UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8742282716

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2010**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Geometrical instruments, Mathematical tables (optional), Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **19** printed pages and **1** blank page.

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UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

For
iner's

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

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]

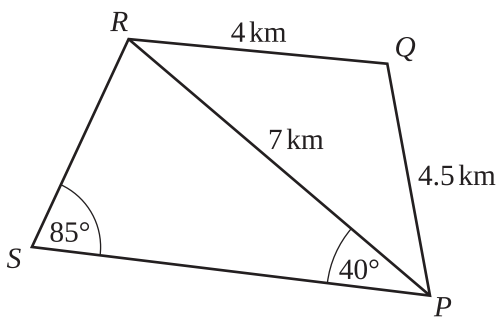
(c) Ursula buys a computer game for $36.80 in a sale.
The sale price is 20% less than the original price.
Calculate the original price of the computer game.

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 $RPS = 40°$ and angle $PSR = 85°$.

(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) .... km^2 [5]

For Examiner's Use

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]

For Examiner's

(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)

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

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 $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$.

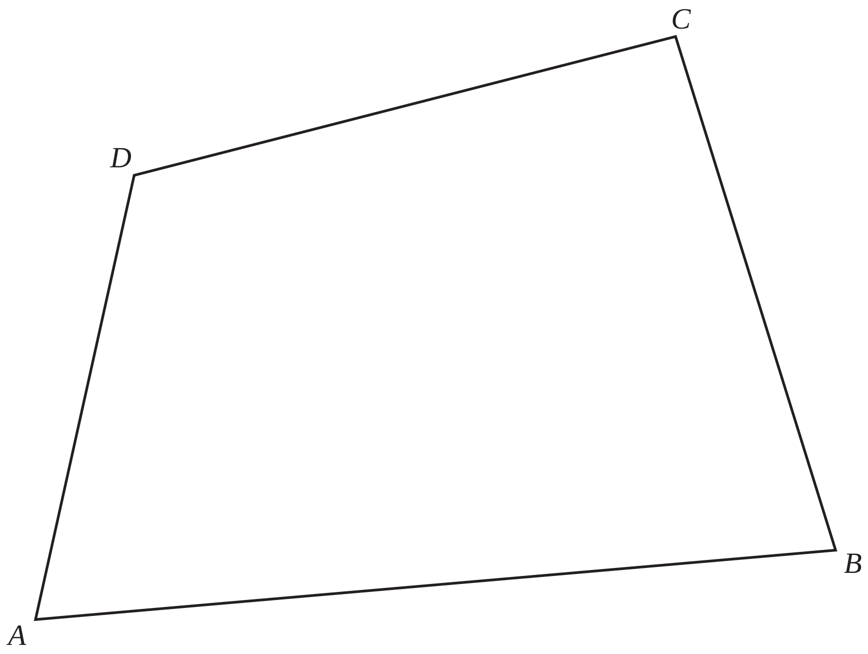
Answer(b) .... [2]

(c) Find the 2 by 2 matrix that represents an anticlockwise rotation of 90° about the origin.

Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

For Examiner's Use

5



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]

For Examiner's Use

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]

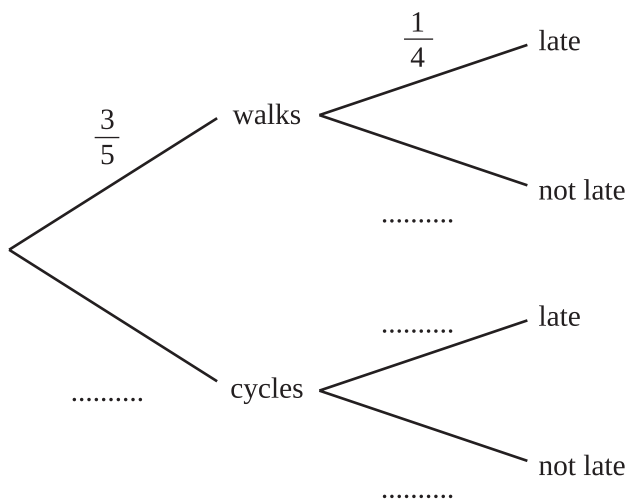
(ii) Calculate the probability that Sacha walks to school on the first 5 days of the term.

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.

