

Answer ALL the questions in this section.

ALL working must be shown clearly.

1. (a) Using a calculator, or otherwise, determine the EXACT value of:
- (i)  $(1.7)^2 + (1.3)^2$  (5 marks)
- (ii)  $\frac{4.8 + 6.9}{1.3 \times 0.2}$  (5 marks)

Use the information given below to answer Parts (b) and (c)

RANDY'S VIDEO CLUB

<p><b>Option A</b></p> <p>Membership Fee for one Year: \$80.00</p> <p>Rental Fee: \$3.00 per video game</p>
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<p><b>Option B</b></p> <p>No Membership Fee</p> <p>Rental Fee: \$5.00 per video game</p>
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- (b) Carla rents 48 video games during one year. What is the TOTAL cost if she chooses
- (i) Option A? (3 marks)
- (ii) Option B? (3 marks)
- (c) Carla estimates that she will be able to spend \$215.00 for renting video games during the next year. How many video games will she be able to rent using
- (i) Option A? (3 marks)
- (ii) Option B? (3 marks)

Total 11 marks

2. (a) Given  $a = 2$ ,  $b = -3$  and  $c = 0$ , evaluate
- (i)  $4a - 2b + 3c$  (3 marks)
- (ii)  $a^c$  (3 marks)
- (b) Factorize completely
- (i)  $7mp^2 + 14m^2p$  (4 marks)
- (ii)  $2y^2 - 11y + 15$  (4 marks)

- (c) Write as a simple fraction in its LOWEST terms.
- $\frac{2}{a-3} + \frac{3}{a}$  (2 marks)

- (d) (i) Solve for  $x$
- $12 \leq 3x + 5$

- (ii) If  $x$  is a member of the set of whole numbers, state the SMALLEST value of  $x$  which satisfies the inequality in (d) (i) above. (3 marks)

Total 12 marks

3. (a) The Universal set,  $U$ , is given as

$U = \{1, 2, 3, \dots, 13, 14, 15\}$ .

The sets  $A$  and  $B$  are subsets of  $U$  such that

$A = \{\text{Factors of } 12\}$

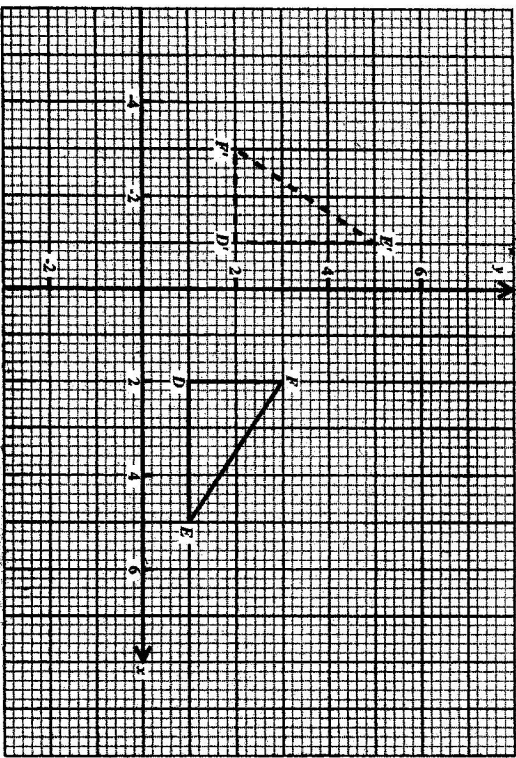
$B = \{\text{Multiples of } 3\}$

- (i) List the members of the set  $A$ .
- (ii) List the members of the set  $B$ .
- (iii) Represent the sets,  $A$ ,  $B$  and  $U$ , on a Venn diagram.
- (iv) List the members of  $(A \cup B)$ . (6 marks)

- (b) (i) Draw a line segment,  $PQ$ , 7 cm long.
- (ii) Using only a ruler, a pencil and a pair of compasses, construct a line segment,  $LM$ , the perpendicular bisector of  $PQ$ , such that  $LM$  cuts  $PQ$  at  $O$ , and  $OL = OM = 4$  cm.
- (iii) Form parallelogram  $PLQM$  by joining the points  $P$ ,  $L$ ,  $Q$  and  $M$ .
- (iv) Measure and state the size of the angle  $PLM$ .
- (v) What type of parallelogram is  $PLQM$ ? Give a reason for your answer. (6 marks)

