



## Formula List

For the equation  $ax^2 + bx + c = 0$   $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Curved surface area,  $A$ , of cylinder of radius  $r$ , height  $h$ .  $A = 2\pi rh$

Curved surface area,  $A$ , of cone of radius  $r$ , sloping edge  $l$ .  $A = \pi rl$

Curved surface area,  $A$ , of sphere of radius  $r$ .  $A = 4\pi r^2$

Volume,  $V$ , of pyramid, base area  $A$ , height  $h$ .  $V = \frac{1}{3}Ah$

Volume,  $V$ , of cylinder of radius  $r$ , height  $h$ .  $V = \pi r^2 h$

Volume,  $V$ , of cone of radius  $r$ , height  $h$ .  $V = \frac{1}{3}\pi r^2 h$

Volume,  $V$ , of sphere of radius  $r$ .  $V = \frac{4}{3}\pi r^3$



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

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

$$\text{Area} = \frac{1}{2}bc \sin A$$

Answer **all** the questions.

- 1 (a) Work out.

$$\frac{\sqrt[3]{402}}{3.15^2}$$

..... [1]

- (b) Write 130.47 correct to

(i) one decimal place,

..... [1]

(ii) one significant figure.

..... [1]

- (c) Work out 23% of \$76.80 .

\$ ..... [2]

- (d) \$4200 is shared in the ratio 3 : 4 : 6 : 8 .

Find the difference between the largest share and the smallest share.

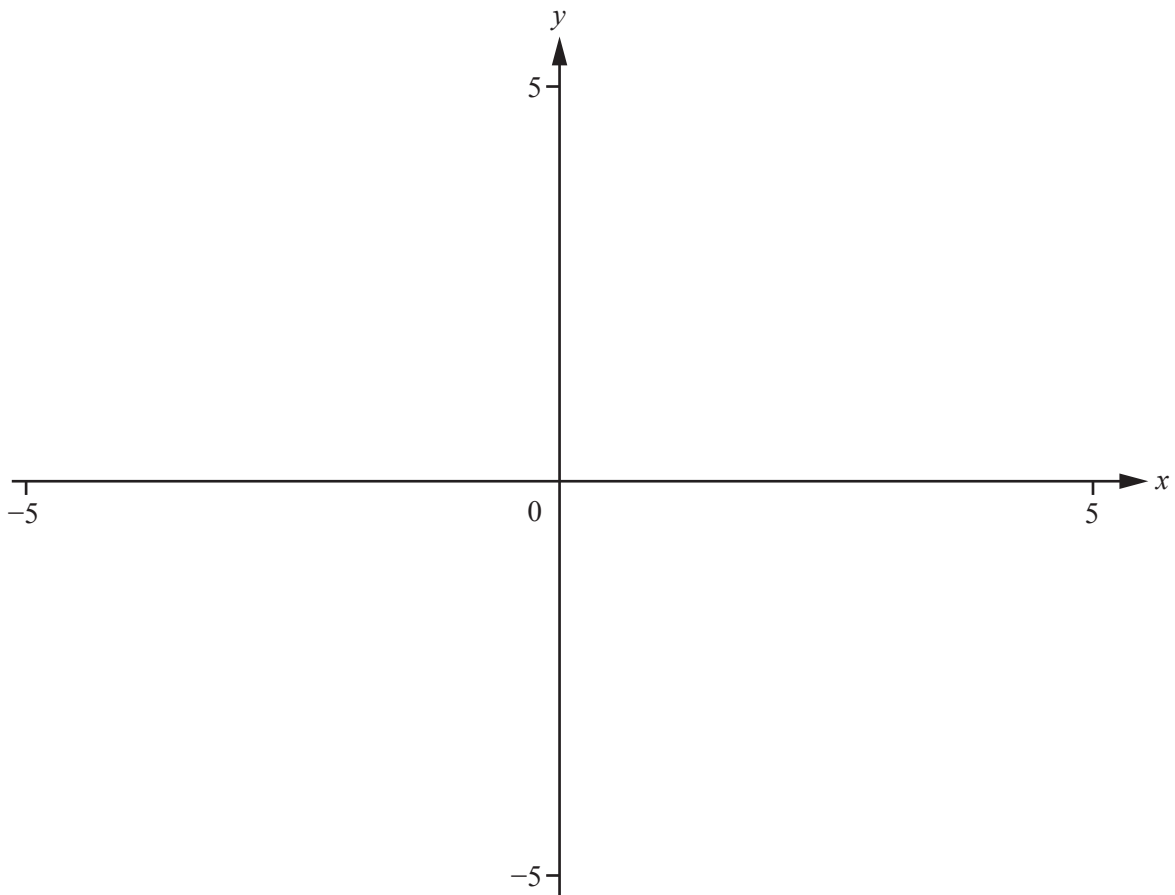
\$ ..... [3]

- (e) Write down an irrational number less than 10.

