



- 1 Thomas, Ursula and Vanessa share \$200 in the ratio

$$\text{Thomas : Ursula : Vanessa} = 3 : 2 : 5.$$

- (a) Show that Thomas receives \$60 and Ursula receives \$40.

*Answer(a)*

[2]

- (b) Thomas buys a book for \$21.  
What percentage of his \$60 does Thomas have left?

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

- (c) Ursula buys a computer game for \$36.80 in a sale.  
The sale price is 20% less than the original price.  
Calculate the original price of the computer game.

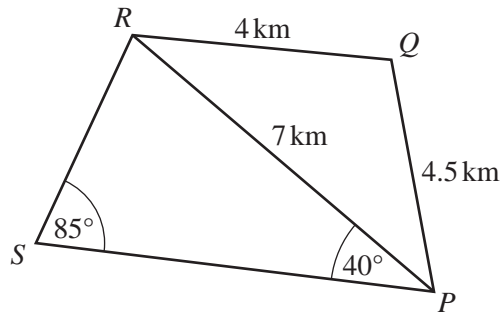
*Answer(c)* \$ ..... [3]

- (d) Vanessa buys some books and some pencils.  
Each book costs \$12 **more** than each pencil.  
The total cost of 5 books and 2 pencils is \$64.20.  
Find the cost of one pencil.

*Answer(d)* \$ ..... [3]

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The diagram shows five straight roads.  
 $PQ = 4.5$  km,  $QR = 4$  km and  $PR = 7$  km.  
 Angle  $RPS = 40^\circ$  and angle  $PSR = 85^\circ$ .

- (a) Calculate angle  $PQR$  and show that it rounds to  $110.7^\circ$ .

*Answer(a)*

[4]

- (b) Calculate the length of the road  $RS$  and show that it rounds to 4.52 km.

*Answer(b)*

[3]

- (c) Calculate the area of the quadrilateral  $PQRS$ .  
 [Use the value of  $110.7^\circ$  for angle  $PQR$  and the value of 4.52 km for  $RS$ .]

*Answer(c)* ..... km<sup>2</sup> [5]

- 3 (a) Expand the brackets and simplify.

$$x(x+3)+4x(x-1)$$

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

- (b) Simplify  $(3x^3)^3$ .

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

- (c) Factorise the following completely.

(i)  $7x^7 + 14x^{14}$

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

(ii)  $xy + xw + 2ay + 2aw$

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

(iii)  $4x^2 - 49$

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

(d) Solve the equation.

$$2x^2 + 5x + 1 = 0$$

Show all your working and give your answers correct to 2 decimal places.

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*Answer(d)*  $x =$  ..... or  $x =$  ..... [4]

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4 (a)

$$\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} 2 \\ 7 \end{pmatrix} \quad \mathbf{C} = (1 \ 2)$$

Find the following matrices.

(i) **AB**

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

(ii) **CB**

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

(iii)  $\mathbf{A}^{-1}$ , the inverse of **A**

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

(b) Describe fully the **single** transformation represented by the matrix  $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ .

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

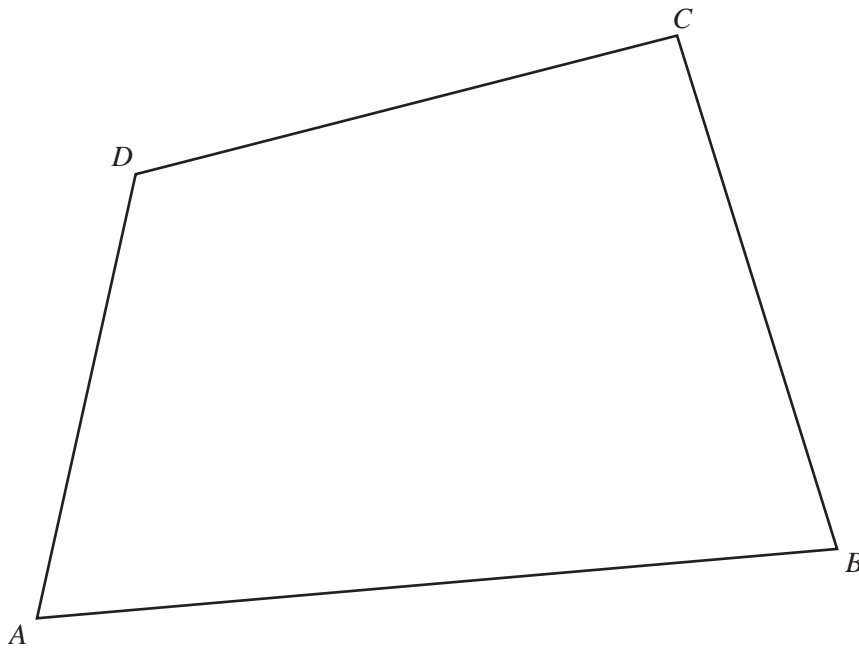
(c) Find the 2 by 2 matrix that represents an anticlockwise rotation of  $90^\circ$  about the origin.