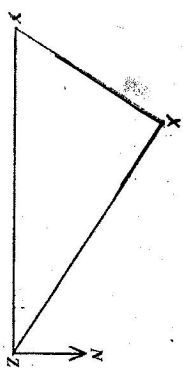
Total 12 marks

4. (a) Triangle  $DEF$ , shown below, undergoes a rotation such that its image is triangle  $D'E'F'$ .



- (i) Describe COMPLETELY this rotation by stating
- the coordinates of the centre
  - the direction of turn
  - the size of the angle turned.
- (ii) Triangle  $DEF$  is mapped onto triangle  $ABC$  under a translation,  $T = \begin{pmatrix} -6 \\ -3 \end{pmatrix}$ . State the coordinates of  $A$ ,  $B$  and  $C$ , the images of  $D$ ,  $E$  and  $F$ , under  $T$ . (6 marks)

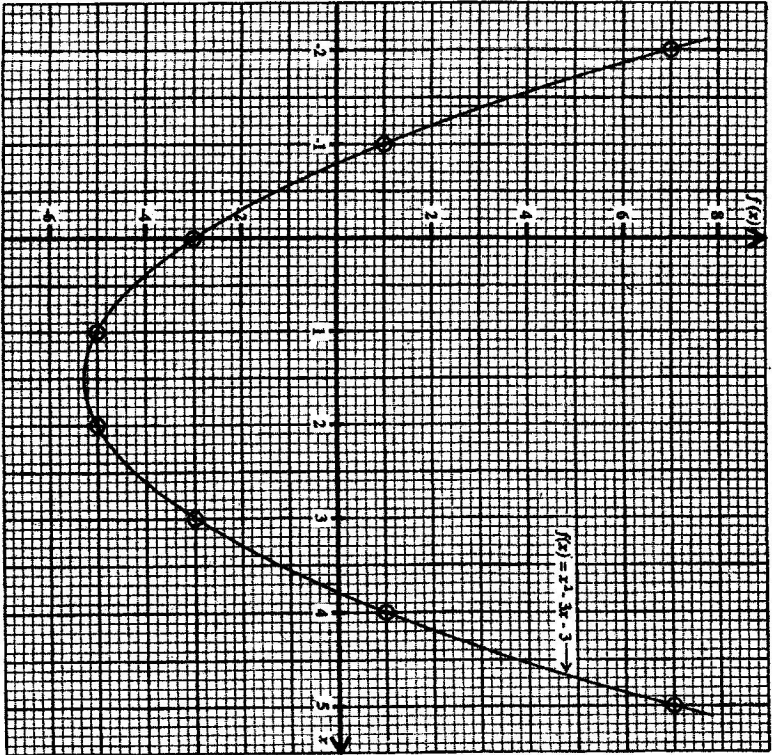
- (b) The figure below, not drawn to scale, represents the journey of an aircraft flying from  $Y$  to  $X$  and then from  $X$  to  $Z$ .



- The bearing of  $X$  from  $Y$  is  $035^\circ$ .  
 The bearing of  $Z$  from  $X$  is  $125^\circ$ .  
 $Z$  is due east of  $Y$ .
- Copy and complete the diagram, showing CLEARLY the bearings  $035^\circ$  and  $125^\circ$ .
  - Determine the size of the angle  $YXZ$ .
  - Calculate, to the NEAREST whole number, the distance  $YZ$  given that  $YX = 100$  km. (6 marks)