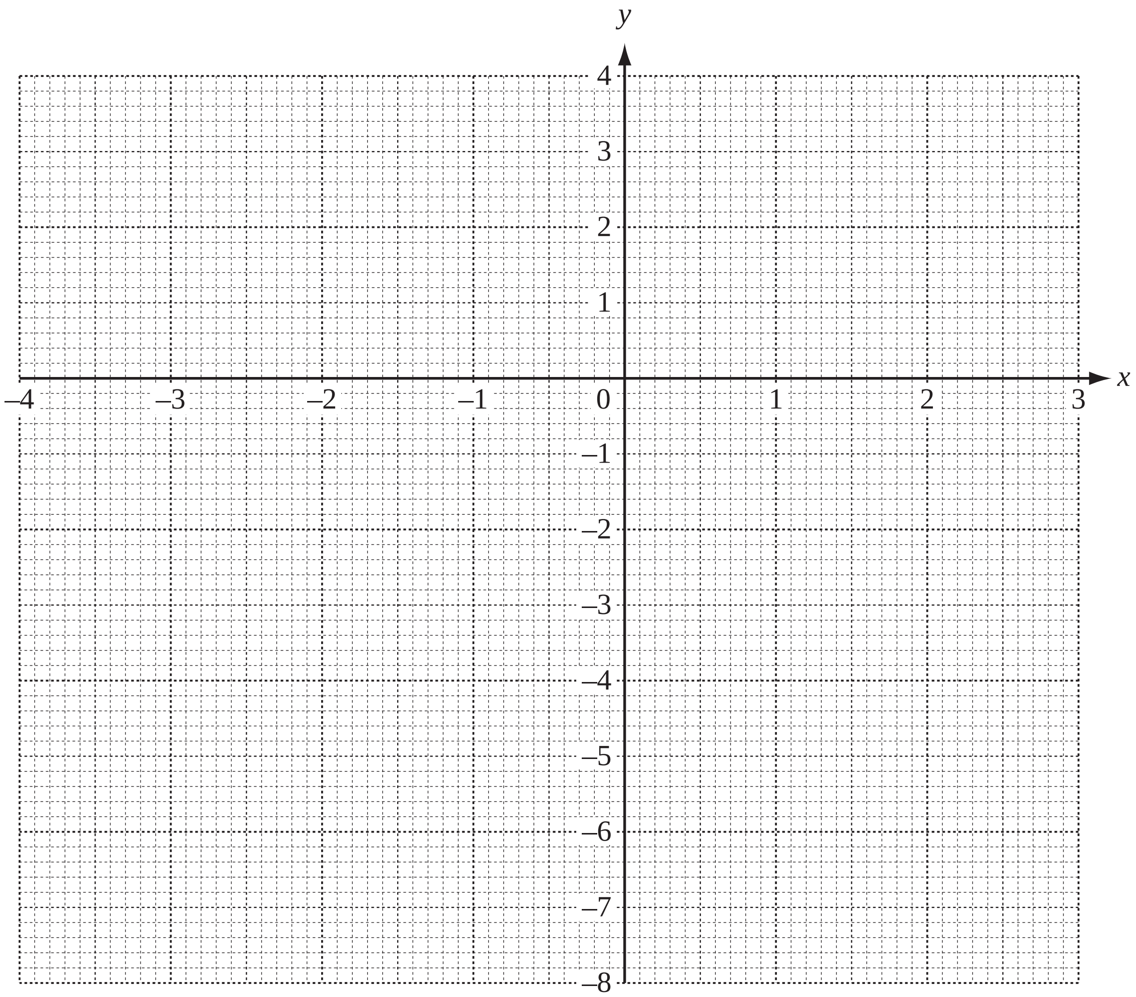
Answer(b)(iii) .... [2]

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 $-4 \leqslant x \leqslant 3$.



[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 $-4 \leqslant x \leqslant -1$ and $1 \leqslant x \leqslant 3$.

