

1 (a) Alex has \$20 and Bobbie has \$25.

(i) Write down the ratio Alex's money : Bobbie's money in its simplest form.

..... [1]

(ii) Alex and Bobbie each spend $\frac{1}{5}$ of their money.

Find the ratio Alex's remaining money : Bobbie's remaining money in its simplest form.

..... [1]

(iii) Alex and Bobbie **then** each spend \$4.

Find the new ratio Alex's remaining money : Bobbie's remaining money in its simplest form.

..... [2]

(b) (i) The population of a town in the year 1990 was 15 600.
The population is now 11 420.

Calculate the percentage decrease in the population.

.....% [3]

(ii) The population of 15 600 was 2.5% less than the population in the year 1980.

Calculate the population in the year 1980.

..... [3]

- (c) Chris invests \$200 at a rate of $x\%$ per year simple interest.
At the end of 15 years the total interest received is \$48.

Find the value of x .

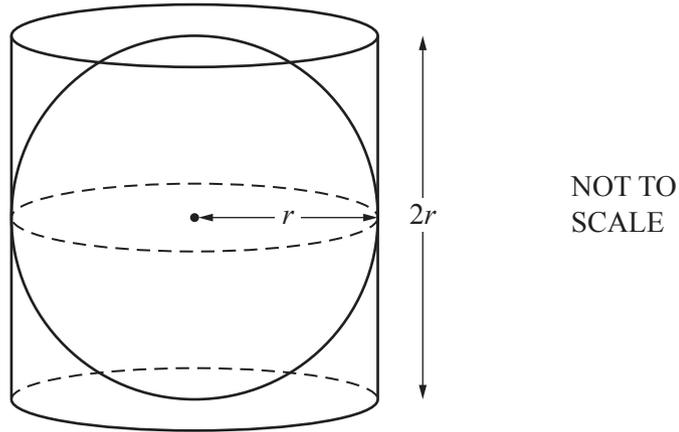
$$x = \dots\dots\dots [2]$$

- (d) Dani invests \$200 at a rate of $y\%$ per year compound interest.
At the end of 10 years the value of her investment is \$256.

Calculate the value of y , correct to 1 decimal place.

$$y = \dots\dots\dots [3]$$

2 (a)



A sphere of radius r is inside a closed cylinder of radius r and height $2r$.

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

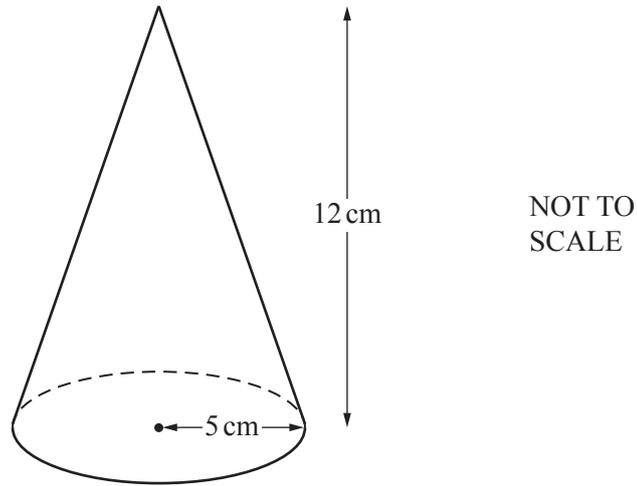
(i) When $r = 8$ cm, calculate the volume inside the cylinder which is **not** occupied by the sphere.

..... cm³ [3]

(ii) Find r when the volume inside the cylinder **not** occupied by the sphere is 36 cm³.

$r =$ cm [3]

(b)



The diagram shows a solid cone with radius 5 cm and perpendicular height 12 cm.

- (i) The **total** surface area is painted at a cost of \$0.015 per cm^2 .

Calculate the cost of painting the cone.

