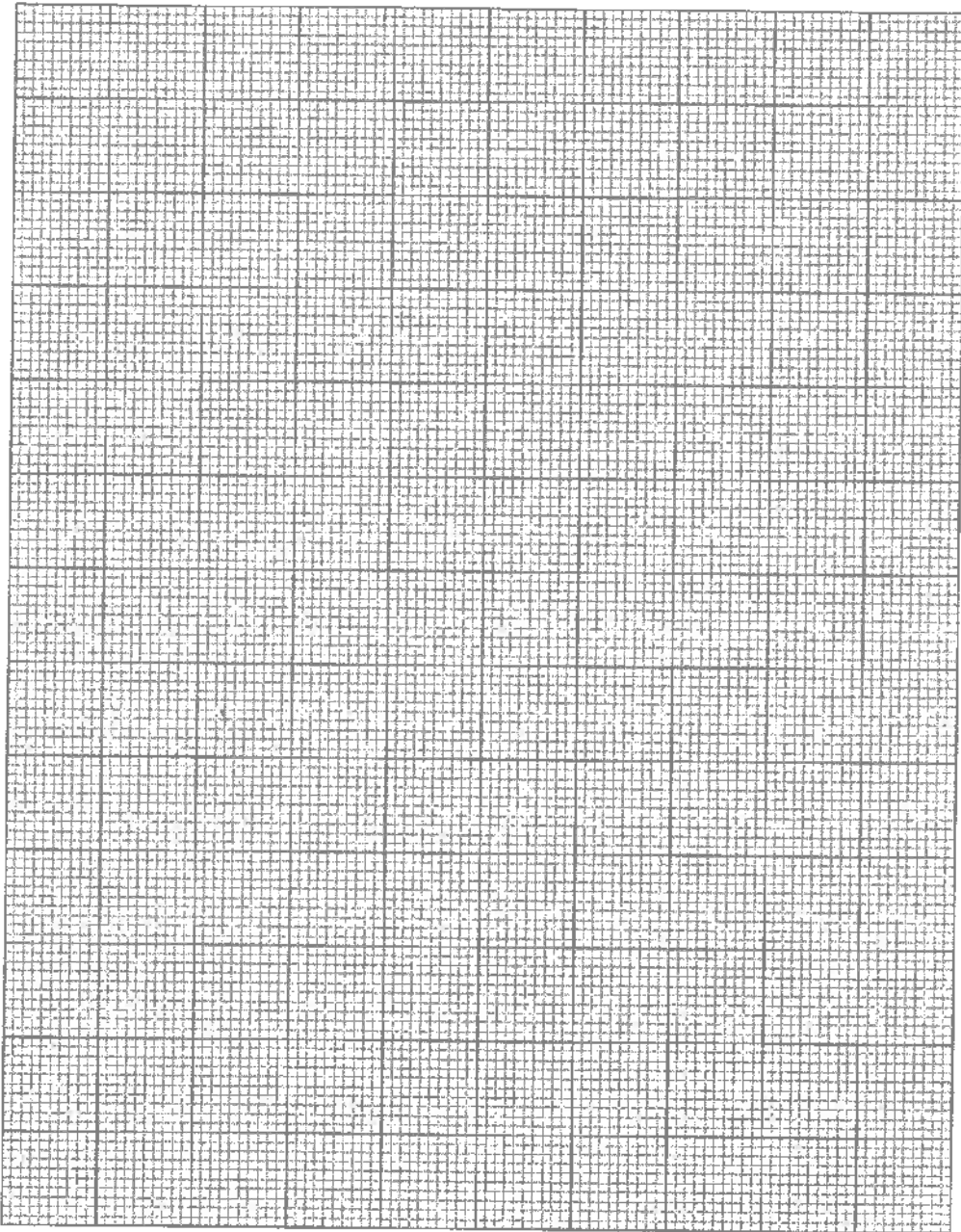
Answer (e) ..... [1]





7

Answer the whole of this question on the grid below. Use a scale of 2 cm to 1 unit on both axes.



- (a) Triangle PQR has vertices at  $P(1; 3)$ ,  $Q(2; 1)$  and  $R(4; 3)$ .  
Draw and label triangle PQR.

Answer (a) on diagram ..... [1]



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(b) Triangle  $P_1Q_1R_1$  is the image of triangle  $PQR$  under a reflection in the line  $y = -x$ .

(i) Draw the line  $y = -x$ .

Answer (b)(i) on diagram ..... [1]

.....

(ii) Draw and label triangle  $P_1Q_1R_1$ .

Answer (b)(ii) on diagram ..... [3]

.....

(iii) A transformation,  $G$ , maps triangle  $PQR$  onto triangle  $P_2Q_2R_2$  with vertices at  $P_2 (1; -6)$ ,  $Q_2 (2; -2)$  and  $R_2 (4; -6)$ .

Draw and label triangle  $P_2Q_2R_2$ .

Answer(b)(iii) on diagram ..... [1]

.....

(iv) Describe fully the single transformation,  $G$ , which maps triangle  $PQR$  onto triangle  $P_2Q_2R_2$ .

Answer(b)(iv) .....