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

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

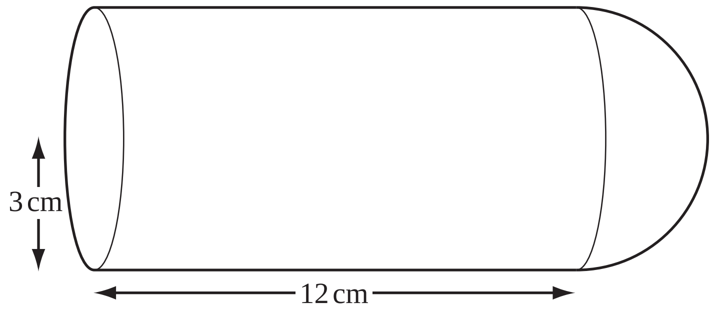
(ii) The equation $\frac{x^3}{10} + 1 = \frac{4}{x}$ can be written as $x^4 + ax + b = 0$.

Find the values of a and b.

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

$b =$ .... [2]

8



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) .... cm^3 [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 $A = 4\pi r^2$.]

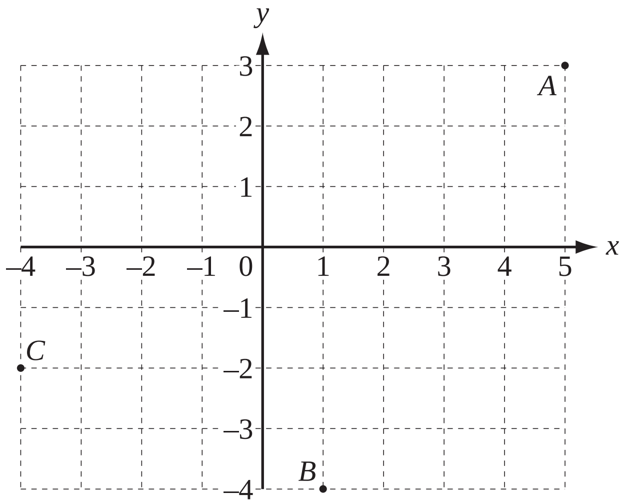
Answer(b)(i) .... cm^2 [5]

(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^2.
Calculate the cost of painting the solid.

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

For Examiner's Use

9 (a)



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

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

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

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

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

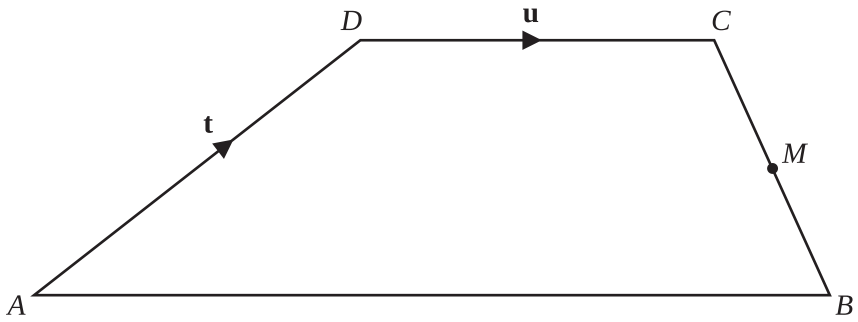
(iii) Complete the following statement.

$\overrightarrow{CA} - \overrightarrow{CB} =$ .... [1]

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

Answer(a)(iv) .... [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*.

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

Find the following vectors in terms of **t** and / or **u**.

Give each answer in its simplest form.

(i) $\overrightarrow{AB}$

Answer(b)(i) $\overrightarrow{AB}$ = ... [1]

(ii) $\overrightarrow{BM}$

Answer(b)(ii) $\overrightarrow{BM}$ = ... [2]

(iii) $\overrightarrow{AM}$

Answer(b)(iii) $\overrightarrow{AM}$ = ... [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]