..... [1]

- (f) Work out  $7.31 \times 10^{-2} + 1.56 \times 10^{-1}$  .  
Give your answer in standard form.

..... [2]



$$f(x) = 1 - \frac{x}{(x^2 - 9)}$$

(a) On the diagram, sketch the graph of  $y = f(x)$ , for values of  $x$  between  $-5$  and  $5$ . [3]

(b) Write down the equations of the three asymptotes.  
 ....., ....., ..... [3]

(c) The line  $y = x$  intersects the curve  $y = 1 - \frac{x}{(x^2 - 9)}$  three times.

Find the values of the  $x$  co-ordinates of the points of intersection.

$x = \dots$  or  $x = \dots$  or  $x = \dots$  [3]

- 3 (a)  $y$  varies directly as the square root of  $x$ .  
 $y = 32$  when  $x = 16$ .

(i) Find  $y$  in terms of  $x$ .

$$y = \dots\dots\dots [2]$$

(ii) Find the value of  $y$  when  $x = 4$ .

$$y = \dots\dots\dots [1]$$

(iii) Find  $x$  in terms of  $y$ .

$$x = \dots\dots\dots [2]$$

- (b)  $p$  varies inversely as  $q + 2$ .  
 $p = 3$  when  $q = 2$ .

Find the value of  $p$  when  $q = 4$ .

$$p = \dots\dots\dots [3]$$

- 4 (a) The mass,  $x$  grams, of each of 100 oranges is found.  
The results are shown in the table.

Mass ( $x$ grams)	Frequency
$0 < x \leq 100$	4
$100 < x \leq 140$	14
$140 < x \leq 180$	22
$180 < x \leq 250$	35
$250 < x \leq 300$	25

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

..... g [2]

- (ii) Two of these oranges are chosen at random.

Calculate the probability that they both have a mass of 140 g or less.

..... [2]

- (iii) The oranges with a mass of 140 g or less are removed.  
From the remaining oranges, two are chosen at random.

Calculate the probability that one orange has a mass of 250 g or less and the other has a mass of more than 250 g.

