1 **(a)** Here are the ingredients needed to make a pasta bake to serve 12 people.

250 g butter
600 g pasta
460 g mushrooms
280 g cheese
800 ml milk

(i) Find the mass of the cheese as a percentage of the mass of the mushrooms.

..... % [1]

(ii) Find the mass of butter needed to make a pasta bake to serve 18 people.

..... g [2]

(iii) Monica has 2.2 litres of milk and 1.5 kg of each other ingredient.

Calculate the greatest number of people she can serve with pasta bake.

..... [3]

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(b) In 2019, a packet of pasta cost $2.40.
This was an increase of 25% of the cost of a packet in 2018.

(i) Work out the cost in 2018.

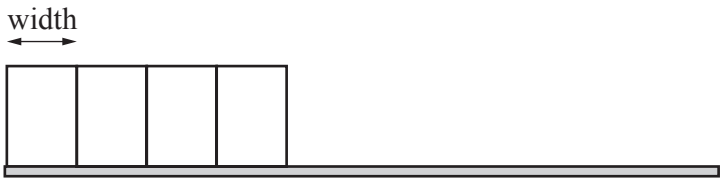
$ ..... [2]

(ii) In 2020, the cost of a packet increased by 15% from the cost in 2019.

Work out the total percentage increase in the cost of a packet from 2018 to 2020.

..... % [3]

(c)



NOT TO SCALE

Pasta is sold in packets with width 11.5 cm, correct to the nearest 0.5 cm.
A shop places these packets in a single line on a shelf of length 2 m, correct to the nearest 0.1 m.

Find the maximum number of these packets that will fit along this shelf.
You must show all your working.

..... [3]

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2 **(a)** Simplify fully.

(i) $p^3 \times p^{11}$

..... [1]

(ii) $\dfrac{18m^6}{3m^2}$

..... [2]

(iii) $\left(\dfrac{27x^9y^{27}}{64}\right)^{-\frac{1}{3}}$

..... [3]

(b) A sequence has nth term $3n^2$.

Write down the first 3 terms of this sequence.

..... , ... , ... [2]

(c) Find the nth term for each of these sequences.

(i) 13, 16, 19, 22, 25, …

..... [2]

(ii) 3, 17, 55, 129, 251, …

..... [2]

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(d) Solve.

$$\frac{3x-22}{4} = 23$$

$x =$ ..... [3]

(e) Use the quadratic formula to solve $3x^2 + 8x - 20 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... , $x =$ ..... [4]