.....

..... [3]

(c) The point  $R_3 (-1; 2)$  is the image of  $R$  under a translation.

(i) Find the translation vector.

Answer (c)(i) ..... [1]



- (ii) Write down the coordinates of  $P_3$  and  $Q_3$  the images of  $P$  and  $Q$  respectively, under the same translation.

Answer (c)(ii) .....

[2]

8

The following is a table of values for the function  $y = x^3 - 3x^2$ .

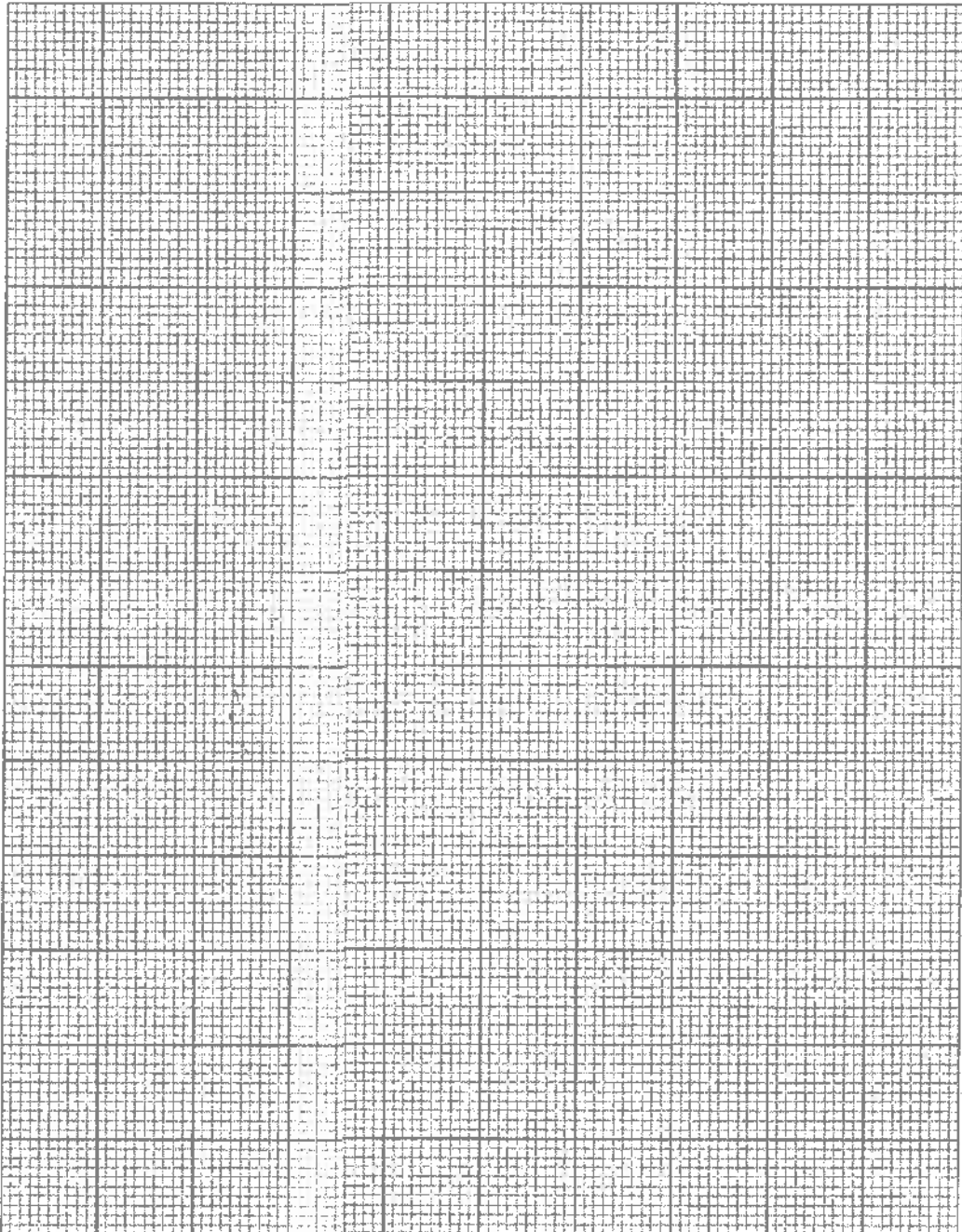
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|-----|-----|-----|---|----|----|---|----|
| $x$ | -2  | -1  | 0 | 1  | 2  | 3 | 4  |
| $y$ | -20 | $m$ | 0 | -2 | -4 | 0 | 16 |

- (a) Find the value of  $m$ .

Answer (a) ..... [1]



Answer this part of the question on the grid below. Use a scale of 2 cm to 1 unit on the  $x$  axis and 2 cm to 5 units on the  $y$  axis.



(b) Draw the graph of  $y = x^3 - 3x^2$ .

Answer (b) on the diagram

..... [4]



- (c) Use the graph to find an estimate the
- (i) gradient of the curve at the point where  $x = 3$ ,

Answer (c)(i) ..... [2]

- (ii) area bounded by the curve, the  $y$ -axis and the line  $y = -12$ .

