

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]

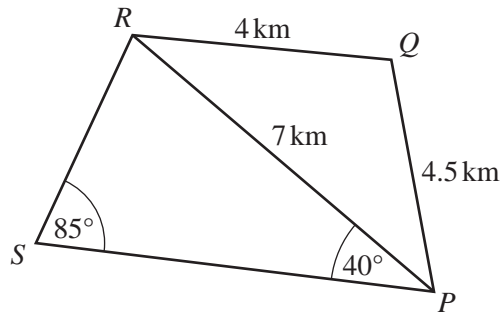
(c) Ursula buys a computer game for \$36.80 in a sale.
The sale price is 20% less than the original price.
Calculate the original price of the computer game.

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]

2



NOT TO SCALE

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° .

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° for angle PQR and the value of 4.52 km for RS .]

Answer(c) km² [5]

- 3 (a) Expand the brackets and simplify.

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

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.

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

4 (a)

$$\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

$$\mathbf{B} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$$

$$\mathbf{C} = (1 \ 2)$$

Find the following matrices.

(i) \mathbf{AB} *Answer(a)(i)*

[2]

(ii) \mathbf{CB} *Answer(a)(ii)*

[2]

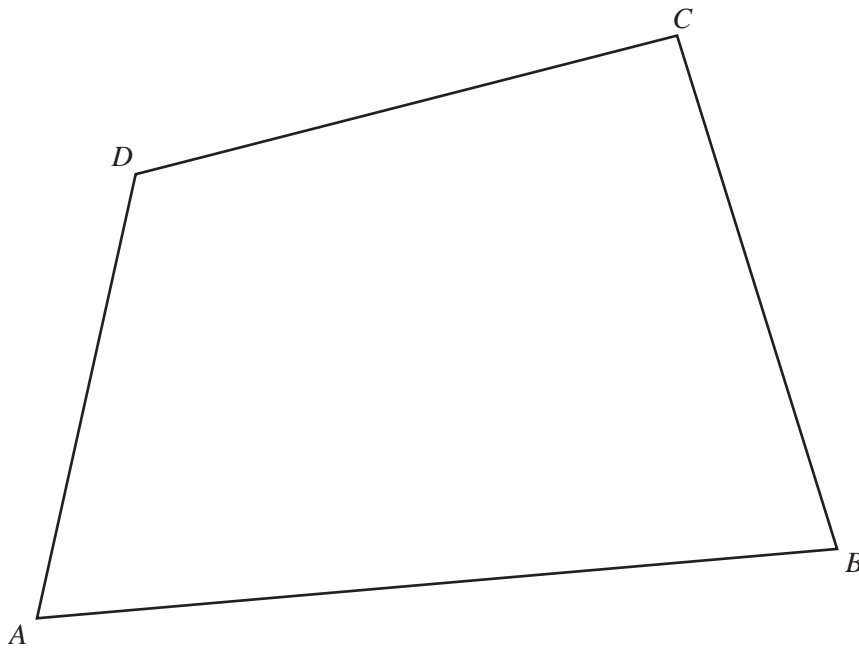
(iii) \mathbf{A}^{-1} , the inverse of \mathbf{A} *Answer(a)(iii)*

[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° about the origin.*Answer(c)*

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

[2]



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]

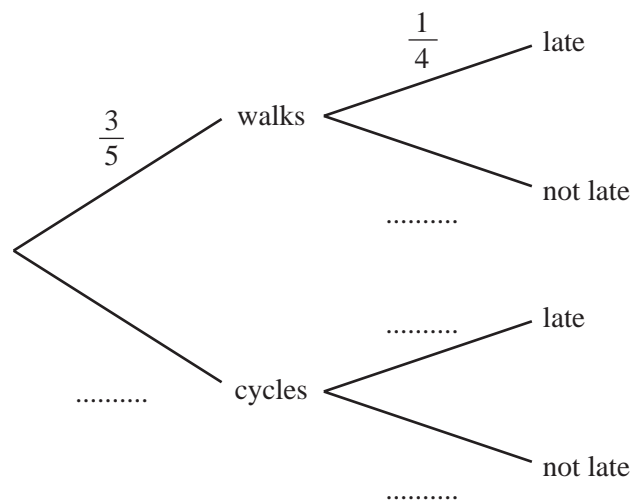
(ii) Calculate the probability that Sacha walks to school on the first 5 days of the term.

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.