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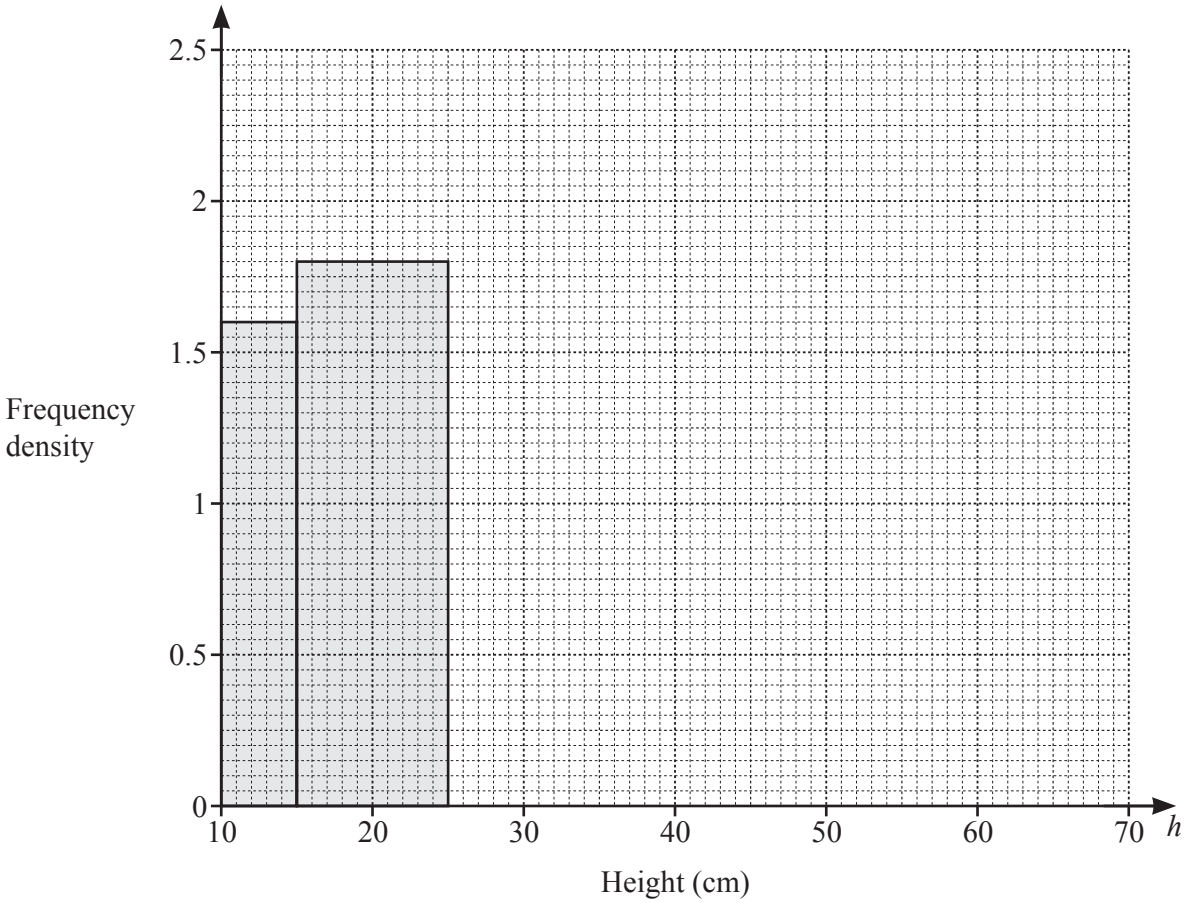
3 The height, h cm, of each of 100 plants is recorded.
The table shows information about the heights of these plants.

Height (h cm)	$10 < h \leqslant 15$	$15 < h \leqslant 25$	$25 < h \leqslant 40$	$40 < h \leqslant 60$	$60 < h \leqslant 70$
Frequency	8	18	28	33	13

(a) Complete the histogram to show this information.
The first two blocks have been drawn for you.



[3]

(b) Calculate an estimate of the mean height.

..... cm [4]

