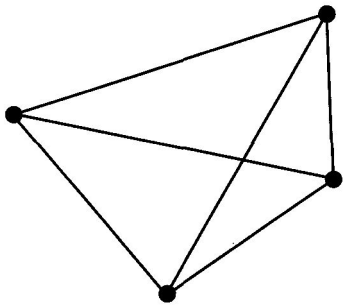
1.

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

$$r = \tfrac{1}{2}n(n-1).$$

(*a*) State the minimum number of roads needed to join 7 towns to each other. 1 2

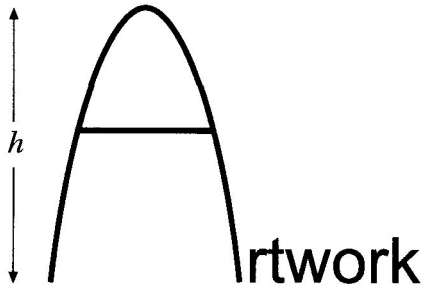
(*b*) When $r = 55$, show that $n^2 - n - 110 = 0$. 2

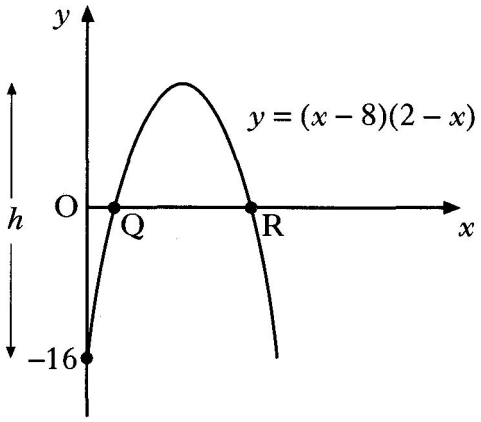
(*c*) Hence find **algebraically** the value of n. 3

2.

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. 2

(*b*) Calculate the height, h, of the letter A. 3

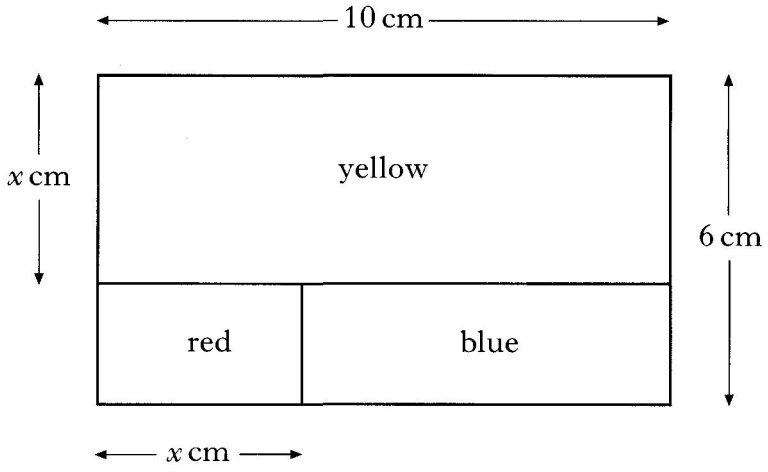
3. Solve the equation

$$3x^2 - 2x - 10 = 0.$$

Give your answer **correct to 2 significant figures**. 4

4. (*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

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

4

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

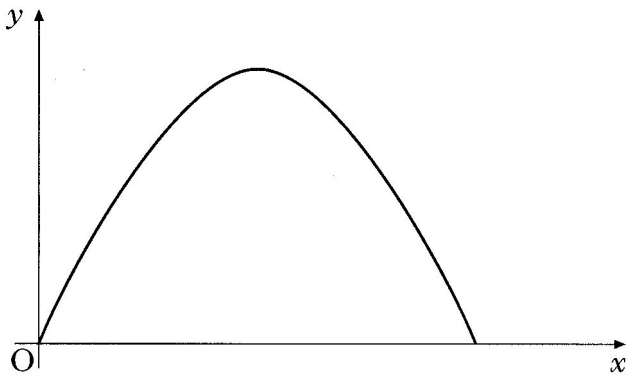
Calculate the value of x. 2

5. 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

6. The number of diagonals, d, in a polygon of n sides is given by the formula

$$d = \tfrac{1}{2}n(n-3).$$

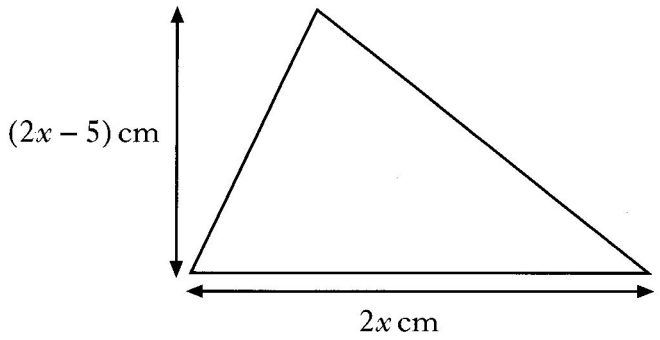
(*a*) How many diagonals does a polygon of 7 sides have? 2