Total 12 marks

5. The graph below represents the function  $f(x) = x^2 - 3x - 3$ .

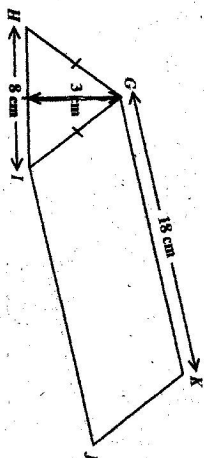


- Use the graph to determine
- (a) the value of  $f(x)$  when  $x = 2$  (1 mark)
  - (b) the value of  $f(x)$  when  $x = -1.5$  (1 mark)
  - (c) the values of  $x$  for which  $f(x) = 0$  (2 marks)
  - (d) the minimum value of  $f(x)$  (1 mark)
  - (e) the value of  $x$  at which  $f(x)$  is a minimum (1 mark)
  - (f) the solution of  $x^2 - 3x - 3 = 5$  (2 marks)
  - (g) the interval on the domain for which  $f(x)$  is less than  $-3$  (2 marks)

Total 10 marks

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6. (a) The triangular prism, shown in the diagram below, not drawn to scale, is 18 cm long. Triangle  $GHI$  has a height of 3 cm,  $HI = 8$  cm and  $GH = GI$ .



- Calculate
- (i) the area of triangle  $GHI$
  - (ii) the volume of the triangular prism
  - (iii) the length of  $GI$
  - (iv) the TOTAL surface area of the prism.
- (b) The triangular prism is melted down and made into a cube. Calculate the length of an edge of the cube.

Total 11 marks

7. The height, in centimetres, of a sample of seedlings were recorded and grouped as shown below.


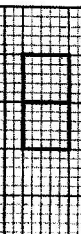

Height (cm)	3-7	8-12	13-17	18-22	23-27
Number of Seedlings	5	16	23	12	4

- (a) Calculate
- (i) the TOTAL number of seedlings in the sample. (5 marks)
  - (ii) an estimate of the mean height of the seedlings in the sample. (5 marks)
- (b) Using a scale of 2 cm to represent a height of 5 cm on the x-axis, and 2 cm to represent 5 seedlings on the y-axis, draw on graph paper the frequency polygon to represent the data given in the table. (5 marks)
- (c) Calculate the probability that a seedling, selected at random, measures at most 12 cm in height. (2 marks)

Total 12 marks

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8. The table below shows a sequence of shapes made from squares with sides of 1 unit.

Shape	Area of Shape	Perimeter of Shape
	1	4
	2	6
	3	8

- (a) On the answer sheet provided, draw the next TWO shapes to continue the sequence.
- (b) For EACH shape drawn, in Part (a), complete the table by stating
- (i) the area of the shape
  - (ii) the perimeter of the shape. (4 marks)
- (c) A shape in the sequence has an area of 12 square units. What is the perimeter of this shape? (2 marks)
- (d) A shape in the sequence has a perimeter of 40 units. What is the area of this shape? (2 marks)
- (e) On the answer sheet provided, draw TWO shapes EACH made up of 4 unit squares so that one has a perimeter of 8 units and the other has a perimeter of 16 units. (2 marks)
- Total 10 marks

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) Given that  $m * l = m^2 - lm$ ,
- (i) evaluate  $5 * 3$
  - (ii) solve for  $g$  given that  $g * 4 = -3$ . (5 marks)
- (b) An athlete runs on a track so that his distance,  $d$  metres, from the starting point after  $t$  seconds is as shown in the table below.

Time (seconds), $t$	0	2	4	6	8	10
Distance (metres), $d$	0	14	40	74	94	100

- (i) a) Using a horizontal scale of 1 cm to represent 1 second and a vertical scale of 1 cm to represent 10 metres, construct a distance-time graph to show the motion of the athlete.
  - b) Draw a smooth curve through all the plotted points.
  - (ii) Use your graph to estimate
    - a) the distance travelled by the athlete after 3 seconds
    - b) the average speed of the athlete during the interval  $t = 6$  seconds to  $t = 8$  seconds
    - c) the speed of the athlete 6 seconds after leaving the starting point. (10 marks)
- Total 15 marks

10. (a) Solve for  $p$  and  $r$  given  
 $3p + 2r = 7$   
 $p^2 - 2r = 11$ . (5 marks)

(b) Two functions,  $g$  and  $h$ , are defined as

$$g : x \rightarrow \frac{2x + 3}{x - 4} \text{ and}$$

$$h : x \rightarrow \frac{1}{x}.$$

Calculate

- (i) the value of  $g(7)$   
 (ii) the value of  $x$  for which  $g(x) = 6$ .