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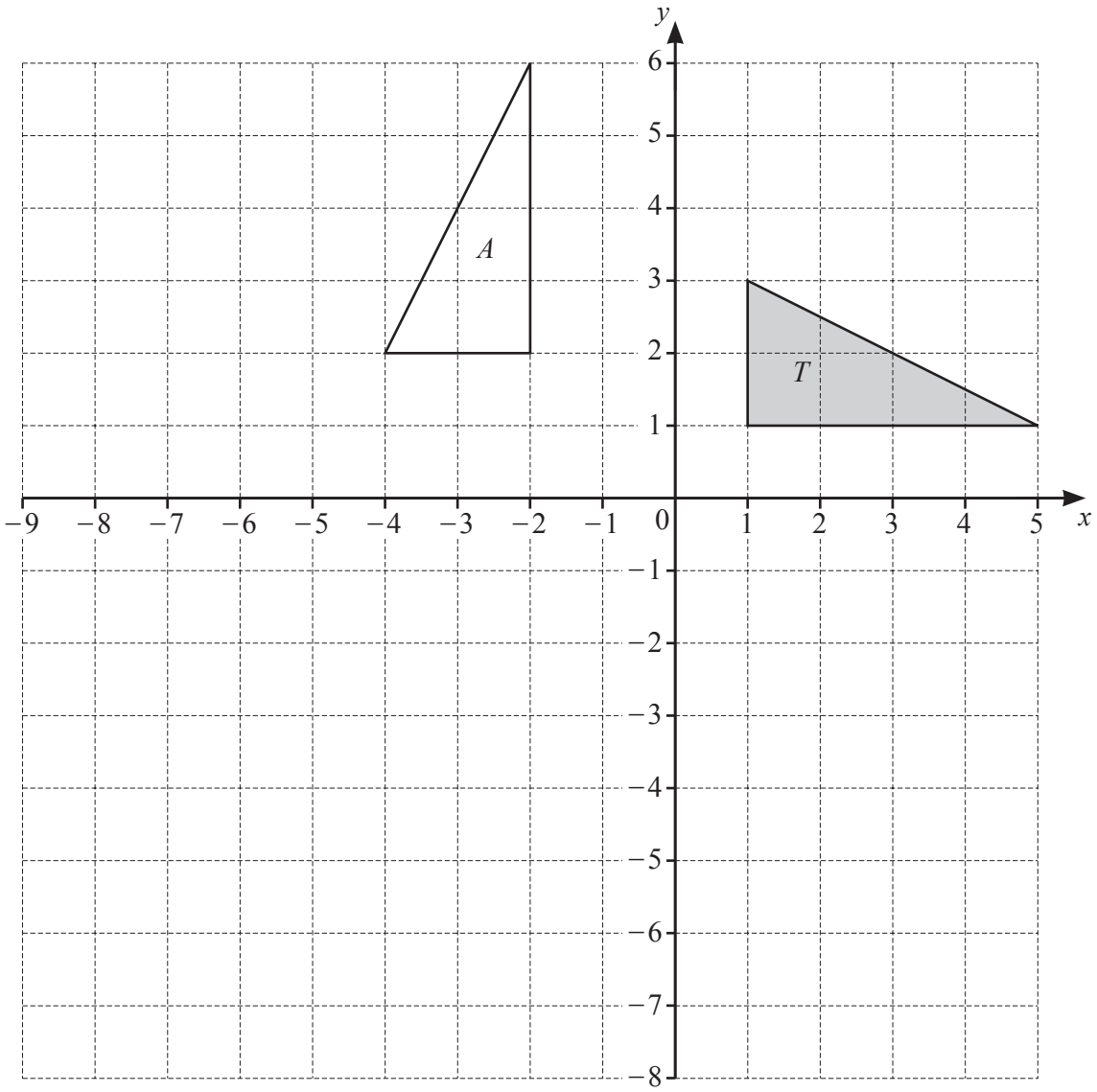
4



(a) Draw the reflection of triangle T in the line $y = -2$. [2]

(b) Draw the enlargement of triangle T with scale factor $\frac{1}{2}$ and centre of enlargement $(-5, -3)$. [2]

(c) Describe fully the **single** transformation that maps triangle T onto triangle A.

.....

..... [3]

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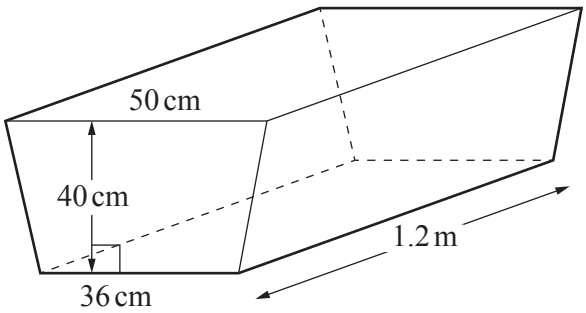
5



NOT TO SCALE

The diagram shows a water trough in the shape of a prism.
The prism has a cross-section in the shape of an isosceles trapezium.
The trough is completely filled with water.

(a) Show that the volume of water in the trough is 206.4 litres.

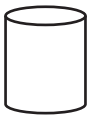
[3]

(b) The water from the trough is emptied at a rate of 600 ml per second.

Calculate the time taken, in minutes and seconds, for the trough to be emptied.

..... minutes ..... seconds [3]

(c) All the water from the trough is emptied into a vertical cylindrical tank.
The depth of the water in the tank is 84 cm.