(*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

7. 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

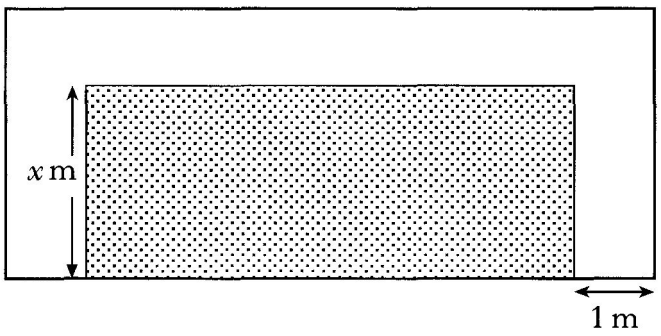
8. Solve the equation

$$x^2 + 2x = 9.$$

Give your answers **correct to 1 decimal place**.

3

9. 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 $3x^2 - 5x - 2 = 0$.

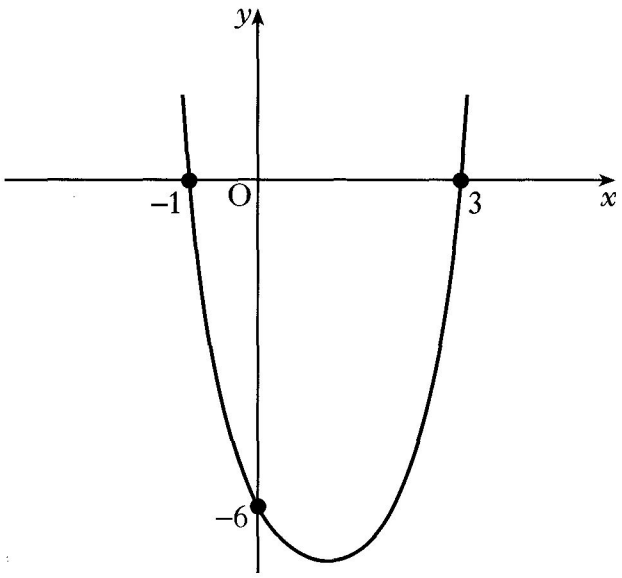
3

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

4

10. 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. 2

(c) Find the coordinates of the minimum turning point of the function. 2

2

11. 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

12. Solve the equation

$$2x^2 + 3x - 7 = 0.$$

Give your answers **correct to 1 decimal place**. 4

13. 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. 1

(*b*) Show that the area, A square centimetres, of the new vent is given by

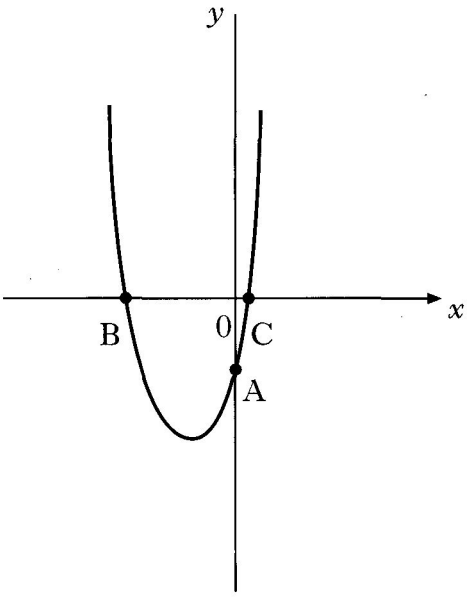
$$A = x^2 + 50x + 600.$$ 2

(*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. 5

14. 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. 1

(*b*) Find the coordinates of B and C. 3

(*c*) Calculate the minimum value of $4x^2 + 4x - 3$. 2

15. Solve the equation $x^2 + 3x - 5 = 0$.

Give your answer **correct to 2 significant figures**. 4

Dalkeith High School – National 5 Exam Style Questions – Quadratics
Solutions:

1.	(a) 21 (b) Proof (c) 11
2.	(a) Q(2 , 0) , R(8 , 0) (b) 25 units
3.	2.2 , −1.5
4.	(a) Proof (b) 4cm
5.	£19600
6.	(a) 14 (b) Proof (c) 13
7.	3.5cm
8.	2.2 , −4.2
9.	(a) area of lawn = $3x^2$ area of path = $5x + 2$ $3x^2 = 5x + 2$ $3x^2 - 5x - 2 = 0$ (b) 6 m
10.	(a) −1, 3 (b) 2 (c) (1, −8)
11.	x = -1, 4
12.	x = 1.3, −2.8
13.	(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
14.	(a) A (0,−3) (b) B$(-\frac{3}{2},0)$ C$(\frac{1}{2},0)$ (c) −4
15.	x = 1.2, −4.2