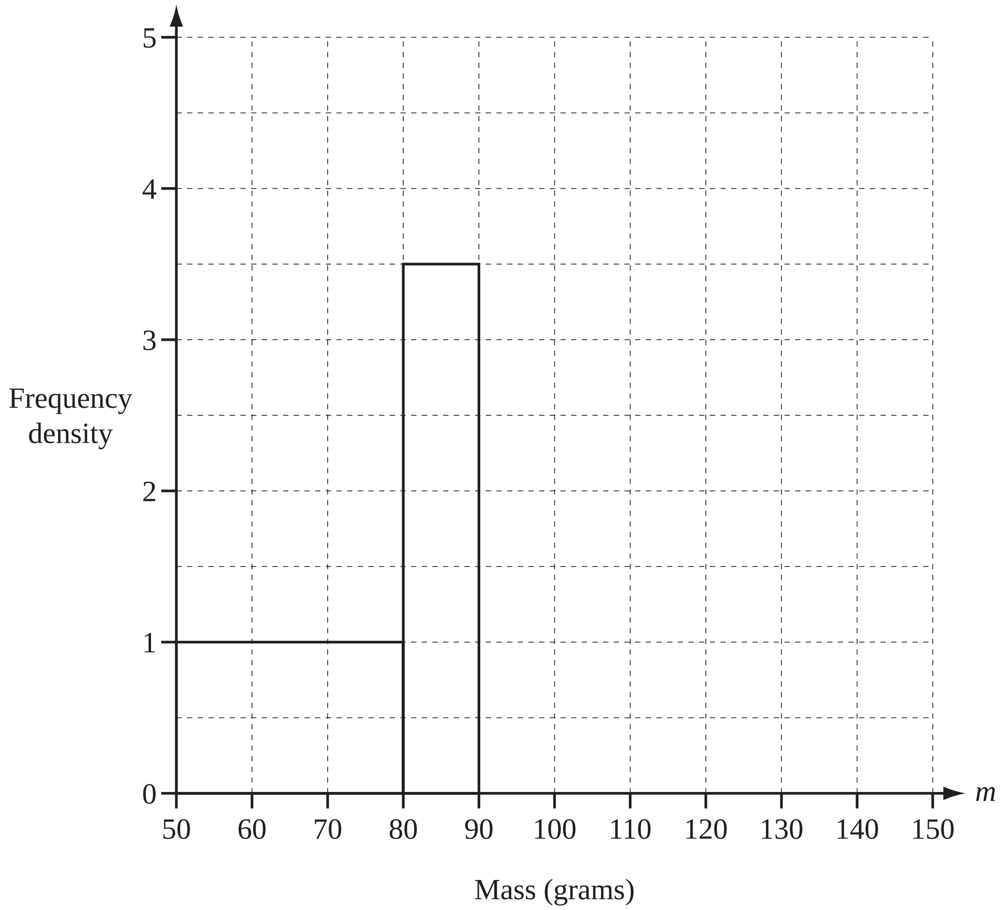
(b) One day Ahmed sells 160 oranges.
He records the mass of each orange.
The results are shown in the table.

Mass (m grams)	$50 < m \leqslant 80$	$80 < m \leqslant 90$	$90 < m \leqslant 100$	$100 < m \leqslant 120$	$120 < m \leqslant 150$
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.

11

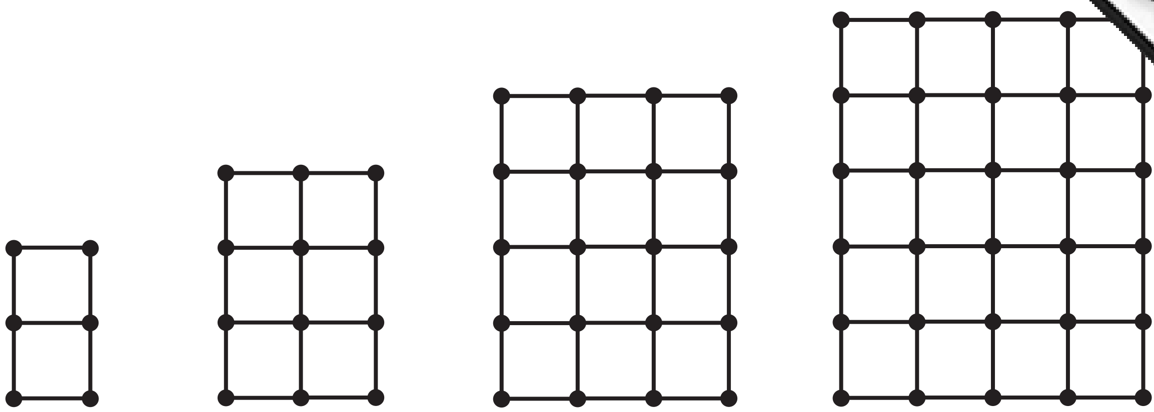


Diagram 1 Diagram 2 Diagram 3 Diagram 4

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 $n(n+1)$ 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]

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