(i) Calculate the radius of the tank.

..... cm [3]

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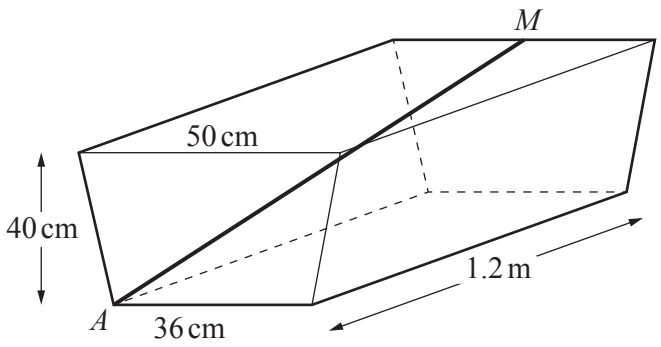
(ii) The tank is 60% full.

Calculate the height of the tank.

..... cm [2]

(d)



NOT TO SCALE

A steel rod AM is placed inside the empty water trough as shown in the diagram.
A is a vertex at the base of the isosceles trapezium and M is the midpoint of the top edge on the opposite face.

Calculate the length of the steel rod, AM.

$AM =$ ..... cm [4]

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6 **(a)** $P = 5k^2 - 7$

(i) Find the value of P when $k = 3$.

$P =$ ..... [2]

(ii) Rearrange the formula to make k the subject.

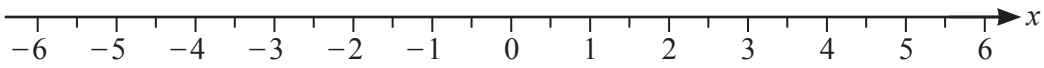
$k =$ ..... [3]

(b) **(i)** Solve.

$$x - 3 \leqslant 5x + 7$$

..... [2]

(ii) Show your answer to **part (b)(i)** on the number line.



[1]

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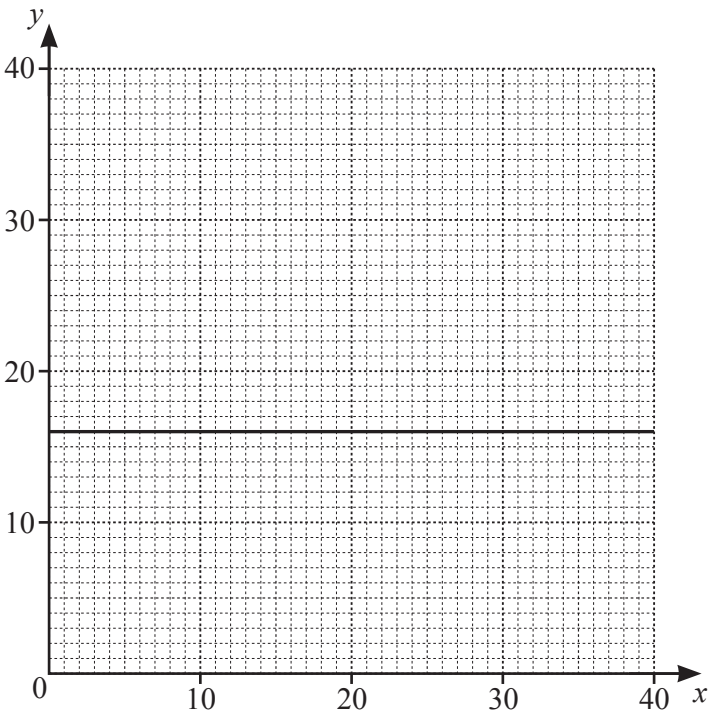
(c) The line $y = 16$ is drawn on the grid.



The region R satisfies the following inequalities.

$y \geqslant 16$ $x > 2$ $2x + 3y \geqslant 72$ $y \leqslant 32 - x$

(i) By drawing three more lines and shading the region **not required**, find and label region R. [6]

(ii) Find the integer coordinates (x, y) in the region R that give the maximum value of $2x + y$.