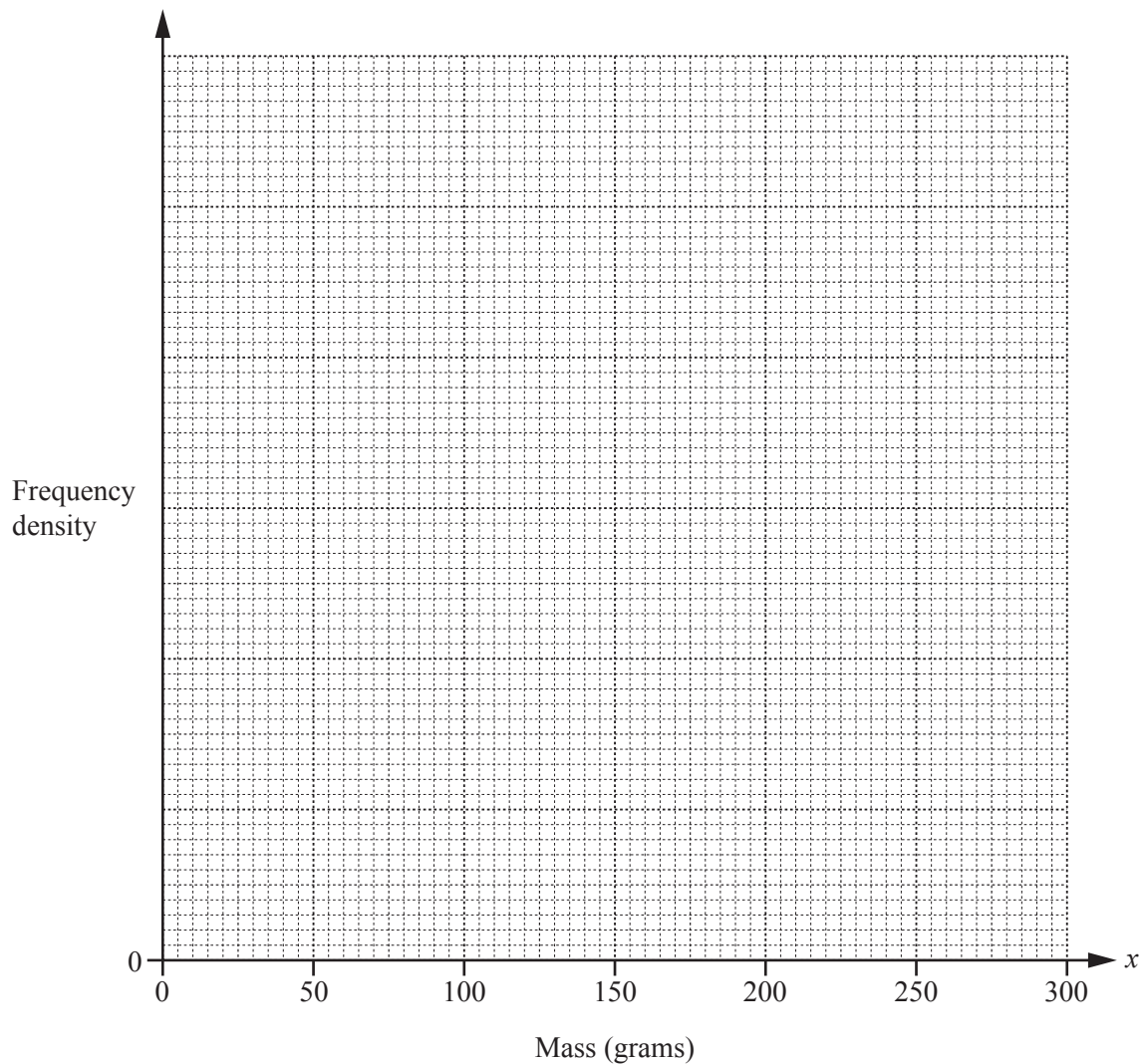
..... [3]

(b) (i) Complete the frequency density column in this table.

Mass ( $x$ grams)	Frequency	Frequency density
$0 < x \leq 100$	4	
$100 < x \leq 140$	14	
$140 < x \leq 180$	22	
$180 < x \leq 250$	35	
$250 < x \leq 300$	25	

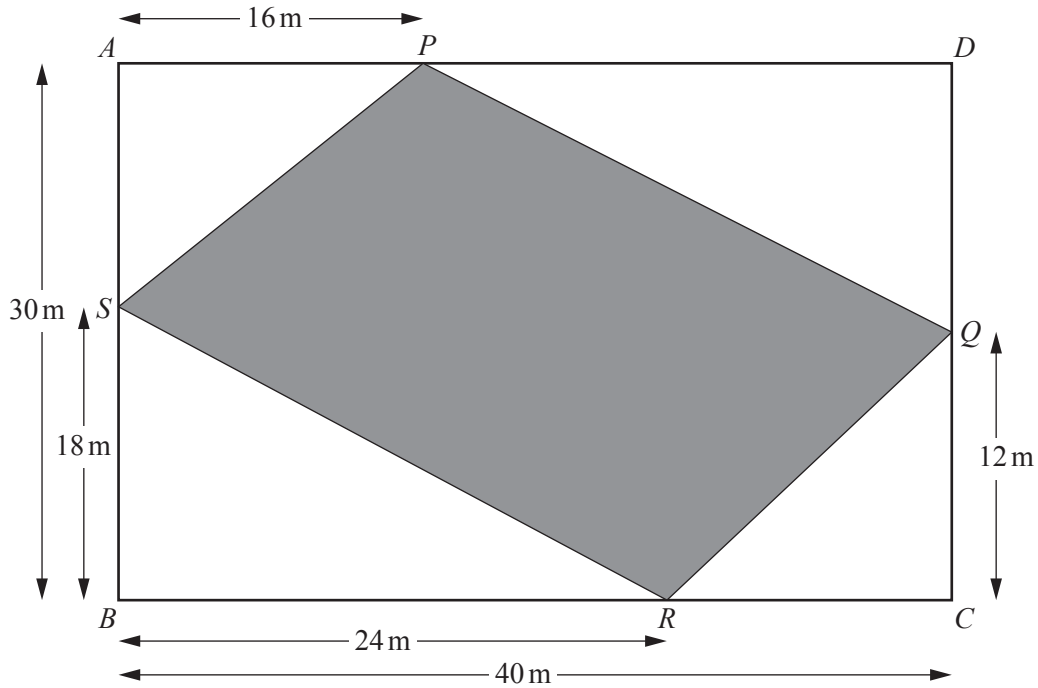
[2]