*Answer(c)*

$$\begin{pmatrix} & \\ & \end{pmatrix}$$

[2]

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The diagram shows an area of land  $ABCD$  used for a shop, a car park and gardens.

**(a)** Using a straight edge and compasses only, construct

**(i)** the locus of points equidistant from  $C$  and from  $D$ , [2]

**(ii)** the locus of points equidistant from  $AD$  and from  $AB$ . [2]

**(b)** The shop is on the land nearer to  $D$  than to  $C$  **and** nearer to  $AD$  than to  $AB$ .

Write the word SHOP in this region on the diagram. [1]

**(c)** **(i)** The scale of the diagram is 1 centimetre to 20 metres.  
The gardens are the part of the land less than 100 m from  $B$ .  
Draw the boundary for the gardens. [1]

**(ii)** The car park is the part of the land not used for the shop and not used for the gardens.  
Shade the car park region on the diagram. [1]

6 Sacha either walks or cycles to school.

On any day, the probability that he walks to school is  $\frac{3}{5}$ .

(a) (i) A school term has 55 days.

Work out the expected number of days Sacha walks to school.

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

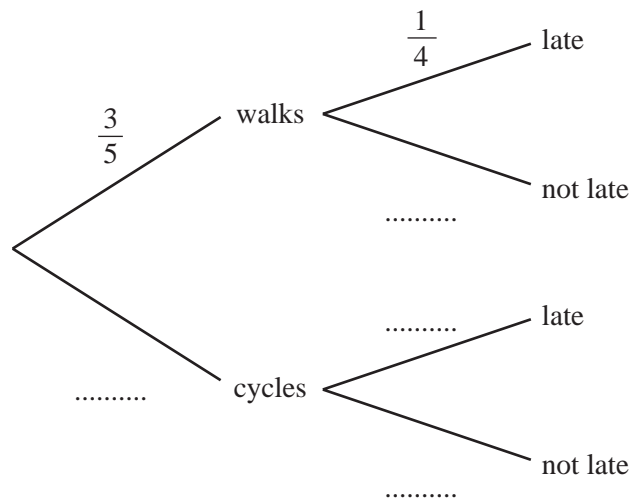
(ii) Calculate the probability that Sacha walks to school on the first 5 days of the term.

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

(b) When Sacha walks to school, the probability that he is late is  $\frac{1}{4}$ .

When he cycles to school, the probability that he is late is  $\frac{1}{8}$ .

(i) Complete the tree diagram by writing the probabilities in the four spaces provided.



[3]



(ii) Calculate the probability that Sacha cycles to school and is late.

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

(iii) Calculate the probability that Sacha is late to school.