(..... , ...) [2]

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7 Regan is playing a game with these six number cards.

−3	−2	2	3	5	7

(a) She takes two cards at random, without replacement, and **multiplies** the two numbers to give a score.

Find the probability that

(i) the score is 35

..... [3]

(ii) the score is a positive number.

..... [3]

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(b) Regan now takes three cards at random from the six cards, without replacement, and **adds** the three numbers to give a total.

Find the probability that her total is 5.

..... [4]

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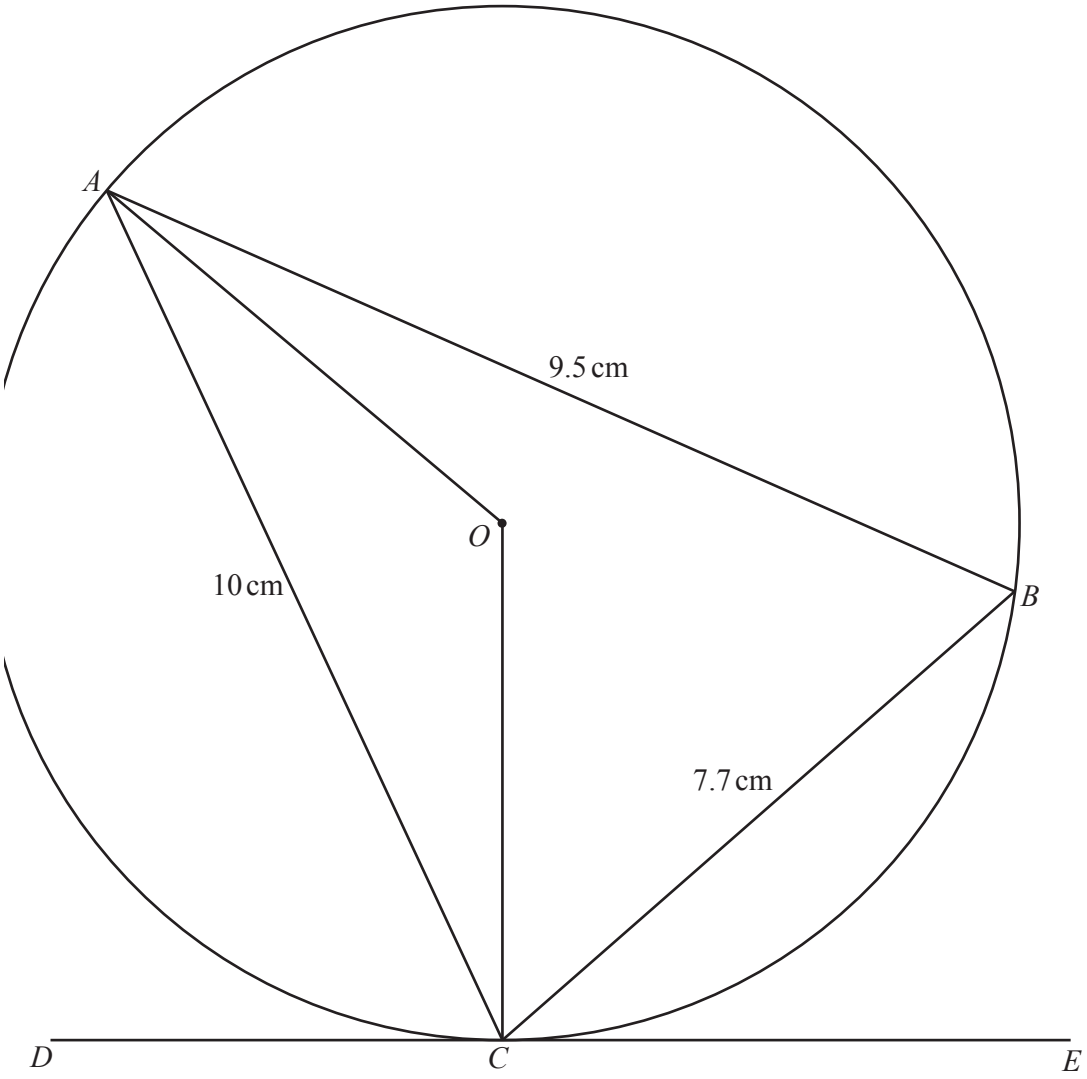
8



