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.

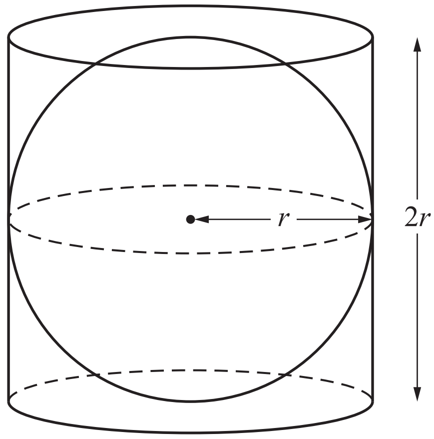
x = ... [2]

(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 = ... [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 $V = \frac{4}{3}\pi r^3$.]

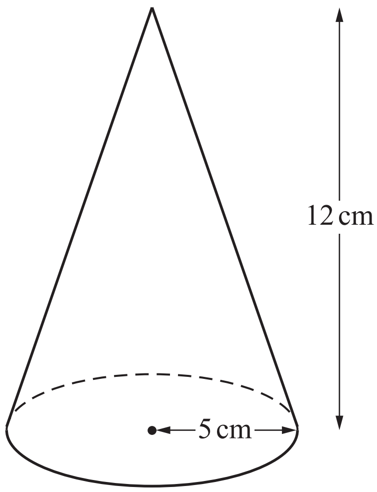
(i) When $r = 8$ cm, calculate the volume inside the cylinder which is **not** occupied by the sphere.

.... cm^3 [3]

(ii) Find r when the volume inside the cylinder **not** occupied by the sphere is 36 cm^3.

r = ... cm [3]

(b)



NOT TO SCALE

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 $A = \pi r l$.]

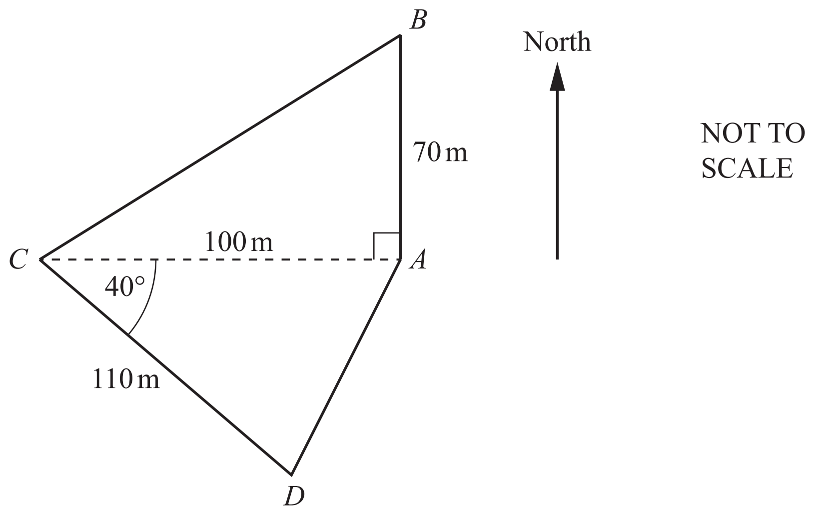
\$ .... [4]

(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]

3



The diagram shows a field *ABCD*.

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

....m^2 [3]

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

.... m [5]