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

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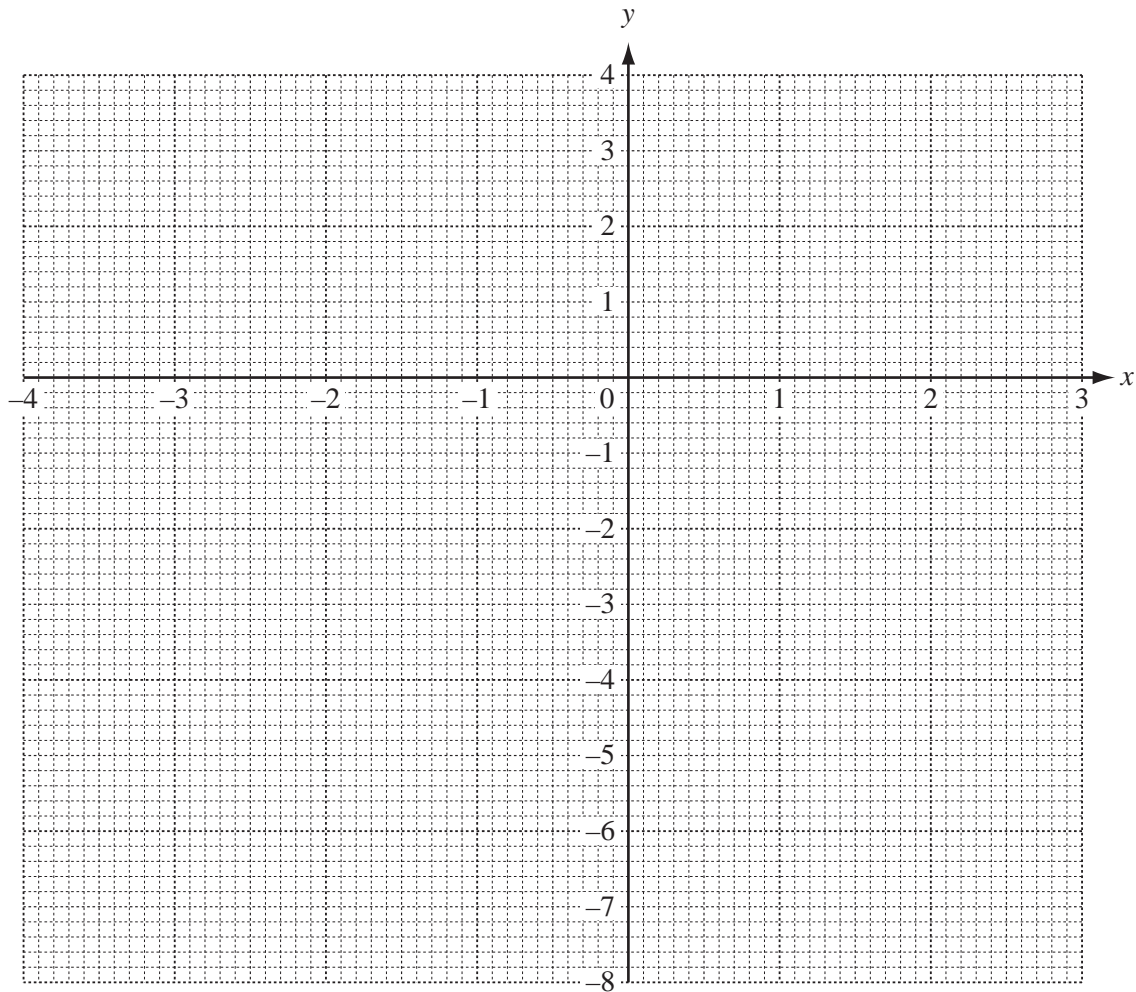
- 7 (a) Complete the table for the function  $f(x) = \frac{x^3}{10} + 1$ .

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Use

$x$	-4	-3	-2	-1	0	1	2	3
$f(x)$		-1.7	0.2	0.9	1	1.1	1.8	

[2]

- (b) On the grid, draw the graph of  $y = f(x)$  for  $-4 \leq x \leq 3$ .



[4]

- (c) Complete the table for the function  $g(x) = \frac{4}{x}$ ,  $x \neq 0$ .

$x$	-4	-3	-2	-1	1	2	3
$g(x)$	-1	-1.3				2	1.3

[2]

(d) On the grid, draw the graph of  $y = g(x)$  for  $-4 \leq x \leq -1$  and  $1 \leq x \leq 3$ .

[3]

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(e) (i) Use your graphs to solve the equation  $\frac{x^3}{10} + 1 = \frac{4}{x}$ .