NOT T
SCALE

A, B and C are points on the circle, centre O.
DE is a tangent to the circle at C.
$AC = 10\,\text{cm}$, $AB = 9.5\,\text{cm}$ and $BC = 7.7\,\text{cm}$.

(a) Show that angle $ABC = 70.2°$, correct to 1 decimal place.

[4]

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(b) Find

(i) angle AOC

Angle AOC = ... [1]

(ii) angle ACO

Angle ACO = ... [1]

(iii) angle ACD.

Angle ACD = ... [1]

(c) Calculate the radius, OC, of the circle.

OC = ... cm [3]

(d) Calculate the area of triangle ABC as a percentage of the area of the circle.

..... % [4]

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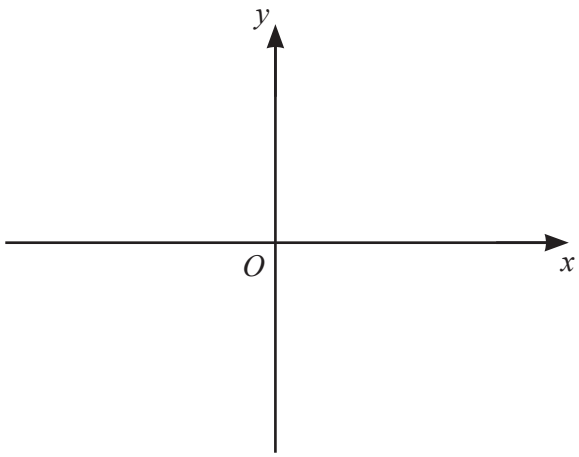
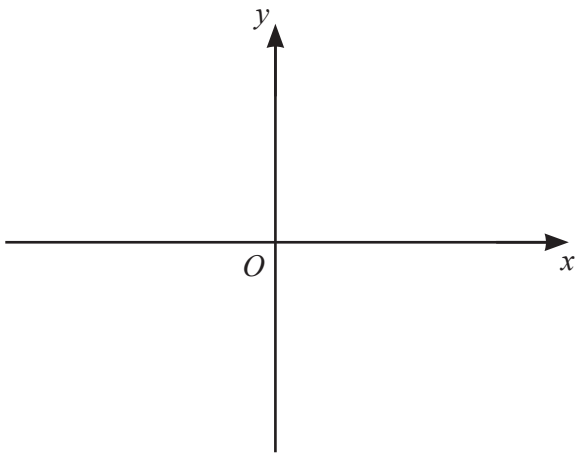
9 **(a)** Sketch the following graphs.
On each sketch, indicate any intercepts with the axes.

(i) $3x - 4y = 12$



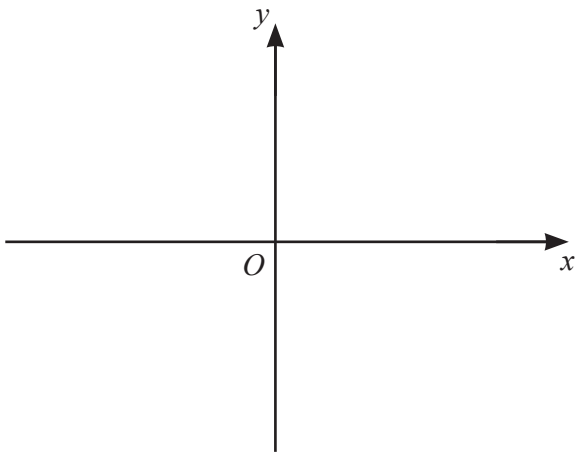
[2]

(ii) $y = x^2 - 3x - 4$



[4]

(iii) $y = 6^x$



[2]

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(b) **(i)** Find the derivative, $\frac{dy}{dx}$, of $y = 5 + 8x - \frac{4}{3}x^3$.