Answer (c)(ii) ..... [2]

.....

- (d) Write down, from the graph, the range of values of  $x$  when the curve has a negative gradient.

Answer (d) ..... [1]

- (e) Use the graph to solve the equation  $x^3 - 3x^2 = 2$ , for positive values of  $x$ .

Answer (e) ..... [2]

.....



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9 (a) Factorise completely

(i)  $x^2 - 4$

Answer (a)(i) ..... [2]

(ii)  $x^2 - 5x + 6$

Answer (a)(ii) ..... [2]

(iii) Hence or otherwise find the Highest Common Factor (H.C.F.) of  $x^2 - 4$  and  $x^2 - 5x + 6$ .

Answer (a)(iii) ..... [1]

(b) It is given that  $S = \frac{a}{1-r}$

(i) Find the value of S when  $a = 81$  and  $r = \frac{1}{3}$

Answer (b)(i) ..... [2]



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(ii) Make  $r$  the subject of the formula.

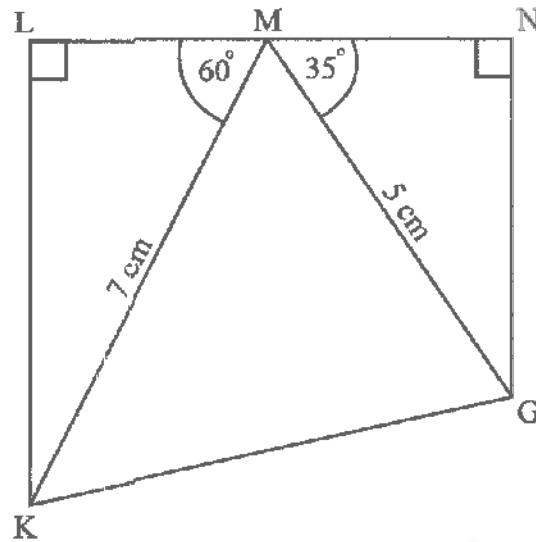
Answer (b)(ii) ..... [3]

- (c) From a group of 30 people at a party, it was observed that 17 people ate beef, 16 people ate pork,  $x$  people ate both beef and pork and 6 people ate neither beef nor pork.  
Calculate  $x$ , the number of people who ate both beef and pork.

Answer (c) ..... [2]



10



In the diagram  $KLNG$  is a trapezium in which  $LMN$  is a straight line and  $\hat{KLM} = \hat{MNG} = 90^\circ$ .  $MK = 7\text{ cm}$ ,  $MG = 5\text{ cm}$ ,  $\hat{LMK} = 60^\circ$  and  $\hat{NMG} = 35^\circ$ . Calculate the

- (a) length of  $NG$ .

Answer (a) ..... [2]

- (b) size of  $\hat{KMG}$ .

Answer (b) ..... [1]





Candidate Name

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(c) area of triangle  $KMG$ ,

Answer (c) ..... [2]

(d) length of  $KG$ ,

Answer (d) ..... [4]

(e) size of  $\hat{MKG}$

Answer (e) ..... [3]



11 A group of youths wishes to make and paint chairs and tables for sale.  
Let  $x$  be the number of chairs and  $y$  the number of tables to be produced.

- (a) The group wishes to produce at least 5 chairs and not less than 5 tables.  
Write down two inequalities, one in  $x$  and the other in  $y$ , that satisfy these conditions.

Answer (a) ..... [2]

- (b) The group has 48 hours to make the chairs and tables.  
If it takes 4 hours to make a chair and 3 hours to make a table, write down an inequality in  $x$  and  $y$  that satisfies this condition.