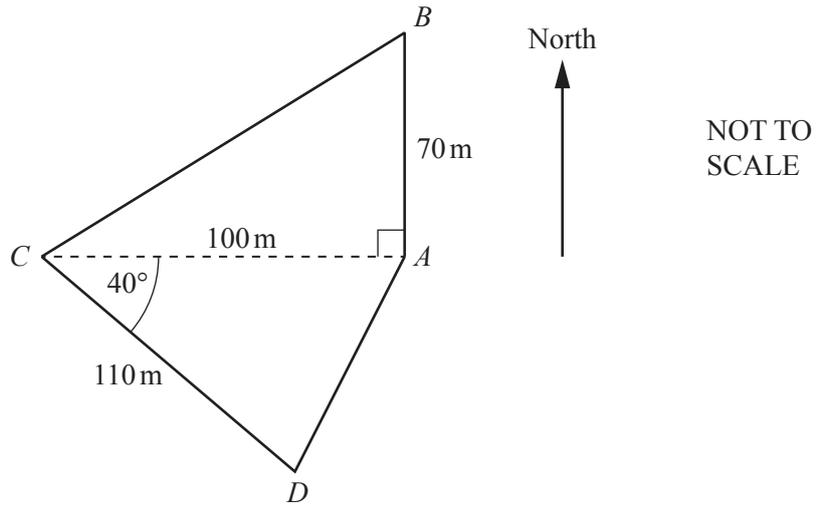
[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi rl$.]

\$ [4]

- (ii) The cone is made of metal and is melted down and made into smaller solid cones with radius 1.25 cm and perpendicular height 3 cm.

Calculate the number of smaller cones that can be made.

..... [3]



The diagram shows a field *ABCD*.

(a) Calculate the area of the field *ABCD*.

.....m² [3]

(b) Calculate the perimeter of the field *ABCD*.

..... m [5]

(c) Calculate the shortest distance from A to CD .

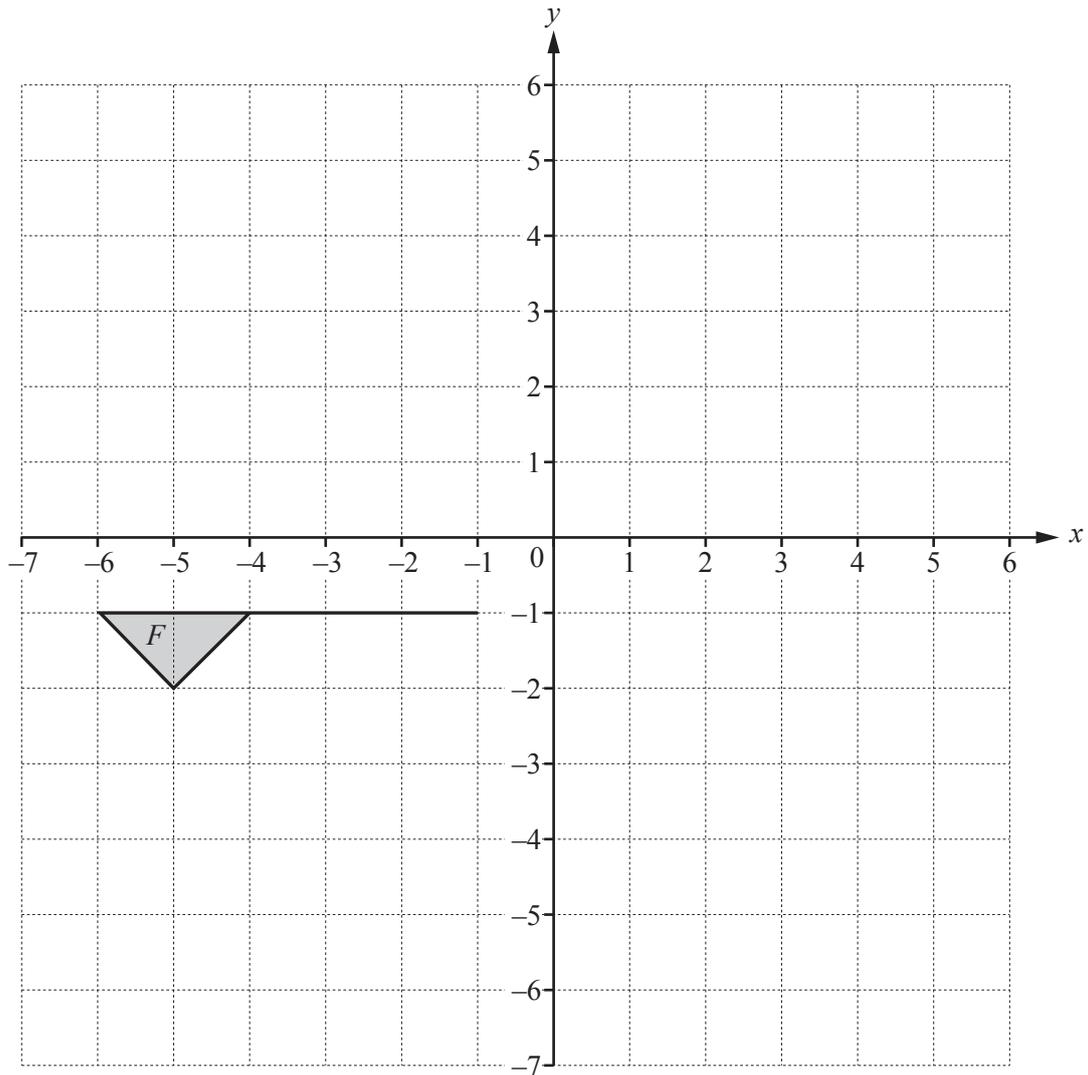
..... m [2]