..... [2]

(ii) Find the gradient of $y = 5 + 8x - \frac{4}{3}x^3$ at $x = -1$.

..... [2]

(iii) A tangent is drawn to the graph of $y = 5 + 8x - \frac{4}{3}x^3$.

The gradient of the tangent is -28.

Find the coordinates of the two possible points where this tangent meets the graph.

(..... , ...)

(..... , ...) [5]

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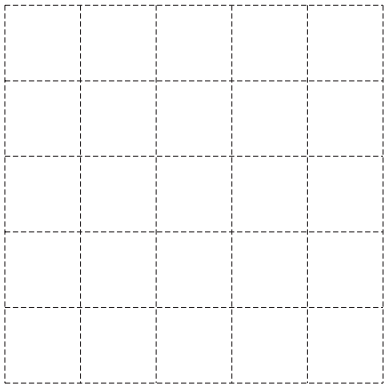
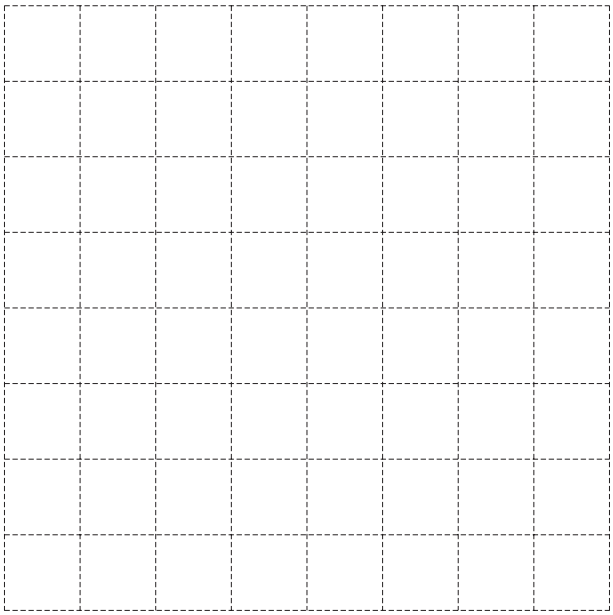
10 **(a)** $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

(i) On the grid, draw and label vector $2\mathbf{a}$.



[1]

(ii) On the grid, draw and label vector $(\mathbf{a} - \mathbf{b})$.



[2]

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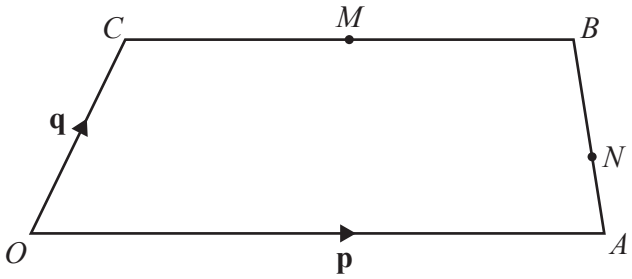
(b)



NOT TO SCALE

$OABC$ is a trapezium with OA parallel to CB.
M is the midpoint of CB and N is the point on AB such that $AN : NB = 1 : 2$.
O is the origin, $\overrightarrow{OA} = \mathbf{p}$, $\overrightarrow{OC} = \mathbf{q}$ and $\overrightarrow{CB} = \frac{3}{4}\mathbf{p}$.

(i) Find, in terms of **p** and/or **q**, in its simplest form

(a) $\overrightarrow{OB}$

$\overrightarrow{OB} =$ ..... [1]

(b) $\overrightarrow{AB}$

$\overrightarrow{AB} =$ ..... [2]

(c) $\overrightarrow{MN}$.

$\overrightarrow{MN} =$ ..... [3]

(ii) OA and MN are extended to meet at G.

Find the position vector of G in terms of **p**.

..... [2]

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