Write expressions for

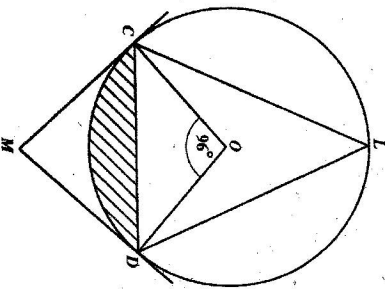
- (iii)  $hg(x)$   
 (iv)  $g^{-1}(x)$ .

(10 marks)

Total 15 marks

GEOMETRY AND TRIGONOMETRY

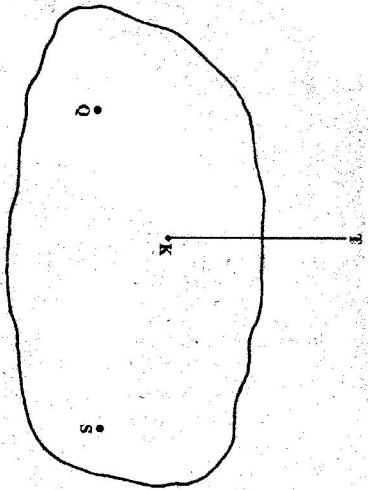
11. In the diagram below, not drawn to scale,  $MC$  and  $MD$  are tangents of the circle whose centre is at  $O$ . Angle  $COD$  measures  $96^\circ$ .



- (a) Calculate, giving reasons for your answer, the size of  
 (i) angle  $MCD$  (5 marks)  
 (ii) angle  $CMD$ . (3 marks)
- (b) Explain why the quadrilateral  $OCMD$  is cyclic. (3 marks)
- (c) Given that the radius of the circle shown in the diagram above is 6.5 cm, calculate  
 (i) the area of triangle  $OCD$   
 (ii) the area of the shaded segment of the circle. (7 marks)  
 [Use  $\pi = 3.14$ ]

Total 15 marks

12.



TK is a vertical tower, 10 metres high, standing on a horizontal plane QKS. Q and S are markers placed on the horizontal plane and angle QKS measures  $112^\circ$ . The angles of elevation of the top of the tower, T, from Q and S are  $14^\circ$  and  $21^\circ$  respectively.

- (a) Draw a diagram to represent the information, CLEARLY showing
- the line segment which represents 10 metres.
  - the angles whose measures are  $14^\circ$ ,  $21^\circ$  and  $112^\circ$ .
  - TWO right angles.
- (b) Calculate, to the NEAREST metre, the distance
- QK
  - SK
  - QS.
- (c) A vertical pole 4 m high is placed at Q. An instrument placed on the top of this pole measures the angle of elevation of the top of the tower. Calculate the size of this angle of elevation.

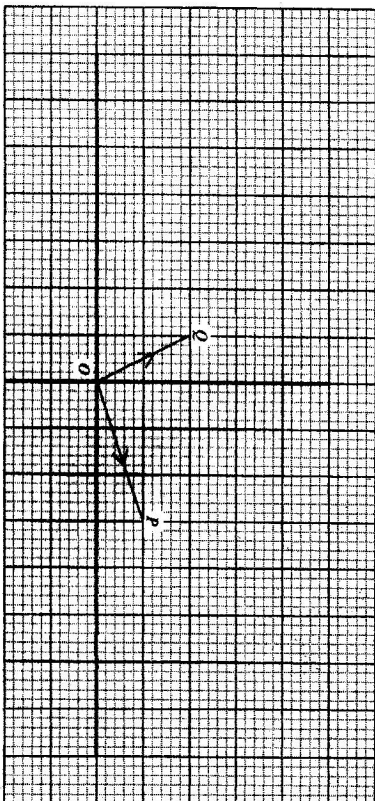
Total 15 marks

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VECTORS AND MATRICES

13.