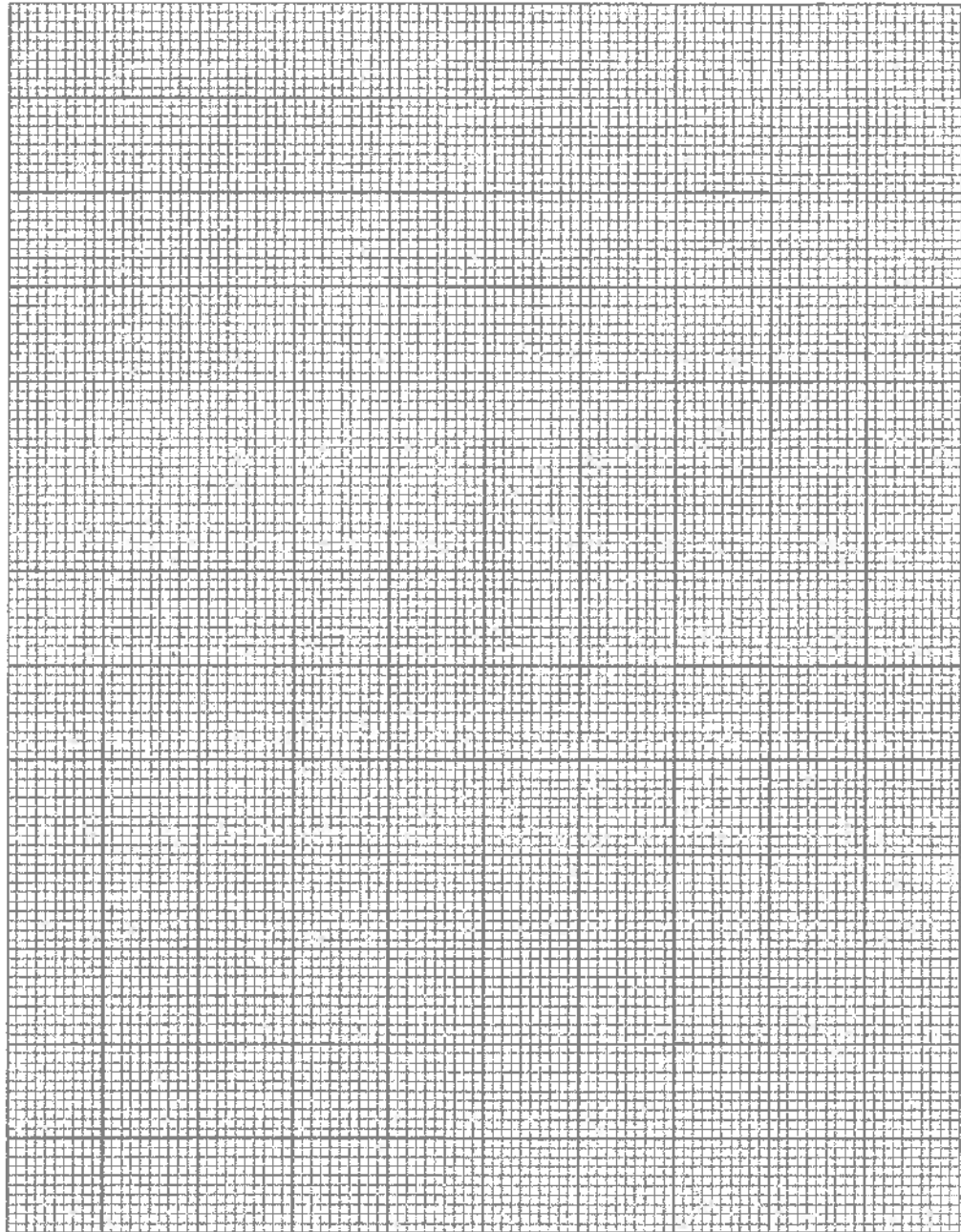
Answer (b) ..... [1]

- (c) The group hired a compressor for 14 hours to paint the chairs and tables.  
Given that it takes 1 hour to paint a chair and 1 hour to paint a table, form an inequality in  $x$  and  $y$  that satisfies this condition.

Answer (c) ..... [1]



- (d) The point  $(x; y)$  represents  $x$  chairs and  $y$  tables.
- (i) Construct and show by shading the **unwanted regions**, the region in which  $(x; y)$  must lie. Use a scale of 2 cm to 2 units on both axes.



Answer (d)(i) on the diagram ..... [6]



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24

- (ii) The profit on a chair is \$10 and the profit on a table is \$20.  
Use the graph to find the greatest possible profit that can be made.

Answer (d)(ii) ..... [2]

12

The table below shows the heights,  $h$ cm, of a group of 200 children.

| Height (hcm)      | $50 < h \leq 60$ | $60 < h \leq 70$ | $70 < h \leq 75$ | $75 < h \leq 80$ | $80 < h \leq 100$ |
|-------------------|------------------|------------------|------------------|------------------|-------------------|
| Frequency         | 24               | 38               | 53               | 45               | 40                |
| Frequency Density | 2,4              | 3,8              | 10,6             | $p$              | $q$               |

- (a) Find the value of

(i)  $p$

Answer (a)(i) ..... [1]