(d) B is due north of A .

Find the bearing of C from B .

..... [3]

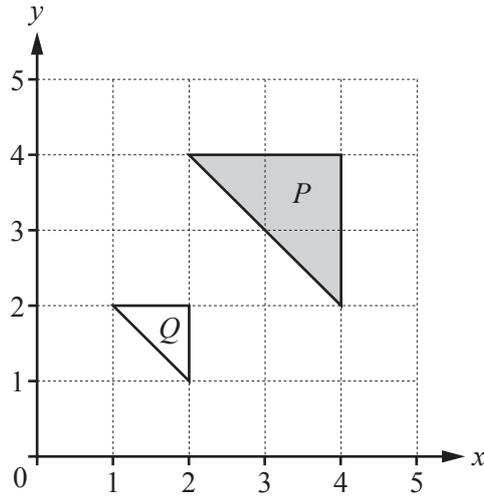
4 (a)



Draw the image of

- (i) flag F after translation by the vector $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$, [2]
- (ii) flag F after rotation through 180° about $(-2, 0)$, [2]
- (iii) flag F after reflection in the line $y = x$. [2]

(b)



(i) Describe fully the **single** transformation that maps triangle P onto triangle Q .

.....
 [3]

(ii) Find the matrix that represents this transformation.

$\left(\begin{array}{cc} & \\ & \end{array} \right)$ [2]

(c) The point A is translated to the point B by the vector $\begin{pmatrix} 4u \\ 3u \end{pmatrix}$.

$|\vec{AB}| = 12.5$

Find u .