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

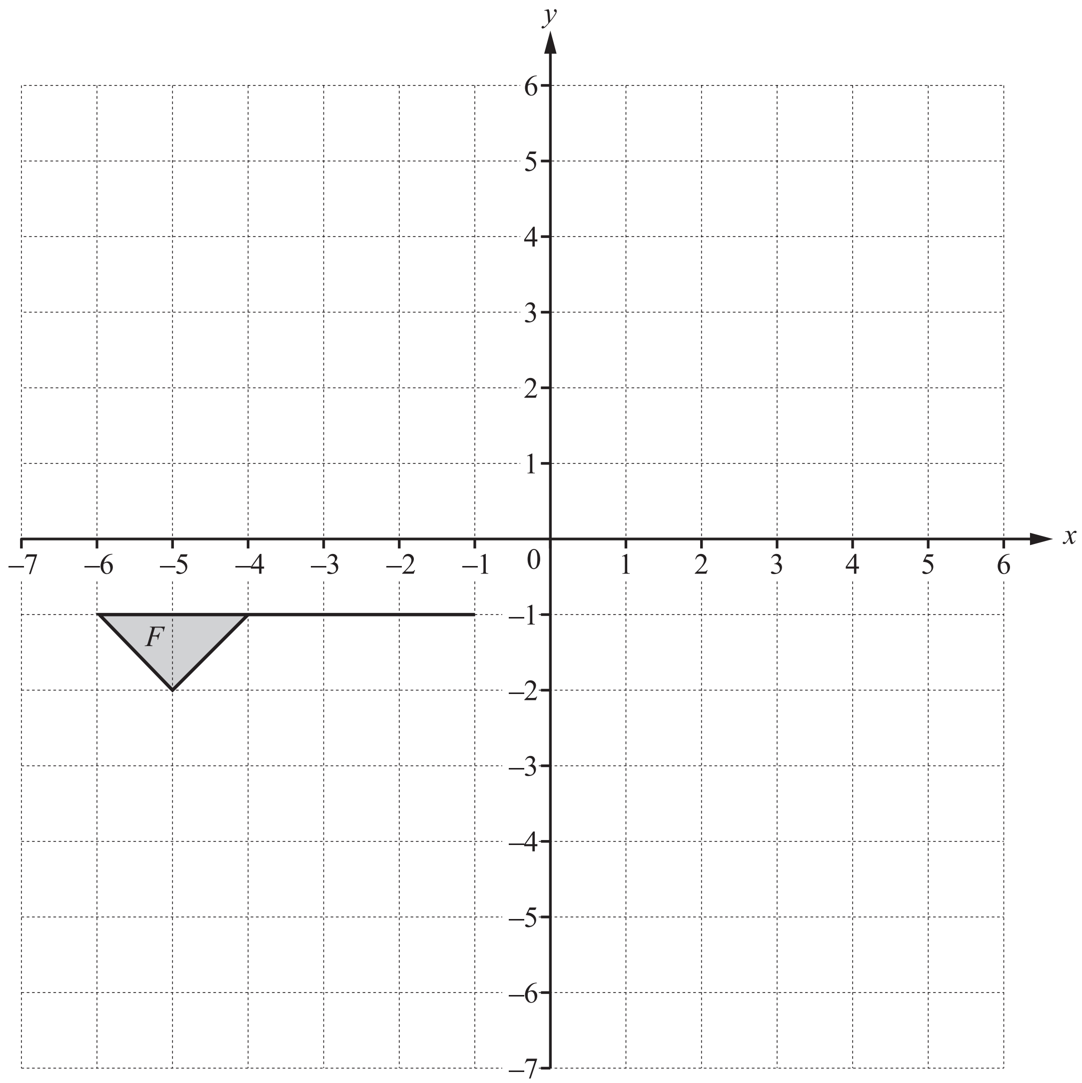
.... m [2]

(d) B is due north of A.

Find the bearing of C from B.

.... [3]

4 **(a)**



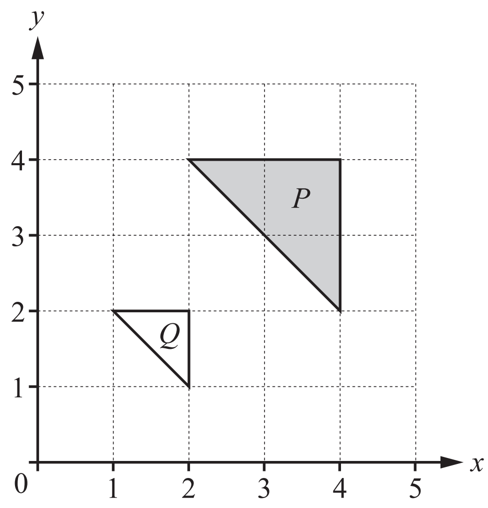
Draw the image of

(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.

$$\begin{pmatrix} & \\ & \end{pmatrix}$$ [2]

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

$|\overrightarrow{AB}| = 12.5$

Find u.