Answer(e)(i)  $x =$  ..... or  $x =$  ..... [2]

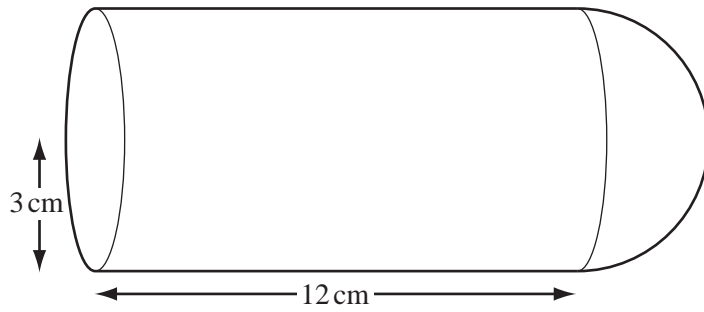
(ii) The equation  $\frac{x^3}{10} + 1 = \frac{4}{x}$  can be written as  $x^4 + ax + b = 0$ .

Find the values of  $a$  and  $b$ .

Answer(e)(ii)  $a =$  .....

$b =$  ..... [2]

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The diagram shows a solid made up of a hemisphere and a cylinder.  
The radius of both the cylinder and the hemisphere is 3 cm.  
The length of the cylinder is 12 cm.

(a) (i) Calculate the volume of the solid.

[ The volume,  $V$ , of a **sphere** with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ . ]

Answer(a)(i) .....  $\text{cm}^3$  [4]

(ii) The solid is made of steel and  $1 \text{ cm}^3$  of steel has a mass of 7.9 g.  
Calculate the mass of the solid.  
Give your answer in kilograms.

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

- (ii) The solid fits into a box in the shape of a cuboid, 15 cm by 6 cm by 6 cm.  
Calculate the volume of the box **not** occupied by the solid.

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Answer(a)(iii) ..... cm<sup>3</sup> [2]

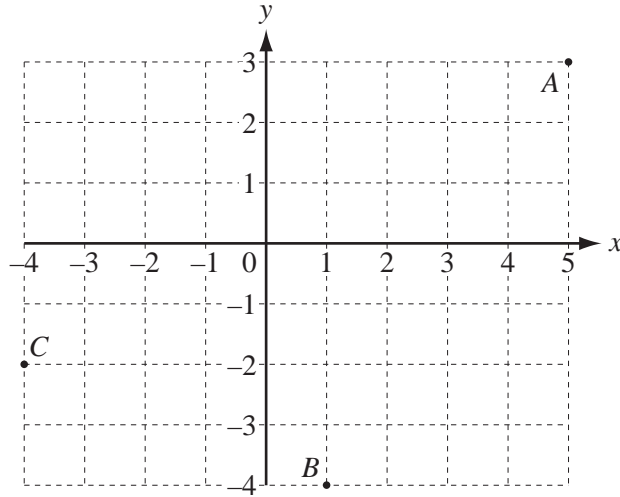
- (b) (i) Calculate the **total** surface area of the solid.  
You must show your working.  
[ The surface area,  $A$ , of a **sphere** with radius  $r$  is  $A = 4\pi r^2$  .]

Answer(b)(i) ..... cm<sup>2</sup> [5]

- (ii) The surface of the solid is painted.  
The cost of the paint is \$0.09 per millilitre.  
One millilitre of paint covers an area of 8 cm<sup>2</sup>.  
Calculate the cost of painting the solid.

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

9 (a)



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The points  $A(5, 3)$ ,  $B(1, -4)$  and  $C(-4, -2)$  are shown in the diagram.

(i) Write  $\vec{CA}$  as a column vector.

Answer(a)(i)  $\vec{CA} = \begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix}$  [1]

(ii) Find  $\vec{CA} - \vec{CB}$  as a single column vector.