$u = \dots\dots\dots$ [3]

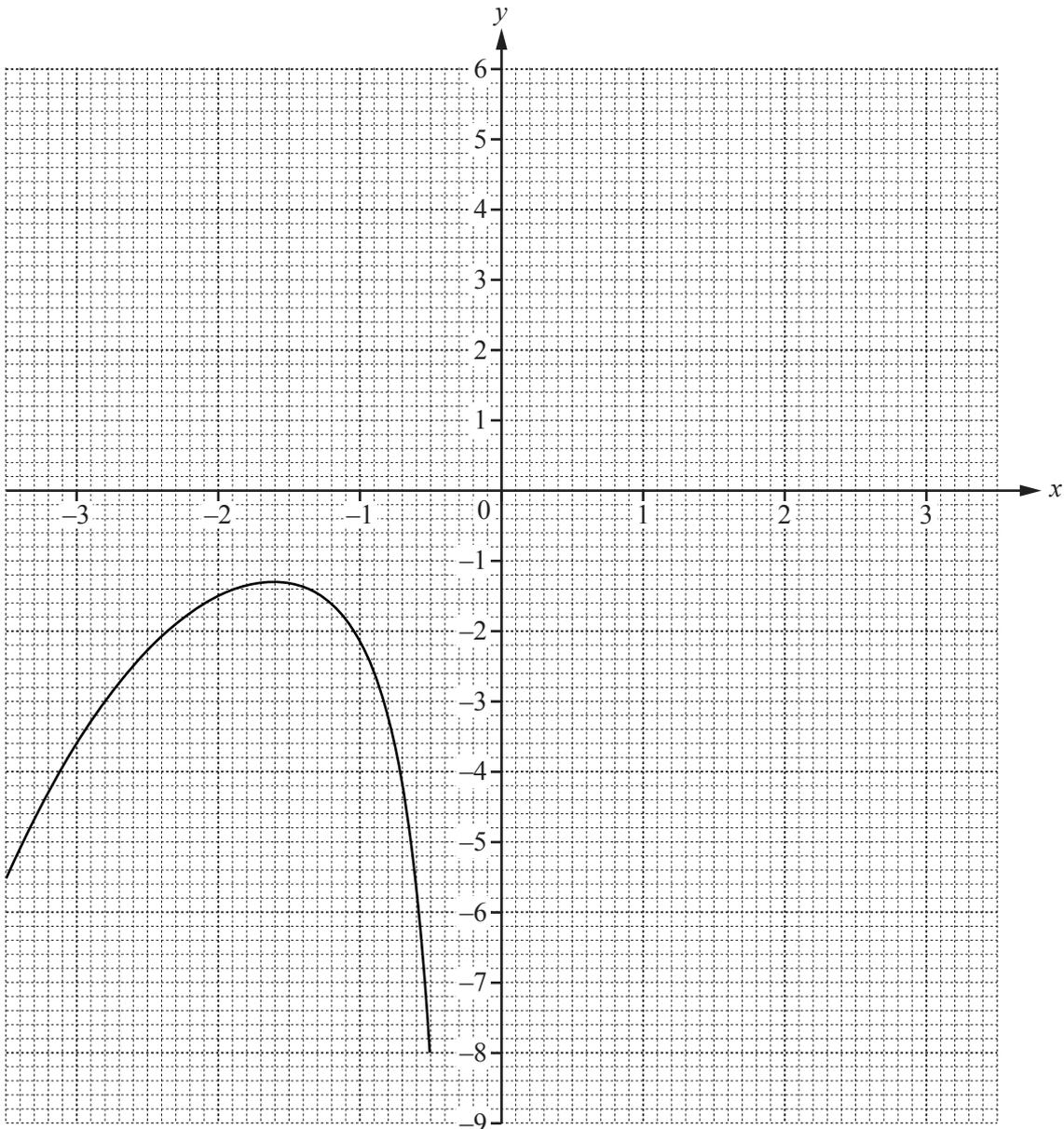
5 $y = \frac{x^3}{8} - \frac{2}{x^2}, x \neq 0$

(a) Complete the table of values.

x	0.5	1	1.5	2	2.5	3	3.5
y	-8.0	-1.9	-0.5	0.5	1.6		

[2]

(b)



The graph of $y = \frac{x^3}{8} - \frac{2}{x^2}$ for $-3.5 \leq x \leq -0.5$ has already been drawn.