$u =$ .... [3]

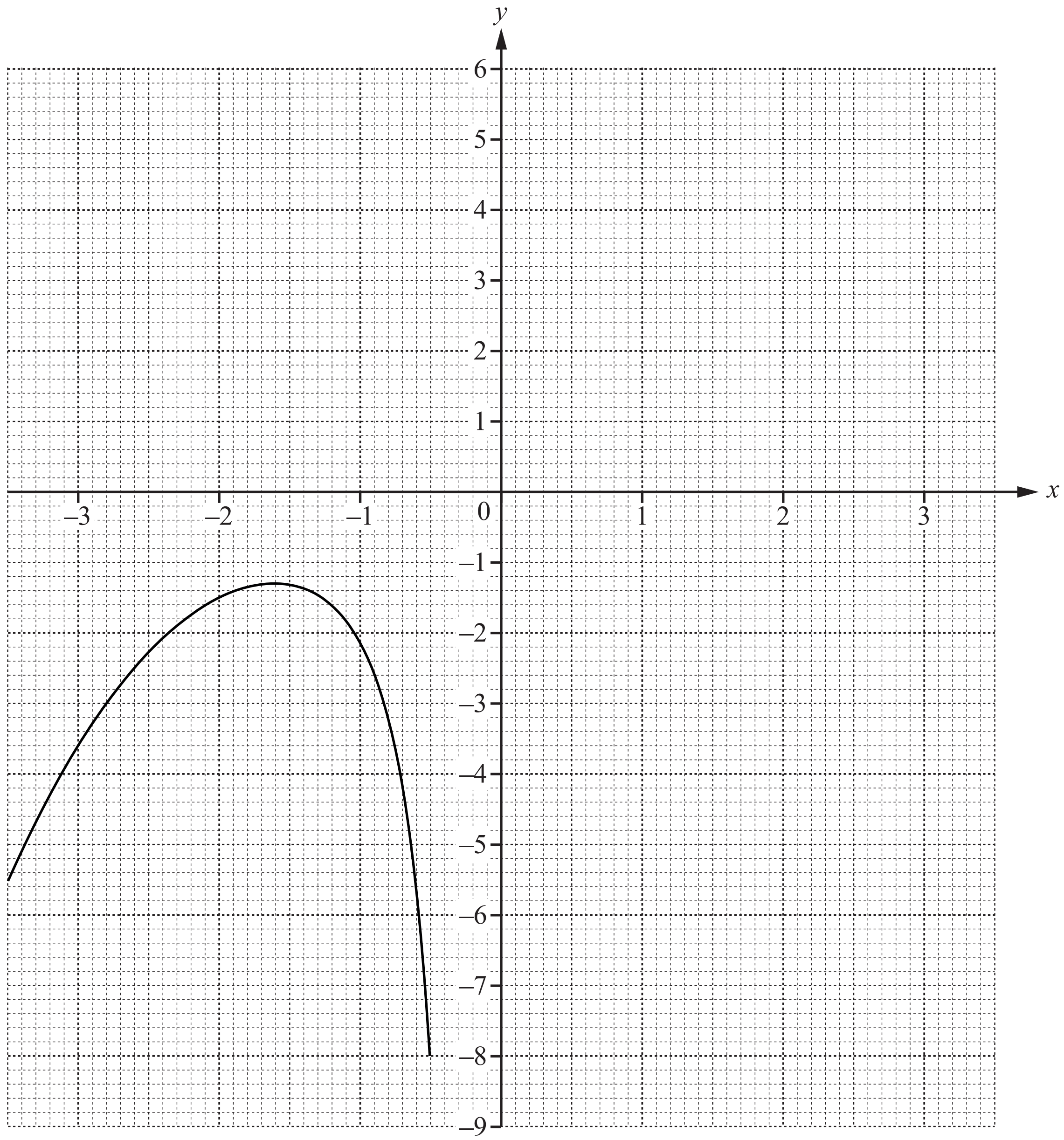
5 $y = \frac{x^3}{8} - \frac{2}{x^2}$, $x \neq 0$

(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 $-3.5 \leqslant x \leqslant -0.5$ has already been drawn.