(ii) On the grid, draw a histogram to show this information.



[4]

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NOT TO SCALE

In the diagram,  $ABCD$  is a rectangle.

(a) Find  $PS$ .

$PS = \dots\dots\dots\text{ m [2]}$

(b) Find angle  $BRS$ .

Angle  $BRS = \dots\dots\dots [2]$

(c) Find the perimeter of  $PQRS$ .

$\dots\dots\dots\text{ m [3]}$

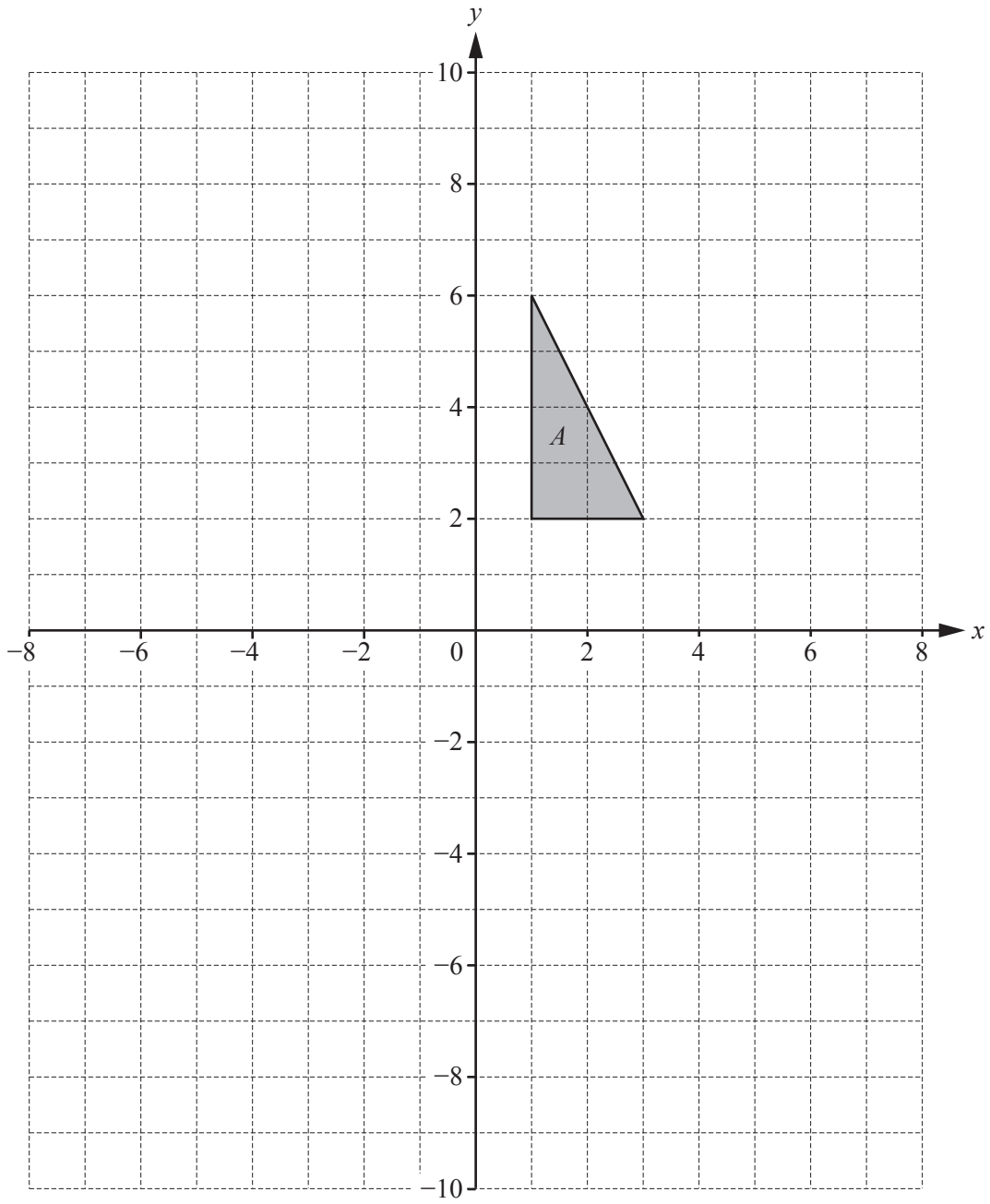


(d) Find the shaded area.

..... m<sup>2</sup> [3]

(e) Explain why triangle *ASP* is similar to triangle *BSR*.

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



(a) Translate triangle  $A$  with vector  $\begin{pmatrix} -7 \\ -3 \end{pmatrix}$ . Label the image  $B$ . [2]

(b) Rotate triangle  $A$  through  $90^\circ$  anti-clockwise about  $(-1, 2)$ . Label the image  $C$ . [2]

(c) Describe fully the **single** transformation that maps triangle  $C$  onto triangle  $B$ .

.....  
..... [3]

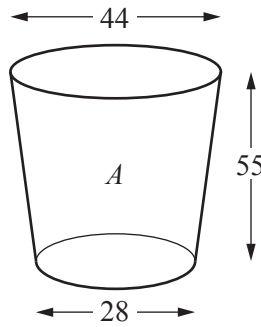