On the grid, draw the graph of $y = \frac{x^3}{8} - \frac{2}{x^2}$ for $0.5 \leq x \leq 3.5$.

[4]

(c) Use your graph to solve the equation $\frac{x^3}{8} - \frac{2}{x^2} = 0$.

$x = \dots\dots\dots$ [1]

(d) $\frac{x^3}{8} - \frac{2}{x^2} = k$ and k is an integer.

Write down a value of k when the equation $\frac{x^3}{8} - \frac{2}{x^2} = k$ has

(i) one answer,

$k = \dots\dots\dots$ [1]

(ii) three answers.

$k = \dots\dots\dots$ [1]

(e) By drawing a suitable tangent, estimate the gradient of the curve where $x = -3$.

$\dots\dots\dots$ [3]

(f) (i) By drawing a suitable line on the grid, find x when $\frac{x^3}{8} - \frac{2}{x^2} = 6 - x$.

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

(ii) The equation $\frac{x^3}{8} - \frac{2}{x^2} = 6 - x$ can be written as $x^5 + ax^3 + bx^2 + c = 0$.

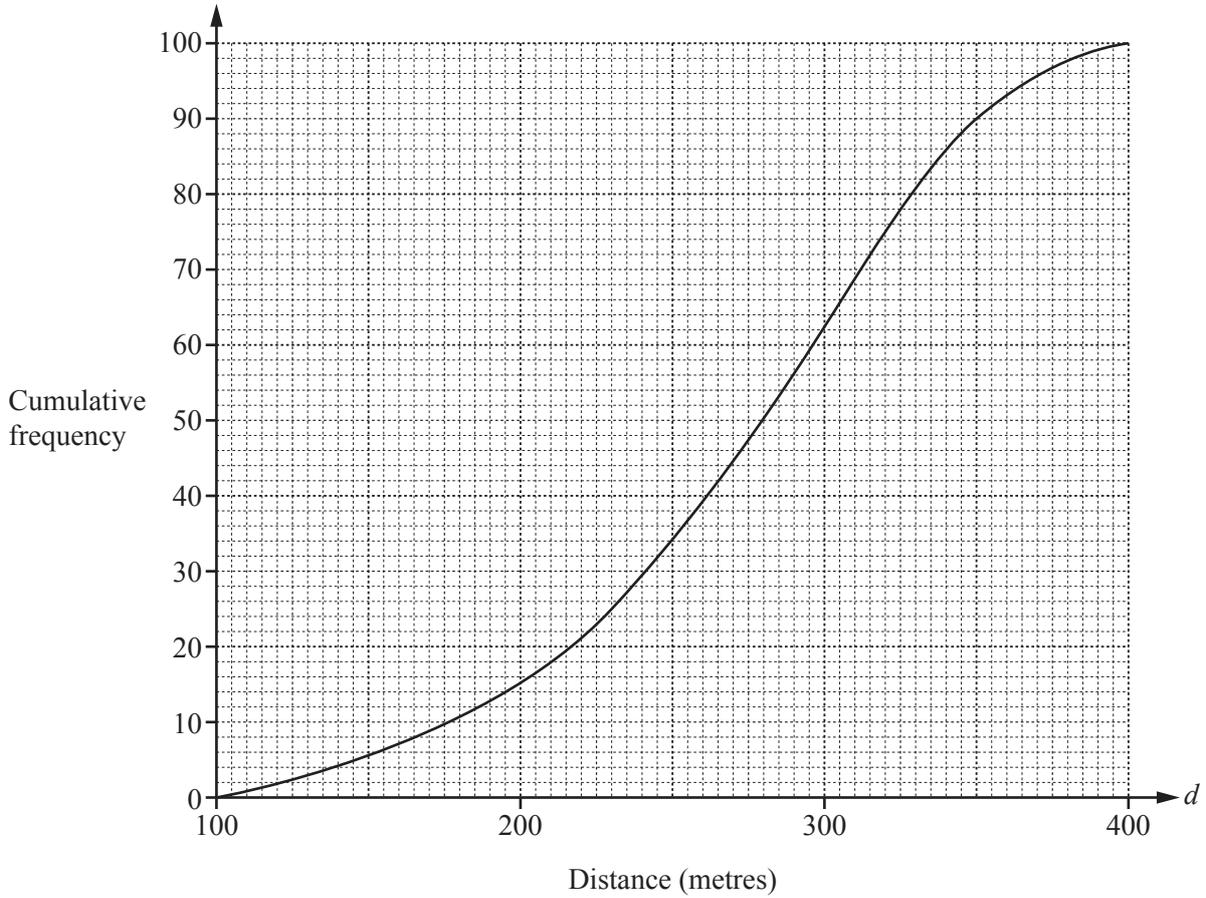
Find the values of a , b and c .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$ [4]