On the grid, draw the graph of $y = \frac{x^3}{8} - \frac{2}{x^2}$ for $0.5 \leqslant x \leqslant 3.5$. [4]

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

$x =$ .... [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, $k =$ .... [1]

(ii) three answers. $k =$ .... [1]

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

.... [3]

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

$x =$ .... [3]

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

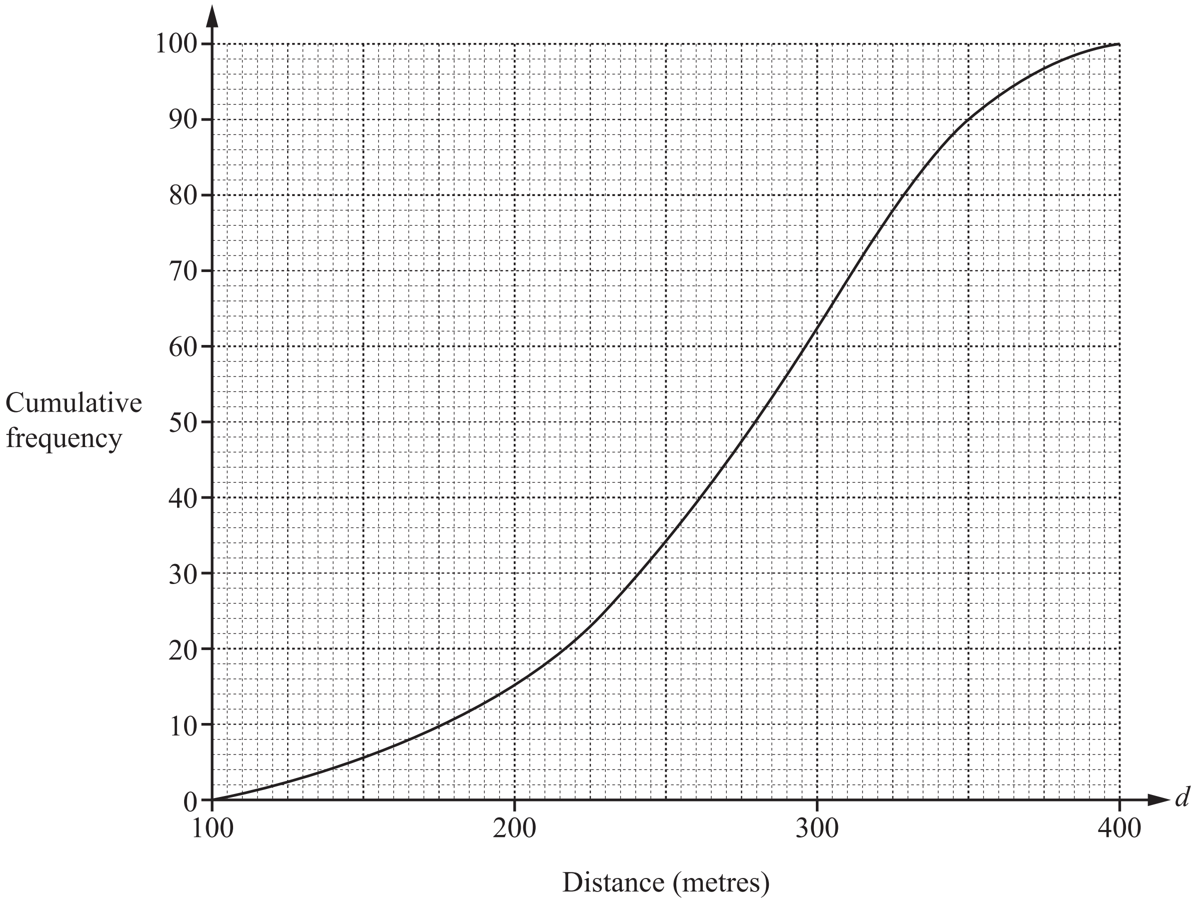
Find the values of a, b and c.