(d) Enlarge triangle  $A$  scale factor  $-2$  with centre  $(3, 1)$ . Label the image  $D$ . [2]

(e) Describe fully the **single** transformation that maps triangle  $D$  onto triangle  $A$ .

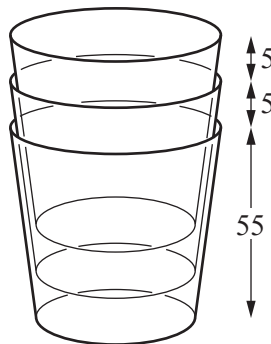
.....  
..... [2]

7 In this question, all lengths are measured in millimetres.

A small plastic cup, *A*, is shown in this diagram.



These plastic cups are stacked as shown in the diagram.



(a) Find the height of a stack of 8 of these cups.

..... mm [2]

(b) Find the number of these cups in a stack that has a total height of 105 mm.

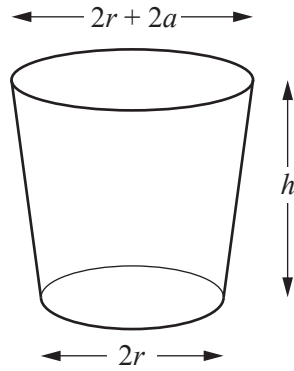
..... [2]

(c) A similar cup, *B*, has base diameter 42 mm.

Find the height of this cup.

..... mm [2]

(d)



The formula for the volume of a similar cup is  $V = \frac{\pi h(3r^2 + 3ar + a^2)}{3}$ .

(i) For cup *A*, show that  $a = 8$  mm.

[2]

(ii) Find the volume of cup *A*.

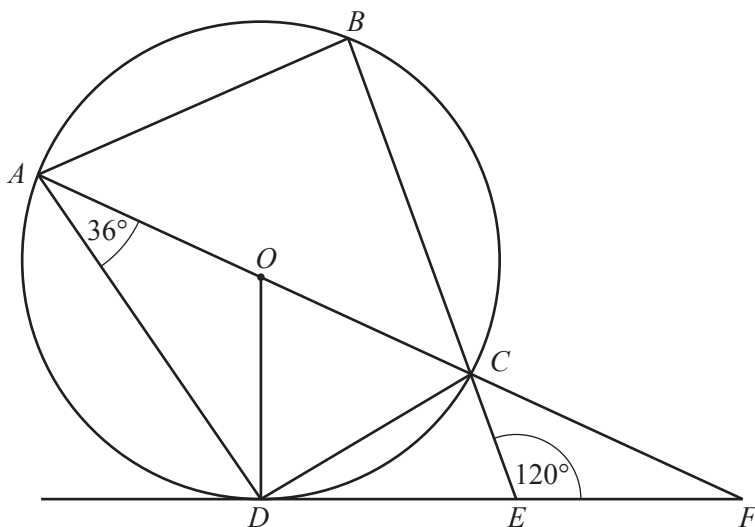
..... mm<sup>3</sup> [2]

(iii) Find the volume of cup *B*.