- 6 (a) There are 100 students in group *A*.
 The teacher records the distance, d metres, each student runs in one minute.
 The results are shown in the cumulative frequency diagram.



Find

- (i) the median,

..... m [1]

- (ii) the upper quartile,

..... m [1]

- (iii) the inter-quartile range,

..... m [1]

- (iv) the number of students who run more than 350 m.

..... [2]

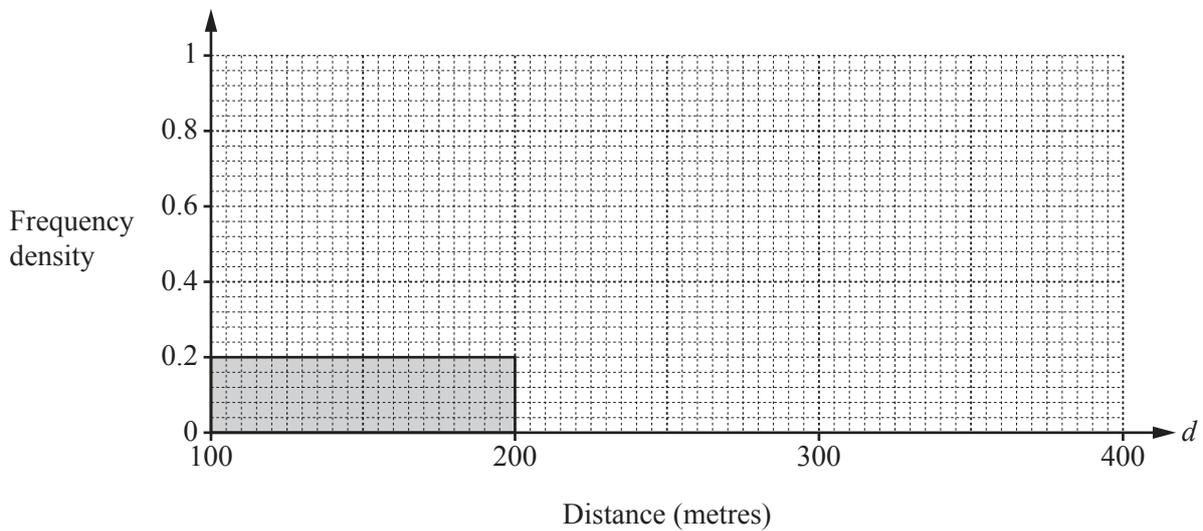
- (b) There are 100 students in group *B*.
 The teacher records the distance, d metres, each of these students runs in one minute.
 The results are shown in the frequency table.

Distance (d metres)	$100 < d \leq 200$	$200 < d \leq 250$	$250 < d \leq 280$	$280 < d \leq 320$	$320 < d \leq 400$
Number of students	20	22	30	16	12

- (i) Calculate an estimate of the mean distance for group *B*.

..... m [4]

- (ii) Complete the histogram to show the information in the frequency table.

