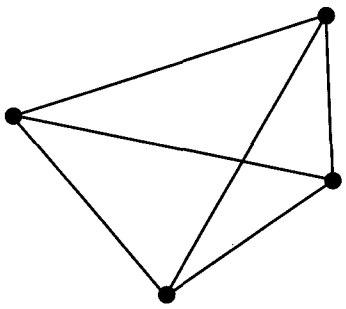
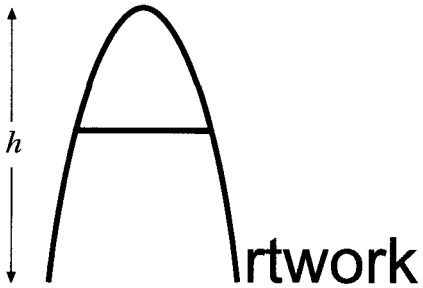
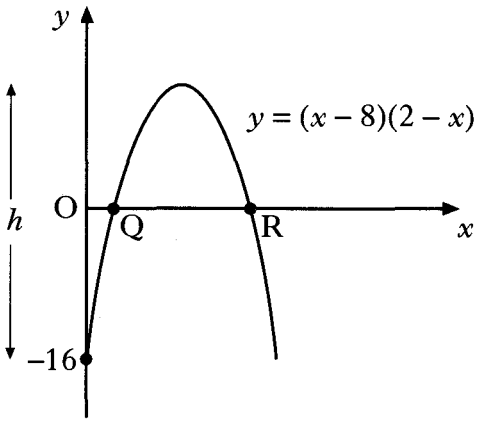
Quadratic Equations & Graphs

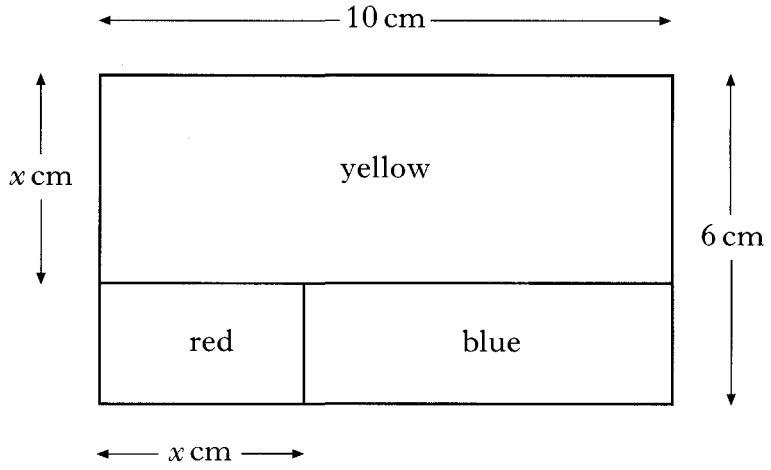
2008 P2	**11.** The minimum number of roads joining 4 towns to each other is 6 as shown.  The minimum number of roads, r, joining n towns to each other is given by the formula $r = \frac{1}{2}n(n-1)$. (*a*) State the minimum number of roads needed to join 7 towns to each other. (*b*) When $r = 55$, show that $n^2 - n - 110 = 0$. (*c*) Hence find **algebraically** the value of n.	1	2 3
Ans	(a) 21 (b) Proof (c) 11		

2008 P1	**8.** The curved part of the letter A in the *Artwork* logo is in the shape of a parabola. The equation of this parabola is $y = (x - 8)(2 - x)$.   (*a*) Write down the coordinates of Q and R. (*b*) Calculate the height, h, of the letter A.	2 3	
Ans	(a) Q(2 , 0) , R(8 , 0) (b) 25 units		
2007 P2	**2.** Solve the equation $3x^2 - 2x - 10 = 0.$ Give your answer **correct to 2 significant figures**.	4	
Ans	2.2 , -1.5		

2007 P2

11. (*a*) A decorator's logo is rectangular and measures 10 centimetres by 6 centimetres.

It consists of three rectangles: one red, one yellow and one blue.



The yellow rectangle measures 10 centimetres by x centimetres.

The width of the red rectangle is x centimetres.