Answer(b)(ii) [2]

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

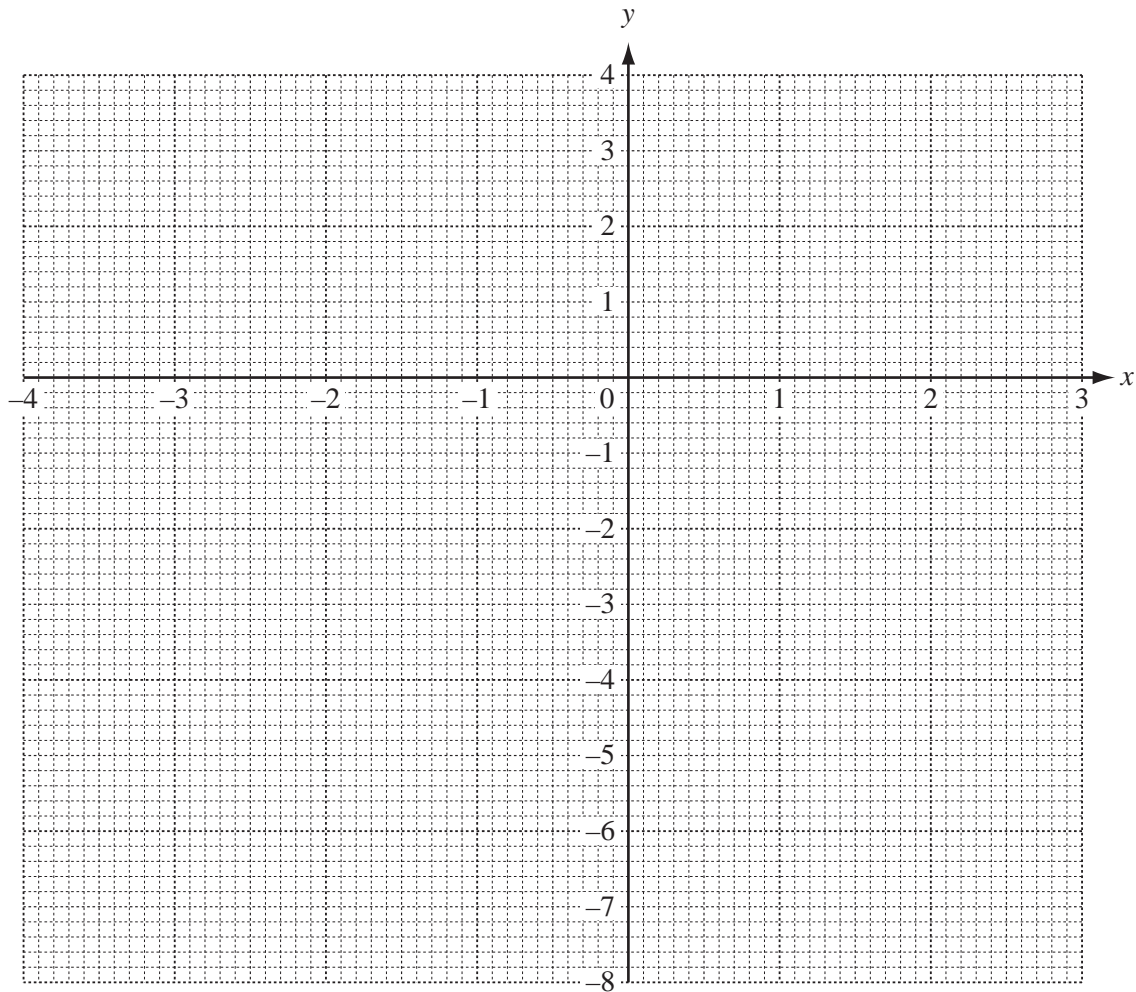
Answer(b)(iii) [2]

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

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 $1 \leq x \leq 3$.

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

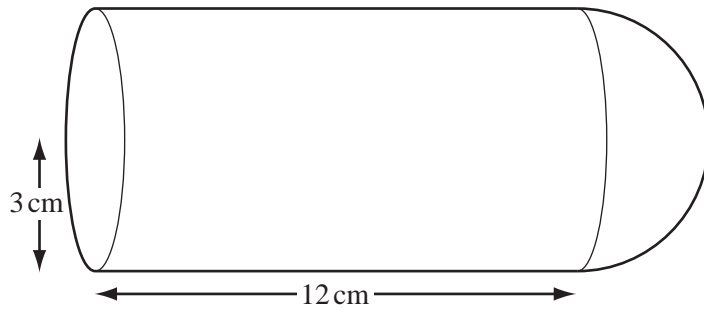
Answer(e)(i) $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

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

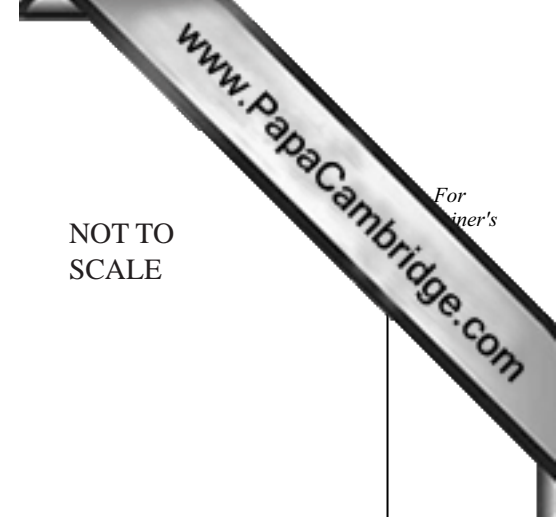
Find the values of a and b .