(ii)  $q$

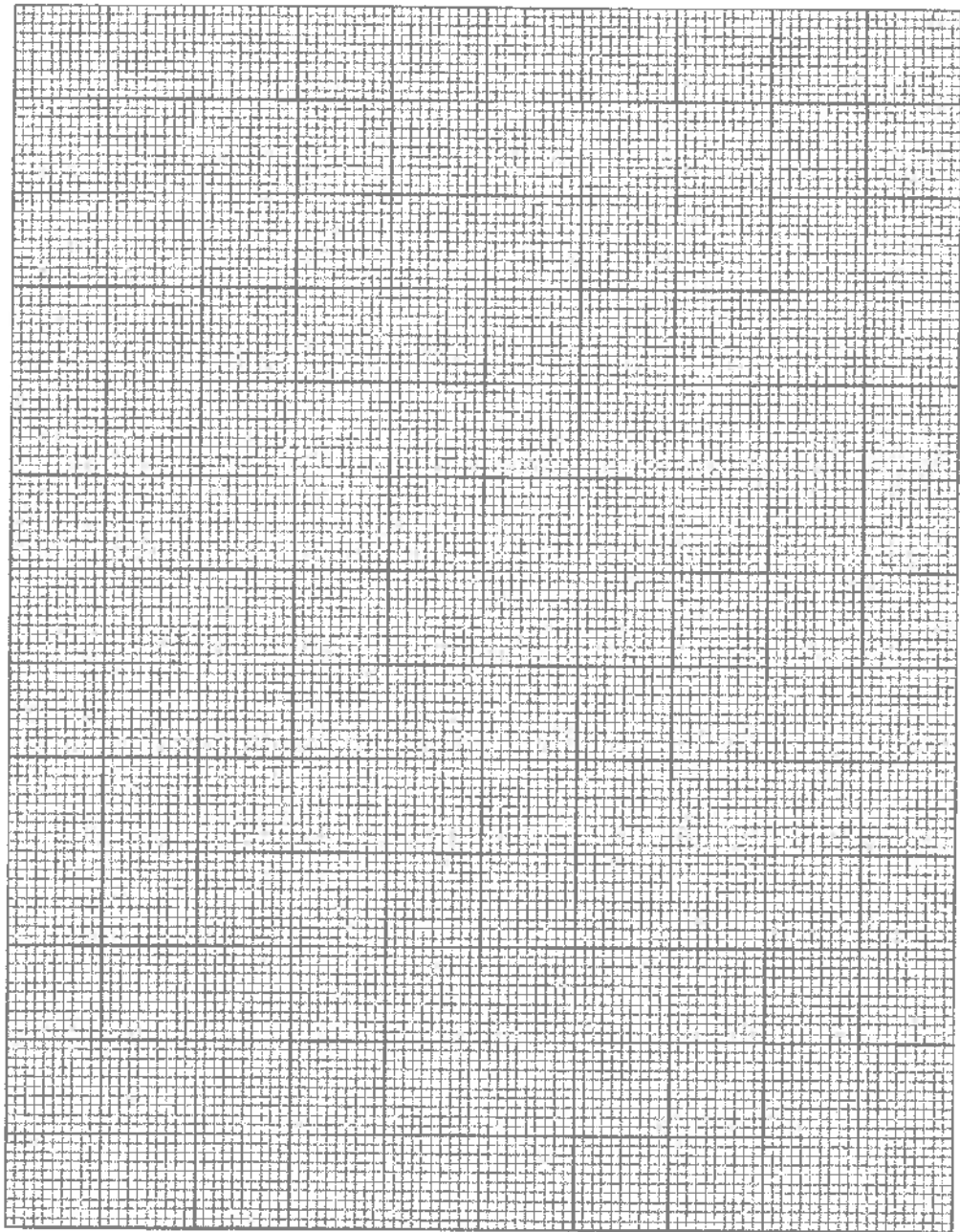
Answer (a)(ii) ..... [1]

- (b) Calculate an estimate of the mean height of the children.

Answer (a)(iii) ..... [3]



- (c) Draw a histogram to show the information in the table.  
Use a scale of 2 cm to represent 10 units on the  $h$  axis and 2 cm to represent 2 units on the Frequency Density axis.



Answer (b) on the graph ..... [5]



Candidate Name

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- (d) Two children are chosen at random from the group.  
Find the probability that each has a height which is greater than 75 cm.

Answer (c) ..... [2]





**ZIMBABWE SCHOOL EXAMINATIONS COUNCIL**  
General Certificate of Education Ordinary Level

**MATHEMATICS**

**4004/2**

PAPER 2

NOVEMBER 2020 SESSION

2 hours 30 minutes

Additional materials:

Mathematical Instruments

Mathematical Tables

Non programmable Electronic Calculator

Plain Paper (1 sheet)

Graph paper (4 sheets)

**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.

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**This question paper consists of 10 printed pages and 2 blank pages.**

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## SECTION A (52 Marks)

Answer all questions in this section

- 1 (a) Evaluate  $20 - 20 \div 5 + 3 \times 2$ . [2]
- (b) Simplify  $(\sqrt{10} - \sqrt{5})^2$  leaving the answer in surd form. [2]
- (c) Find the Lowest Common Multiple (LCM) of 15, 20 and 25. [2]
- (d) (i) Express 252 as a product of its prime factors in index form. [2]
- (ii) Find the smallest number by which 252 must be multiplied by to make the product a perfect square. [1]

- 2 (a) The following is an incomplete table of distances, in kilometres, between capital cities, A, B, C and D, of four countries.

|        |        |   |   |
|--------|--------|---|---|
| A      |        |   |   |
| 14 520 | B      |   |   |
| 23 490 | 8 970  | C |   |
| 33 260 | 18 740 |   | D |

- (i) Write down the distance from A to D, giving the answer in standard form. [1]
- (ii) Calculate the distance between C and D. [2]
- (b) A three-digit number in base  $n$  is given as  $147_n$ .
- (i) Write down the least possible value of  $n$ . [1]
- (ii) If  $147_n = 324_6$ , find the possible value of  $n$ . [4]
- 3 (a) (i) Write down the number of degrees in 4 complete revolutions. [1]
- (ii) Find the number of sides of a polygon whose interior angles add up to 4 complete revolutions. [3]
- (b) Two similar containers are of capacities 1,728 l and 5,832 l respectively.  
If the surface area of the bigger container is  $153 \text{ cm}^2$ ,  
find the surface area of the smaller container. [3]



- (c) Triangle ABC has sides  $AB = 6,5$  cm,  $BC = 7,8$  cm and  $AC = 9,1$  cm, measured to the nearest mm.
- (i) Express the length of side AB as a range, in the form  $\dots \leq AB < \dots$  [2]
- (ii) Calculate the least possible perimeter of the triangle. [2]

4

It is given that matrix  $A = \begin{pmatrix} 2 & x \\ 4 & 3 \end{pmatrix}$   
and matrix  $B = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$ .