..... mm<sup>3</sup> [3]

(iv) Rearrange  $V = \frac{\pi h(3r^2 + 3ar + a^2)}{3}$  to make  $h$  the subject.

$h =$  ..... [2]



NOT TO SCALE

*A, B, C and D lie on a circle, centre O.  
DEF is a tangent to the circle at D.  
AOCF and BCE are straight lines.*

**(a)** Complete the statement.

Angle  $ODE = 90^\circ$  because .....

..... [1]

**(b)** Find the value of

**(i)** angle  $AOD$ ,

Angle  $AOD = \dots\dots\dots$  [2]

**(ii)** angle  $ODC$ ,

Angle  $ODC = \dots\dots\dots$  [2]

(iii) angle  $ABC$ ,

Angle  $ABC = \dots\dots\dots$  [1]

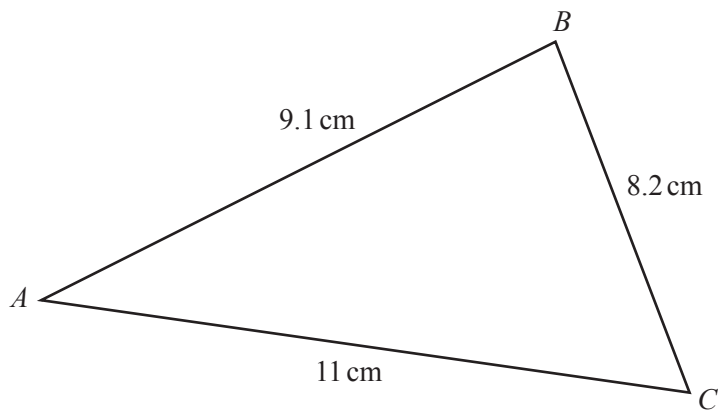
(iv) angle  $CFD$ ,

Angle  $CFD = \dots\dots\dots$  [1]

(v) angle  $CAB$ .

Angle  $CAB = \dots\dots\dots$  [1]

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NOT TO SCALE

(a) Show that angle  $BAC = 47.0^\circ$ , correct to 1 decimal place.

[3]

(b) Use the sine rule to find angle  $ABC$ .

Angle  $ABC = \dots\dots\dots$  [3]



(c) Find the area of triangle  $ABC$ .

.....  $\text{cm}^2$  [2]