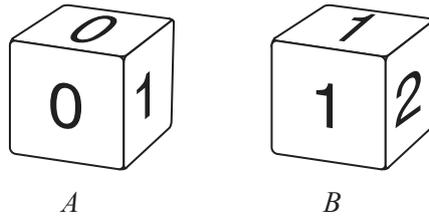


[4]

- (c) For the 100 students in group *B*, the median is 258 m.

Complete the statement.

On average, the students in group *A* run than the students in group *B*. [1]



The diagram shows two fair dice.
 The numbers on dice *A* are 0, 0, 1, 1, 1, 3.
 The numbers on dice *B* are 1, 1, 2, 2, 2, 3.
 When a dice is rolled, the score is the number on the top face.

(a) Dice *A* is rolled once.

Find the probability that the score is not 3.

..... [1]

(b) Dice *A* is rolled twice.

Find the probability that the score is 0 both times.

..... [2]

(c) Dice *A* is rolled 60 times.

Calculate an estimate of the number of times the score is 0.

..... [1]

(d) Dice *A* and dice *B* are each rolled once.
The product of the scores is recorded.

(i) Complete the possibility diagram.

Dice <i>B</i>	3	0	0				
	2	0	0				
	2	0	0				
	2	0	0				
	1	0	0				
	1	0	0	1	1	1	3
		0	0	1	1	1	3
		Dice <i>A</i>					

[2]

(ii) Find the probability that the product of the scores is

(a) 2,

..... [1]

(b) greater than 3.

..... [1]

(e) Eva keeps rolling dice *B* until 1 is scored.

Find the probability that this happens on the 5th roll.

..... [2]

- 8 (a) The cost of 1 apple is a cents.
The cost of 1 pear is p cents.
The total cost of 7 apples and 9 pears is 354 cents.

(i) Write down an equation in terms of a and p .

..... [1]

(ii) The cost of 1 pear is 2 cents more than the cost of 1 apple.

Find the value of a and the value of p .

$a =$

$p =$ [3]

(b) Rowena walks 2 km at an average speed of x km/h.

(i) Write down an expression, in terms of x , for the time taken.

..... h [1]

(ii) Rowena then walks 3 km at an average speed of $(x - 1)$ km/h.
The total time taken to walk the 5 km is 2 hours.

(a) Show that $2x^2 - 7x + 2 = 0$.

[3]

- (b) Find the value of x .
Show all your working and give your answer correct to 2 decimal places.

$x = \dots\dots\dots$ [4]

9 $f(x) = 1 - 2x$ $g(x) = x + 4$ $h(x) = x^2 + 1$

(a) Find $f(-1)$.

..... [1]

(b) Solve the equation.

$$2f(x) = g(x)$$

$x =$ [2]

(c) Find $fg(x)$.

Give your answer in its simplest form.

..... [2]

(d) Find $hh(2)$.

..... [2]

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

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

(f) $hgf(x) = 4x^2 + px + q$

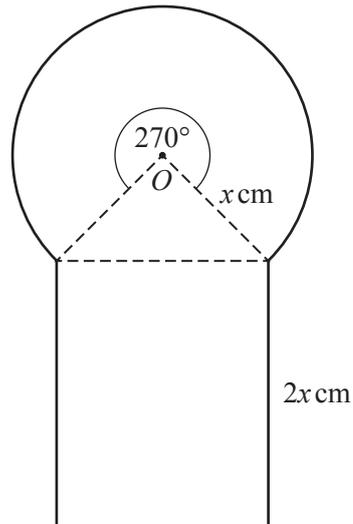
Find the value of p and the value of q .

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [4]$$

Question 10 is printed on the next page.

10

NOT TO
SCALE

The diagram shows a sector of a circle, a triangle and a rectangle.
The sector has centre O , radius x cm and angle 270° .
The rectangle has length $2x$ cm.

The total area of the shape is kx^2 cm².

(a) Find the value of k .

$k = \dots\dots\dots$ [5]

(b) Find the value of x when the total area is 110 cm².

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

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