Answer(e)(ii) $a = \dots\dots\dots$

$b = \dots\dots\dots$ [2]



NOT TO SCALE



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) cm^3 [4]

(ii) The solid is made of steel and 1 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]

- (iii) 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.

Answer(a)(iii) cm³ [2]

- (b) (i) Calculate the **total** surface area of the solid.
You must show your working.

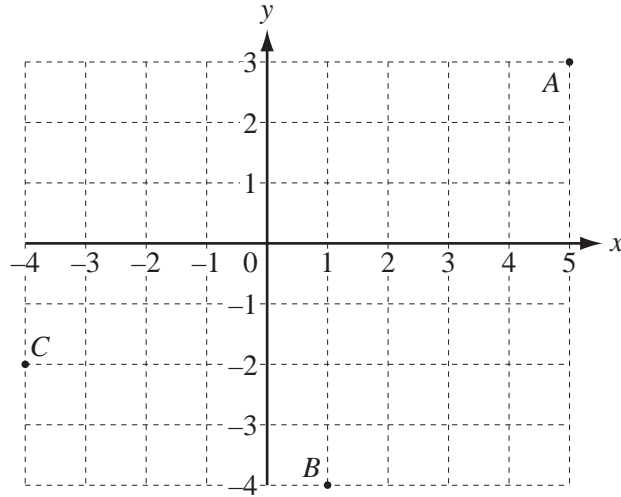
[The surface area, A , of a **sphere** with radius r is $A = 4\pi r^2$.]

Answer(b)(i) cm² [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 cm².
Calculate the cost of painting the solid.

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

9 (a)



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) $\vec{CA} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

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

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

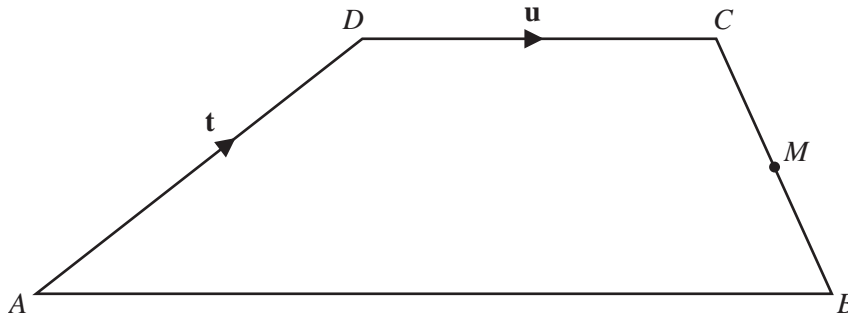
(iii) Complete the following statement.

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

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

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

(b)



NOT TO SCALE

$ABCD$ 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}

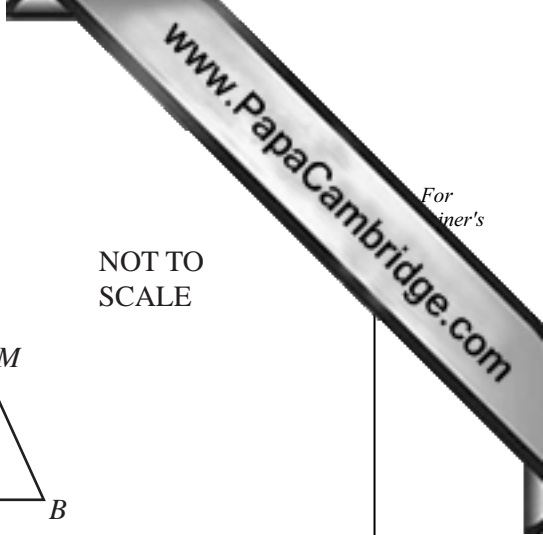
Answer(b)(i) $\vec{AB} = \dots\dots\dots$ [1]

(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.