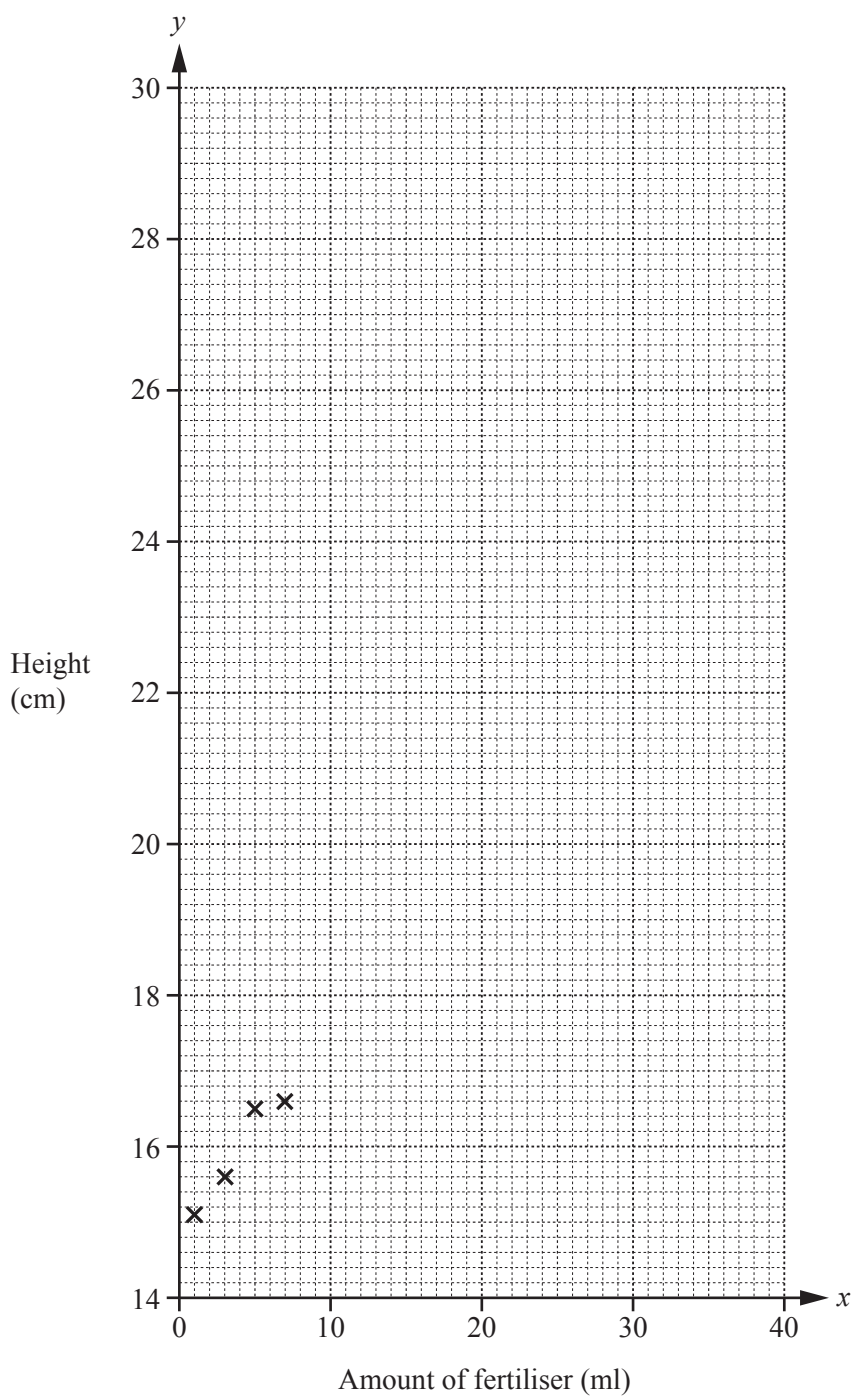
(d) Find the length of the perpendicular from  $B$  to  $AC$ .

.....  $\text{cm}$  [2]

- 10 Wasim sprays different amounts of fertiliser on some seedlings. He measures the amount,  $x$  millilitres, sprayed on each seedling. A week later he measures the height,  $y$  centimetres, of each seedling. His results are shown in the table.

Amount of fertiliser ( $x$ ml)	1	3	5	7	10	14	18	25	30	35	40
Height ( $y$ cm)	15.1	15.6	16.5	16.6	17	19.8	21	25.1	28.8	28.6	29.1

- (a) (i) Complete the scatter diagram.  
The first four points have been plotted for you.



(ii) What type of correlation is shown by the scatter diagram?

..... [1]

(b) Find

(i) the mean amount of fertiliser,

..... ml [1]

(ii) the mean height.

..... cm [1]

(c) (i) Find the equation of the regression line in the form  $y = mx + c$ .

$y =$  ..... [2]

(ii) Use your answer to **part (c)(i)** to estimate the height of a seedling when the amount of fertiliser is 20 ml.

..... cm [1]

(iii) Write down the units of  $m$  in the equation of the regression line,  $y = mx + c$ .

..... [1]

**Question 11 is printed on the next page.**

11  $f(x) = 2x - 7$        $g(x) = \sqrt{x}$        $h(x) = \frac{1}{x}, x \neq 0$

(a) (i) Find  $f(3)$ .

..... [1]

(ii) Solve  $f(x) = 1$ .

$x =$  ..... [2]

(b) Find  $f^{-1}(x)$ .

$f^{-1}(x) =$  ..... [2]

(c) (i) Find  $f(g(x))$  in terms of  $x$ .

..... [1]

(ii) Solve  $f(g(x)) = 5$ .

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

(d) (i) Find  $h(g(f(x)))$  in terms of  $x$ .

..... [2]

(ii) Find an inequality in terms of  $x$  for which  $h(g(f(x)))$  exists.

..... [2]

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