Show that the area, A, of the blue rectangle is given by the expression

$$A = x^2 - 16x + 60.$$

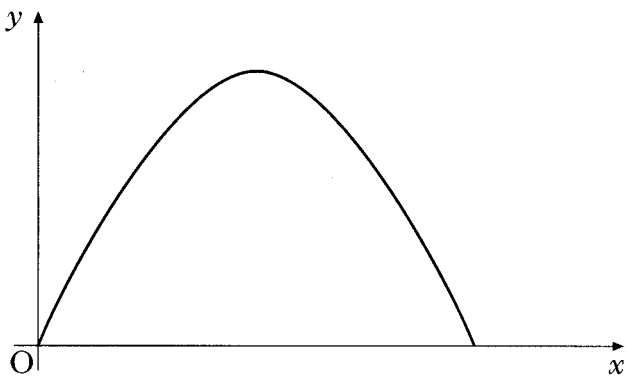
2

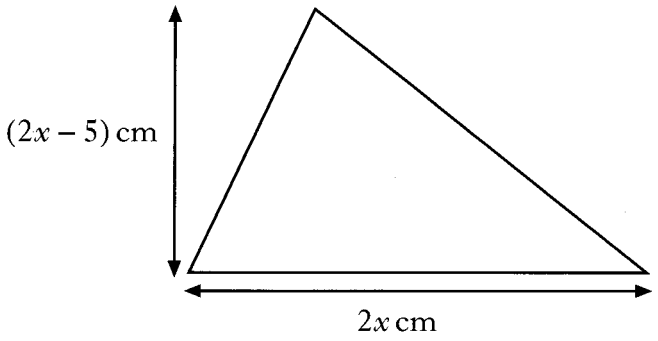
(*b*) The area of the blue rectangle is equal to $\frac{1}{5}$ of the total area of the logo.

Calculate the value of x.

4

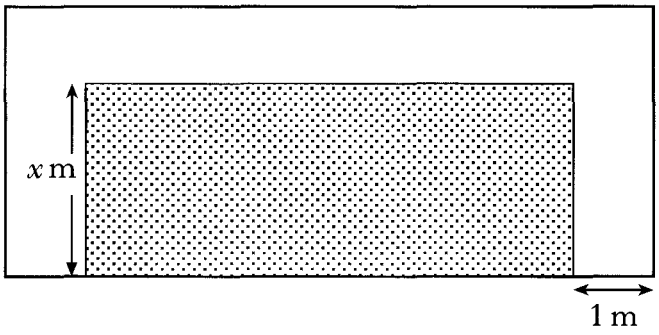
Ans (a) Proof (b) 4cm

2007 P2	**13.** The profit made by a publishing company of a magazine is calculated by the formula $$y = 4x(140 - x),$$ where y is the profit (in pounds) and x is the selling price (in pence) of the magazine. The graph below represents the profit y against the selling price x.  Find the maximum profit the company can make from the sale of the magazine.		4
Ans	£19600		
2006 P2	**9.** The number of diagonals, d, in a polygon of n sides is given by the formula $$d = \tfrac{1}{2}n(n-3).$$ (*a*) How many diagonals does a polygon of 7 sides have?	2	
	(*b*) A polygon has 65 diagonals. Show that for this polygon, $n^2 - 3n - 130 = 0$.		2
	(*c*) Hence find the number of sides in this polygon.		3
Ans	(a) 14 (b) Proof (c) 13		

2005 P1	**12.** The height of a triangle is $(2x - 5)$ centimetres and the base is $2x$ centimetres.  The area of the triangle is 7 square centimetres. Calculate the value of x.		5
Ans	3.5cm		
2005 P2	**4.** Solve the equation $x^2 + 2x = 9.$ Give your answers **correct to 1 decimal place**.	3	
Ans	2.2 , -4.2		

2004 P2

11. A rectangular lawn has a path, 1 metre wide, on 3 sides as shown.



The breadth of the lawn is x metres.

The length of the lawn is three times its breadth.

The area of the lawn equals the area of the path.