In the diagram above, the position vectors,  $\vec{OP}$  and  $\vec{OQ}$ , are given as

$$\vec{OP} = p \text{ and } \vec{OQ} = q.$$

- (a) Copy the diagram on graph paper and draw and label the vectors  $\vec{OW}$  and  $\vec{OE}$  such that
- $$\vec{OW} = 2p \text{ and } \vec{OE} = 2p - q.$$
- (b) (i) Write down in terms of  $p$  and  $q$ , the vectors  $\vec{PQ}$  and  $\vec{PE}$ . (4 marks)
- (ii) Hence, state the relationship between  $\vec{PQ}$  and  $\vec{PE}$ . (4 marks)
- (c) The point D is such that  $\vec{OD} = \vec{QE}$ .
- Write down, in terms of  $p$  and  $q$ , the vector  $\vec{OD}$ . (4 marks)
  - Hence, state the coordinates of D. (4 marks)
- (d) Calculate the magnitude of the vector  $\vec{OW}$ . (3 marks)

Total 15 marks



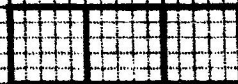
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14. (a) Using a scale of 1 cm to represent 1 unit on BOTH the x and y-axes, draw on graph paper the triangle  $PQR$  and  $P'Q'R'$  such that  $P(-3, -2)$ ,  $Q(-2, -2)$ ,  $R(-2, -4)$  and  $P'(6, 4)$ ,  $Q'(4, 4)$  and  $R'(4, 8)$ . (3 marks)
- (b) Describe FULLY the transformation,  $G$ , which maps triangle  $PQR$  onto triangle  $P'Q'R'$ . (3 marks)
- (c) The transformation,  $M$ , is a reflection in the line  $y = -x$ .  
On the same diagram, draw and label the triangle  $P''Q''R''$ , the image of triangle  $P'Q'R'$  under the transformation  $M$ . (3 marks)
- (d) Write down the  $2 \times 2$  matrix for
- (i) transformation  $G$
  - (ii) transformation  $M$
  - (iii) transformation  $G$  followed by  $M$ . (6 marks)
- Total 15 marks

END OF TEST

**Answer sheet for Question 8 (a) and (e).**

(a)	Shape	Area of Shape	Perimeter of Shape
		1	4
		2	6
		3	8

(e)										



# List of Formulae

## LIST OF FORMULAE

Volume of a prism  $V = Ah$  where  $A$  is the area of a cross-section and  $h$  is the perpendicular length.

Volume of a right pyramid  $V = \frac{1}{3}Ah$  where  $A$  is the area of the base and  $h$  is the perpendicular height.

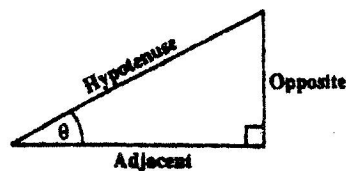
Circumference  $C = 2\pi r$  where  $r$  is the radius of the circle.

Area of a circle  $A = \pi r^2$  where  $r$  is the radius of the circle.

Area of trapezium  $A = \frac{1}{2}(a + b)h$  where  $a$  and  $b$  are the lengths of the parallel sides and  $h$  is the perpendicular distance between the parallel sides.

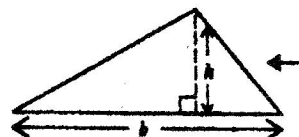
Roots of quadratic equations If  $ax^2 + bx + c = 0$ ,  
then  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios  $\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$



$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$

$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$



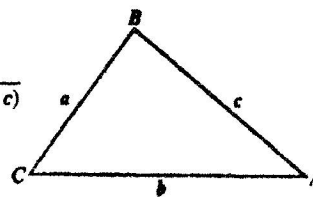
Area of triangle

Area of  $\Delta = \frac{1}{2}bh$  where  $b$  is the length of the base and  $h$  is the perpendicular height

Area of  $\Delta ABC = \frac{1}{2}ab \sin C$

Area of  $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

where  $s = \frac{a+b+c}{2}$



Sine rule

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule

$a^2 = b^2 + c^2 - 2bc \cos A$

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