$a =$ ....

$b =$ ....

$c =$ .... [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]

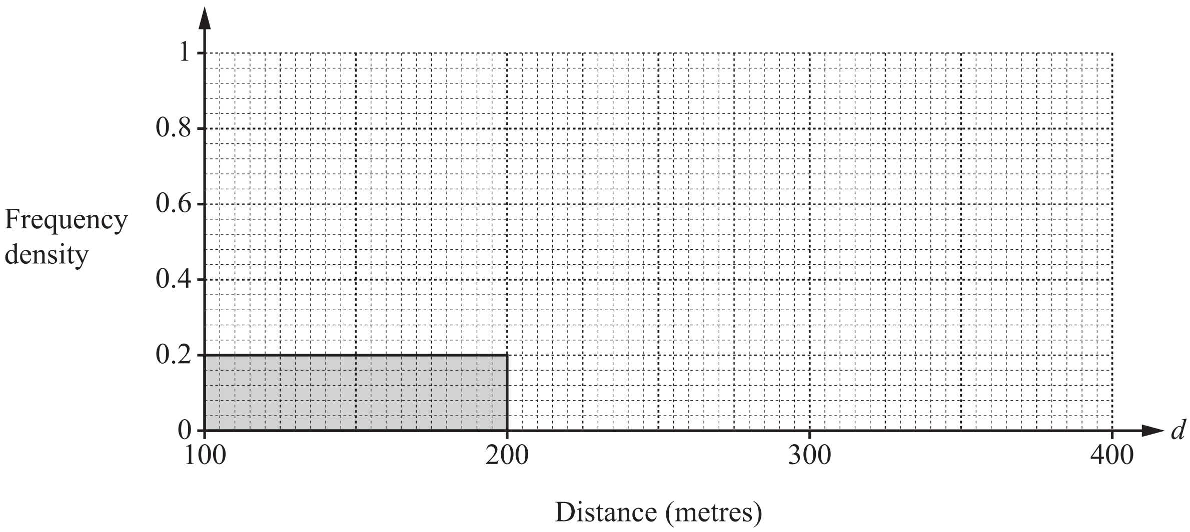
(b) There are 100 students in group B.
The teacher records the distance, d metres, each of these students runs in one minute.
The results are shown in the frequency table.

Distance (d metres)	$100 < d \leqslant 200$	$200 < d \leqslant 250$	$250 < d \leqslant 280$	$280 < d \leqslant 320$	$320 < d \leqslant 400$
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.



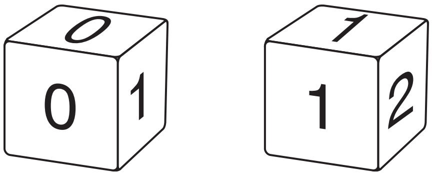
[4]

(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]

7



A *B*

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 B						
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 A					

[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.

$x =$ .... [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) $\mathrm{hgf}(x) = 4x^2 + px + q$

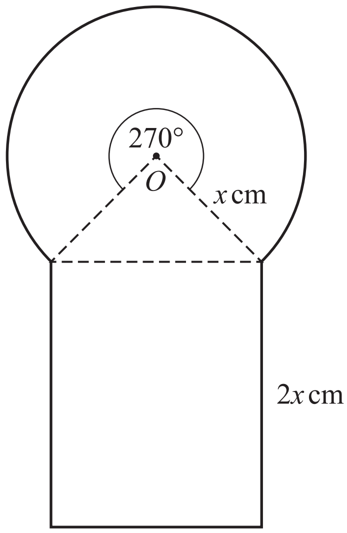
Find the value of p and the value of q.

$p =$ ....

$q =$ .... [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 cm^2.

(a) Find the value of k.

k = ... [5]

(b) Find the value of x when the total area is 110 cm^2.

x = ... [2]