- (a) Simplify leaving the answers in terms of  $x$ ,
- (i)  $A^2$ , [2]
- (ii)  $AB$ , [2]
- (b) If matrix  $A$  is singular, find the value of  $x$ . [2]
- (c) A primary school decided to send all their Grade 3 learners on a trip. The learners were asked to indicate the places they would like to visit, choosing from Birchenough Bridge, Great Zimbabwe Monuments and Matopo Monuments. The following statistics were gathered.
- 39 wanted to visit the Great Zimbabwe Monuments.
  - 31 wanted to visit the Birchenough Bridge.
  - 30 wanted to visit the Matopo Monuments.
  - 10 wanted to visit all the three places.
  - 6 were **not** keen to visit any one of the three places.
  - 19 wanted to visit both the Great Zimbabwe Monuments and Birchenough Bridge.
  - 15 wanted to visit both the Great Zimbabwe Monuments and the Matopo Monuments.
  - 17 wanted to visit the Birchenough Bridge and the Matopo Monuments.

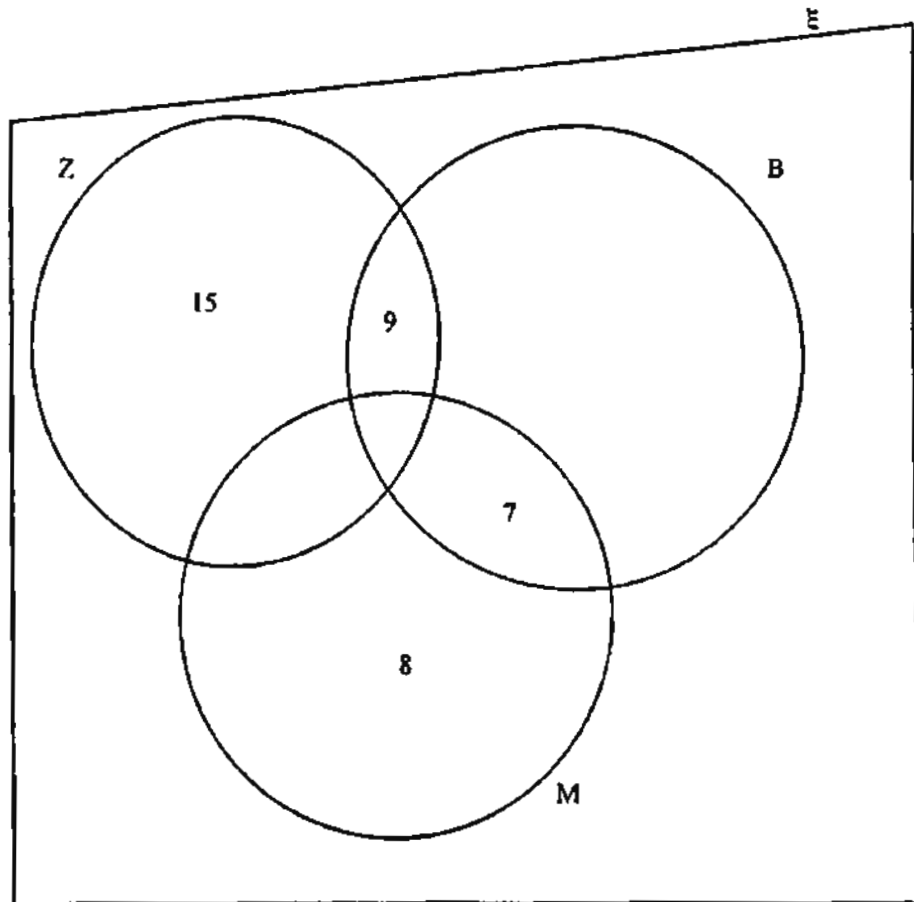
- (i) Using the given information, copy and complete the Venn diagram shown where

$\xi$  is the set of all Grade 3 pupils in that school

Z is the set of learners who chose Great Zimbabwe Monuments,

B is the set of learners who chose Birchenough Bridge and

M is the set of learners who chose Matopo Monuments.



[4]

- (ii) Write down the total number of the Grade 3 learners.