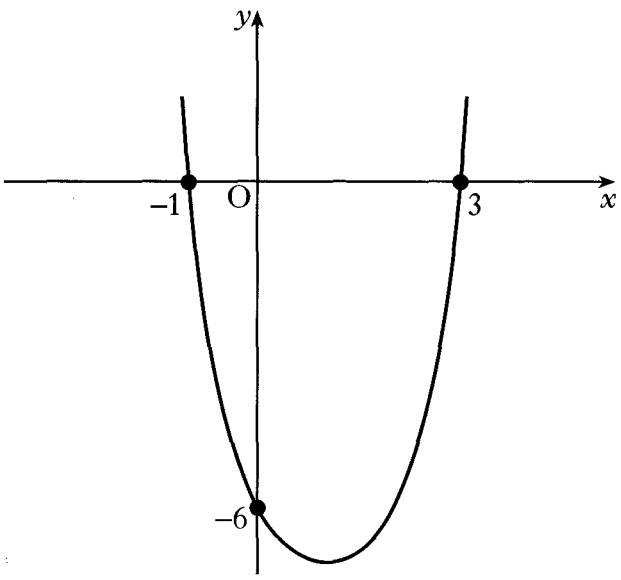
(*a*) Show that $3x^2 - 5x - 2 = 0$. 3

(*b*) Hence find the **length** of the lawn. 4

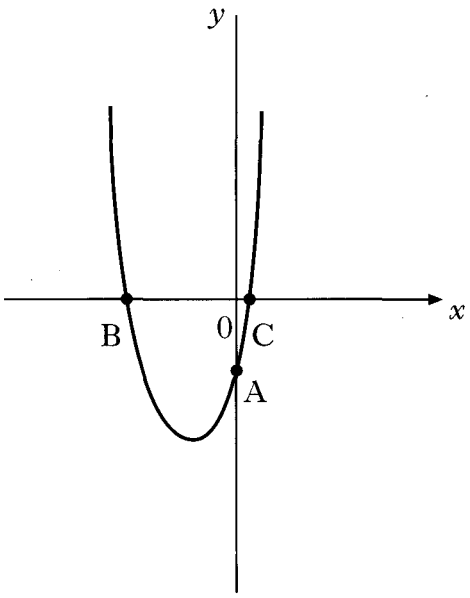
Ans

(*a*) area of lawn = $3x^2$
area of path = $5x + 2$
$3x^2 = 5x + 2$
$3x^2 - 5x - 2 = 0$

(*b*) 6 m

2003 P2	**8.** The diagram below shows part of the graph of a quadratic function, with equation of the form $y = k(x - a)(x - b)$. The graph cuts the y-axis at $(0, -6)$ and the x-axis at $(-1, 0)$ and $(3, 0)$.  (*a*) Write down the values of a and b. (*b*) Calculate the value of k. (*c*) Find the coordinates of the minimum turning point of the function.	2 2	2
Ans	(a) -1, 3 (b) 2 (c) (1,-8)		
2002 P1	**9.** Two functions are given below. $f(x) = x^2 + 2x - 1$ $g(x) = 5x + 3$ Find the values of x for which $f(x) = g(x)$.	4	
Ans	x = -1, 4		

2002 P2	**3.** Solve the equation $2x^2 + 3x - 7 = 0.$ Give your answers **correct to 1 decimal place**.	4	
Ans	$x = 1.3, -2.8$		
2001 P2	**11.** A rectangular wall vent is 30 centimetres long and 20 centimetres wide. It is to be enlarged by increasing **both** the length and the width by x centimetres. (*a*) Write down the length of the new vent. (*b*) Show that the area, A square centimetres, of the new vent is given by $A = x^2 + 50x + 600.$ (*c*) The area of the new vent **must** be **at least** 40% more than the original area. Find the **minimum** dimensions, to the nearest centimetre, of the new vent.		1 2 5
Ans	(*a*) $30 + x$ (*b*) $A = (30 + x)(20 + x)$ $= 600 + 30x + 20x + x^2$ $= 600 + 50x + x^2$ (*c*) Minimum dimensions are 35 cm and 25 cm		

2001 P1	**8.** The diagram below shows part of the graph of $y = 4x^2 + 4x - 3$. The graph cuts the y-axis at A and the x-axis at B and C.  (*a*) Write down the coordinates of A. (*b*) Find the coordinates of B and C. (*c*) Calculate the minimum value of $4x^2 + 4x - 3$.	1 3	2
Ans	(*a*) A (0,–3) (*b*) B$(-\frac{3}{2},0)$ C$(\frac{1}{2},0)$ (*c*) – 4		
2000 P2	**3.** Solve the equation $x^2 + 3x - 5 = 0$. Give your answer **correct to 2 significant figures**.	4	
Ans	x = 1.2, -4.2		