Answer(a)(ii)  $\begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix}$  [2]

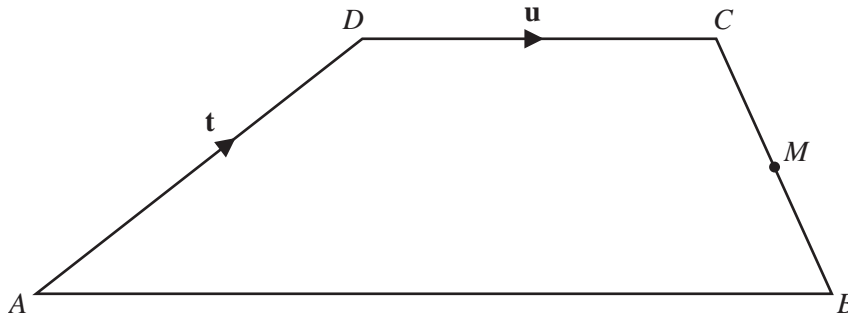
(iii) Complete the following statement.

$\vec{CA} - \vec{CB} = \dots\dots\dots$  [1]

(iv) Calculate  $|\vec{CA}|$ .

Answer(a)(iv)  $\dots\dots\dots$  [2]

(b)



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$ABCD$  is a trapezium with  $DC$  parallel to  $AB$  and  $DC = \frac{1}{2}AB$ .

$M$  is the midpoint of  $BC$ .

$\vec{AD} = \mathbf{t}$  and  $\vec{DC} = \mathbf{u}$ .

Find the following vectors in terms of  $\mathbf{t}$  and / or  $\mathbf{u}$ .

Give each answer in its simplest form.

(i)  $\vec{AB}$

Answer(b)(i)  $\vec{AB} = \dots\dots\dots$  [1]

(ii)  $\vec{BM}$

Answer(b)(ii)  $\vec{BM} = \dots\dots\dots$  [2]

(iii)  $\vec{AM}$

Answer(b)(iii)  $\vec{AM} = \dots\dots\dots$  [2]

10 (a) For a set of six integers, the mode is 8, the median is 9 and the mean is 10.

The smallest integer is greater than 6 and the largest integer is 16.

Find the two possible sets of six integers.

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Answer(a) First set ..... , ..... , ..... , ..... , ..... , .....  
 Second set ..... , ..... , ..... , ..... , ..... , ..... [5]

(b) One day Ahmed sells 160 oranges.  
 He records the mass of each orange.  
 The results are shown in the table.

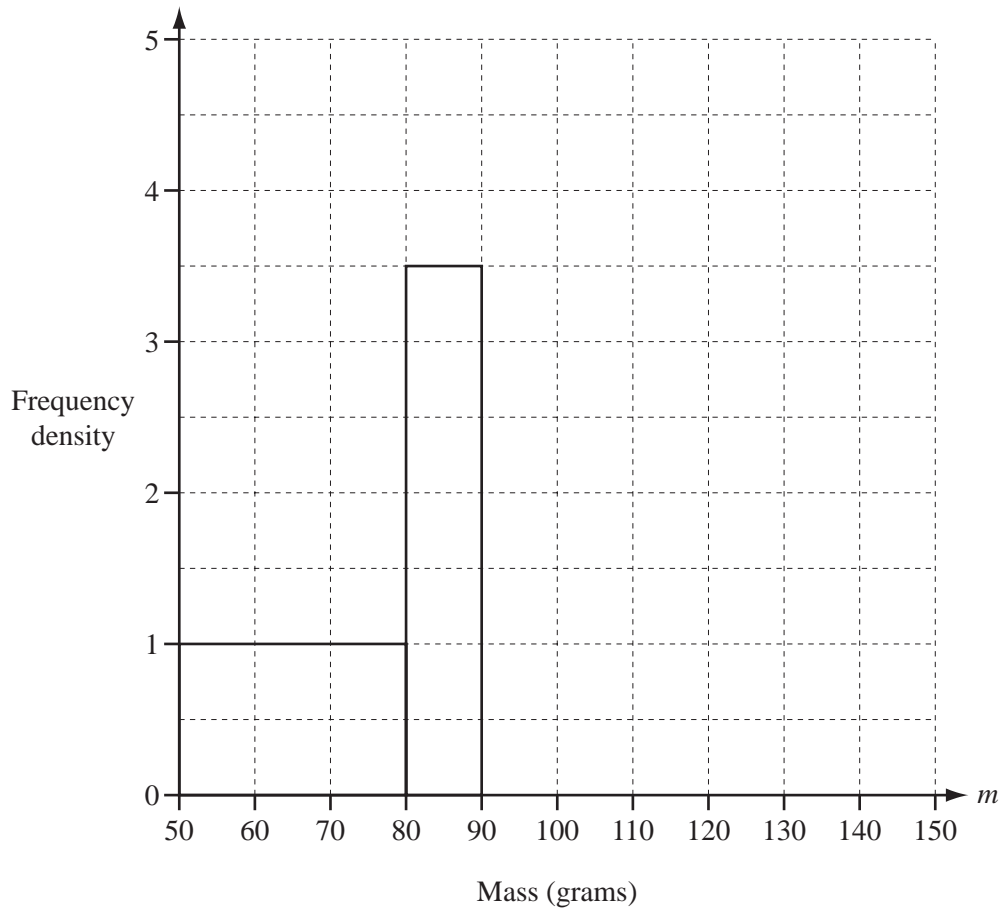
Mass ( $m$ grams)	$50 < m \leq 80$	$80 < m \leq 90$	$90 < m \leq 100$	$100 < m \leq 120$	$120 < m \leq 150$
Frequency	30	35	40	40	15