[1]

5

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

**Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.**

**All constructions should be done on a single diagram.**

- (a) (i) Construct a triangle PQR such that  
 $QR = 7,5\text{cm}$ ,  $\hat{PQR} = 90^\circ$  and  $\hat{QRP} = 30^\circ$ . [5]
- (ii) Construct the locus of points equidistant from P and R. [2]
- (iii) Construct the locus of points that are 3 cm from Q. [1]
- (b) Mark and label the points  $D_1$  and  $D_2$  that are equidistant from points P and R and are 3 cm from Q. [2]
- (c) A point  $X$ , inside the triangle is such that it is nearer P than R and more than 3 cm from Q. Shade the region in which  $X$  must lie. [2]
- (d) Measure and write down the length of PR. [1]

**SECTION B (48 Marks)**

Answer any four questions from this section

Each question carries 12 marks

- 6 (a) Mrs Chuhwa invested a certain amount of money with a bank that offered 4,5% p.a. simple interest. After 8 months her money amounted to \$504,70 before any bank charges were deducted. Calculate the amount of money that Mrs Chuhwa had initially invested. [3]
- (b) (i) Mrs Bande bought a set of sofas for \$368 cash, including 15% VAT. Calculate the price of the sofas excluding VAT. [2]
- (ii) Mr Ndioru decided to buy a similar set of sofas on layby terms. He paid a deposit of \$150 plus three equal monthly instalments of \$87 including VAT. Calculate the difference in the amounts of money the two customers paid. [3]
- (c) The average expenditure  $E$  of a family over a certain period of time is partly constant and partly varies as the number,  $n$  of people in the family.
- (i) Find a relationship between  $E$  and  $n$  using constants  $h$  and  $k$ . [1]
- (ii) The expenditure for 5 people is \$55 and for 3 people is \$45. Find the value of  $h$  and the value of  $k$ . [3]
- 7 (a) A rectangle with a width of  $(x + 2)$  cm has a perimeter of  $(8x + 2)$  cm. Find an expression for the length of the rectangle. [2]
- (b) Given that the area of the rectangle is  $16 \text{ cm}^2$ , form an equation in  $x$  and show that it reduces to  $3x^2 + 5x - 18 = 0$ . [3]
- (c) Solve the equation  $3x^2 + 5x - 18 = 0$ , giving the answers correct to three significant figures. [5]
- (d) Hence, find the perimeter of the rectangle. [2]

8

A particle is thrown vertically upwards and its height,  $h$  metres above the ground after  $t$  seconds, is given by the equation

$$h = 10 + 25t - 5t^2.$$

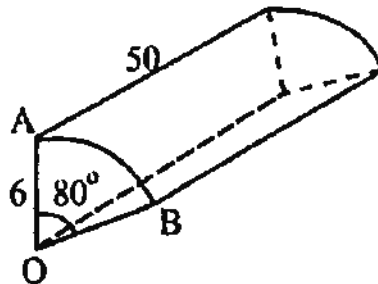
The following is an incomplete table of values for

$$h = 10 + 25t - 5t^2.$$

|                       |    |    |     |    |    |    |     |
|-----------------------|----|----|-----|----|----|----|-----|
| Time ( $t$ ) seconds  | 0  | 1  | 2   | 3  | 4  | 5  | 6   |
| Height ( $h$ ) metres | 10 | 30 | $m$ | 40 | 30 | 10 | -20 |

- (a) Find the value of  $m$ . [1]
- (b) Answer the whole of this part of the question on sheet of graph paper. Use a scale of 2cm to 1 unit on the  $t$  axis and 2cm to 10 units on the  $h$  axis.
- (i) Draw the graph of  $h = 10 + 25t - 5t^2$ . [4]
- (ii) Write down the distance between the initial and final positions of the particle. [1]
- (c) Use the graph to answer the following questions.
- (i) Find the greatest height reached by the particle. [2]
- (ii) Estimate the velocity of the particle when  $t = 5$ . [2]
- (iii) Find the times when the particle is 21 m above the ground. [2]

9 (a)



In this question, take  $\pi$  to be 3.142.

In this diagram, sector OAB is the cross-section of a solid prism that is 50cm long.

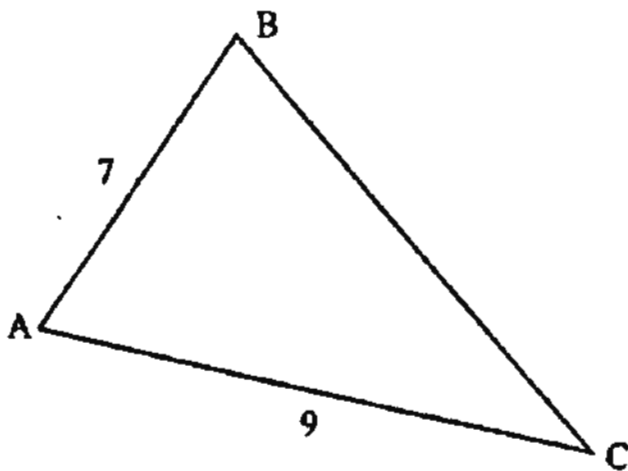
The radius of the sector is 6 cm and  $\angle AOB = 80^\circ$ .

Calculate the

- (i) length of arc AB, [2]

- (ii) total surface area of the prism. [3]

(b)



In the diagram, ABC is a triangle in which  $AB = 7$  cm,  $AC = 9$  cm and  $\sin \hat{BAC} = \frac{2}{3}$ , where  $\hat{BAC}$  is acute.

Find the

- (i)  $\cos \hat{BAC}$ . [3]
- (ii) length of BC. [4]

10

An Agriculture class studied the effect of a certain chemical on the growth rate of 30 Moringa seedlings.