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

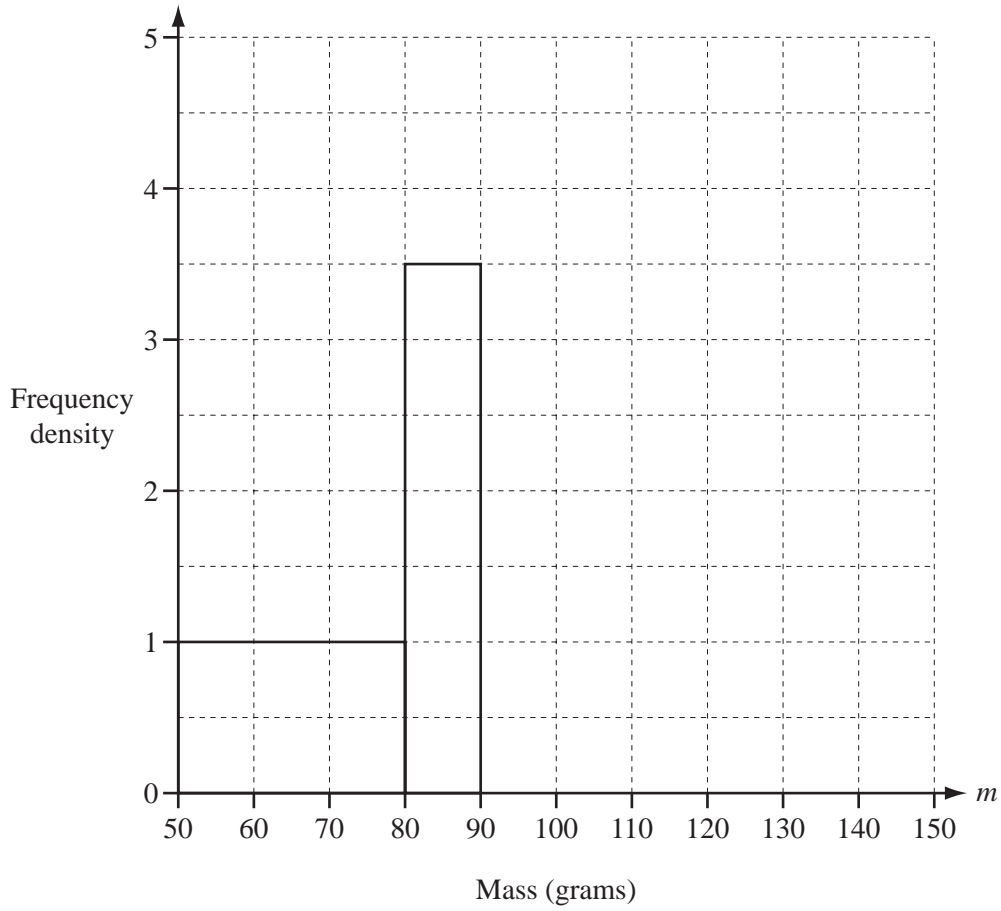
- (b) One day Ahmed sells 160 oranges.
He records the mass of each orange.
The results are shown in the table.

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.

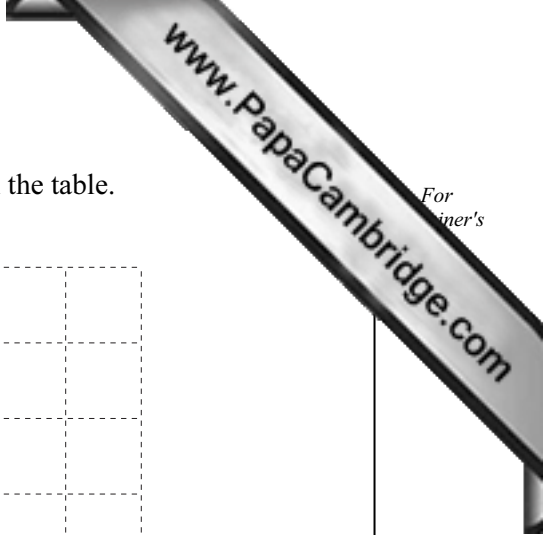
Answer(b)(i) g [4]

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



[4]

Question 11 is printed on the next page.



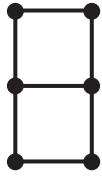


Diagram 1

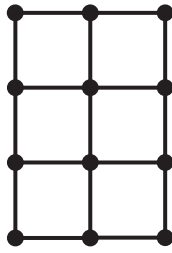


Diagram 2

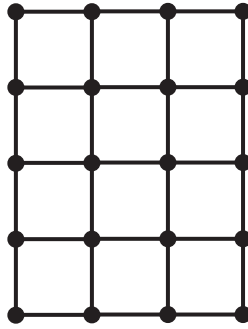


Diagram 3

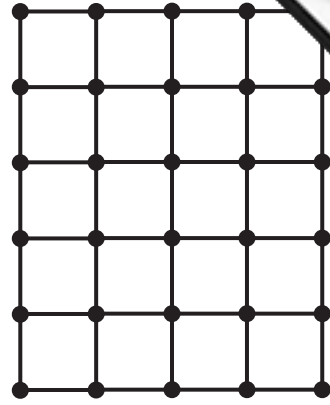


Diagram 4

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 cm^2 .

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

Diagram	1	2	3	4	5	6
Area (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) cm^2 [1]

(ii) Which Diagram has an **area** of 930 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 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]