(i) Calculate an estimate of the mean mass of the 160 oranges.

Answer(b)(i) ..... g [4]



(ii) On the grid, complete the histogram to show the information in the table.



[4]

Question 11 is printed on the next page.

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Diagram 1

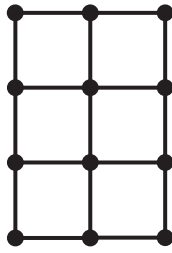


Diagram 2

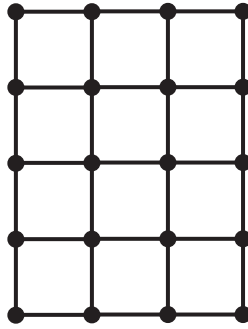


Diagram 3

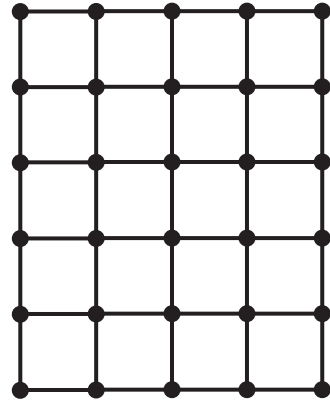


Diagram 4

The first four Diagrams in a sequence are shown above.  
Each Diagram is made from dots and one centimetre lines.  
The area of each small square is  $1 \text{ cm}^2$ .

(a) Complete the table for Diagrams 5 and 6.

Diagram	1	2	3	4	5	6
Area ( $\text{cm}^2$ )	2	6	12	20		
Number of dots	6	12	20	30		
Number of one centimetre lines	7	17	31	49		

[4]

(b) The **area** of Diagram  $n$  is  $n(n+1) \text{ cm}^2$ .

(i) Find the **area** of Diagram 50.

Answer(b)(i) .....  $\text{cm}^2$  [1]

(ii) Which Diagram has an **area** of  $930 \text{ cm}^2$ ?

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

(c) Find, in terms of  $n$ , the number of **dots** in Diagram  $n$ .

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

(d) The number of one centimetre lines in Diagram  $n$  is  $2n^2 + pn + 1$ .

(i) Show that  $p = 4$ .

*Answer(d)(i)*

[2]

(ii) Find the number of one centimetre lines in Diagram 10.

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

(iii) Which Diagram has 337 one centimetre lines?

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

(e) For **each** Diagram, the number of squares of area  $1 \text{ cm}^2$  is  $A$ , the number of dots is  $D$  and the number of one centimetre lines is  $L$ .

Find a connection between  $A$ ,  $D$  and  $L$  that is true for each Diagram.

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

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