The heights of the Moringa seedlings are shown in the frequency table.

| Height $h$ (cm) | $10 < h \leq 20$ | $20 < h \leq 25$ | $25 < h \leq 35$ | $35 < h \leq 40$ |
|-----------------|------------------|------------------|------------------|------------------|
| Frequency       | 5                | 6                | 10               | 9                |

- (a) Write down the modal class. [1]
- (b) If this information is represented on a histogram, write down the frequency densities of the following classes.
- (i)  $10 < h \leq 20$ . [2]
- (ii)  $35 < h \leq 40$ . [1]
- (c) Calculate the size of the angle that would represent the class  $35 < h \leq 40$  on a pie chart. [2]

- (d) Calculate an estimate of the mean height of the seedlings. [3]
- (e) If 2 seedlings are picked at random, find the probability that one is at most 20 cm tall and the other is more than 35 cm tall. [3]

11

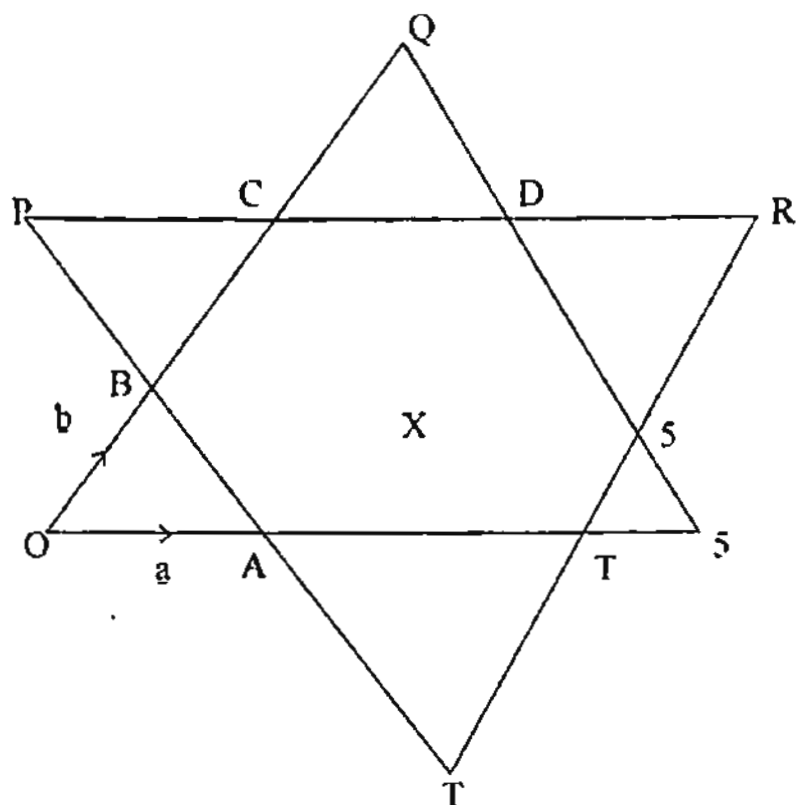
**Answer the whole of this question on a sheet of graph paper**

**Use a scale of 2 cm to 2 units on both axes**

**for  $-10 \leq x \leq 8$  and  $-4 \leq y \leq 8$ .**

- (a) Triangle ABC has vertices at  $A(2; -2)$ ,  $B(4; 2)$  and  $C(6; 2)$ .  
Draw and label triangle ABC. [1]
- (b) Triangle  $A_1B_1C_1$  has vertices at  $A_1(-2; 2)$ ,  $B_1(0; 6)$  and  $C_1(2; 6)$ .  
Draw and label triangle  $A_1B_1C_1$ . [1]
- (c) Describe fully the single transformation which maps, triangle ABC onto triangle  $A_1B_1C_1$ . [2]
- (d) Triangle ABC is mapped onto triangle  $A_2B_2C_2$  by a reflection in the  $x$ -axis.  
Draw and label triangle  $A_2B_2C_2$ . [2]
- (e) Draw and label triangle  $A_3B_3C_3$ , the enlargement of triangle ABC about centre  $(-4; 2)$  and scale factor of  $-\frac{1}{2}$ . [3]
- (f) Transformation V is defined by the matrix  $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}$ .  
Draw and label triangle  $A_4B_4C_4$ , the image of triangle ABC under transformation V. [3]

12



The diagram is a star made up of a regular hexagon ABCDEF, centre X, surrounded by 6 equilateral triangles AOB, BPC, CQD, DRE, ESF and FTA.  $\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$ .

- (a) Write down the following vectors in terms of  $\mathbf{a}$  and/or  $\mathbf{b}$  giving the answers in their simplest form.
- (i)  $\vec{OS}$ . [1]
- (ii)  $\vec{AB}$ . [1]
- (iii)  $\vec{OR}$ . [2]
- (iv)  $\vec{CF}$ . [2]
- (b) The length of line OA = 5 cm.  
Find
- (i)  $|\mathbf{a} - \mathbf{b}|$ , [2]
- (ii) the perimeter of triangle OQS, [2]
- (iii) the area of triangle OAB. [2]