

*Solving Quadratic Equations - Lesson 4*

## Finding Where a Quadratic Crosses the x - axis

### LI

- Find the roots of a quadratic (i.e. where it crosses the x - axis).

### SC

- Factorise quadratics.
- Solve simple (i.e. linear) equations.
- Quadratic formula.

Quadratic Expression :

$$ax^2 + bx + c$$

quadratic ( $x^2$ ) term

x term

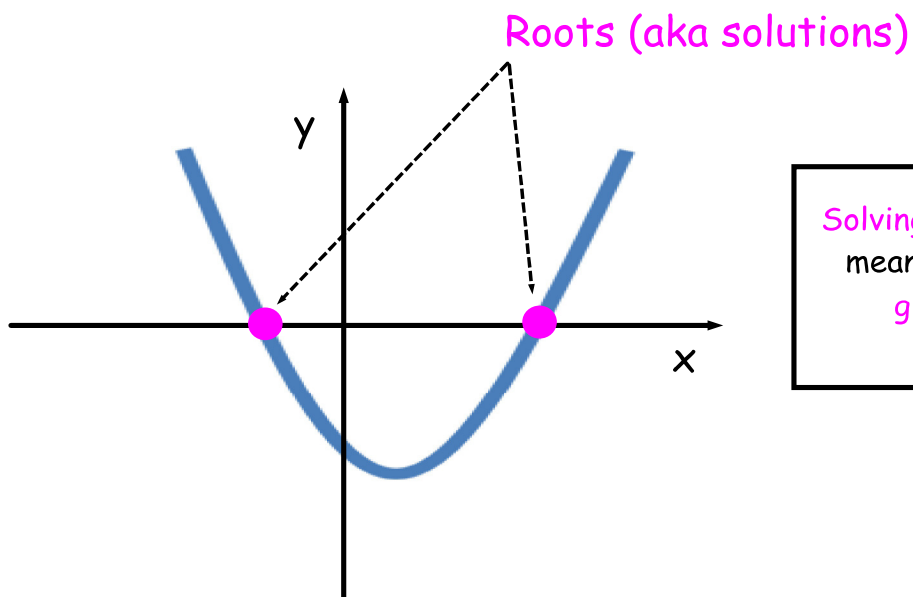
constant term

Quadratic Equation :

$$ax^2 + bx + c = 0$$

To **solve** a quadratic equation means to find out which **x-values** fit the equation

Graphical Interpretation

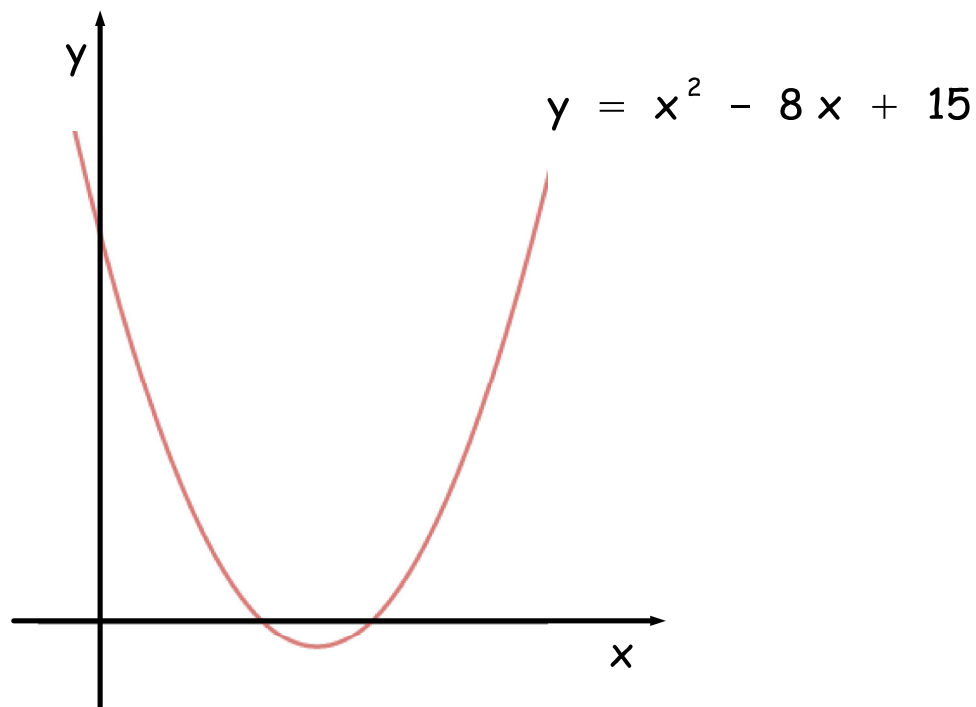


**Solving** a quadratic equation means finding where the graph crosses the **x-axis**

## Roots by Factorisation

### Example 1

Find where the following curve cuts the x - axis.



For intersections with the x - axis,  $y = 0$  :

$$x^2 - 8x + 15 = 0$$

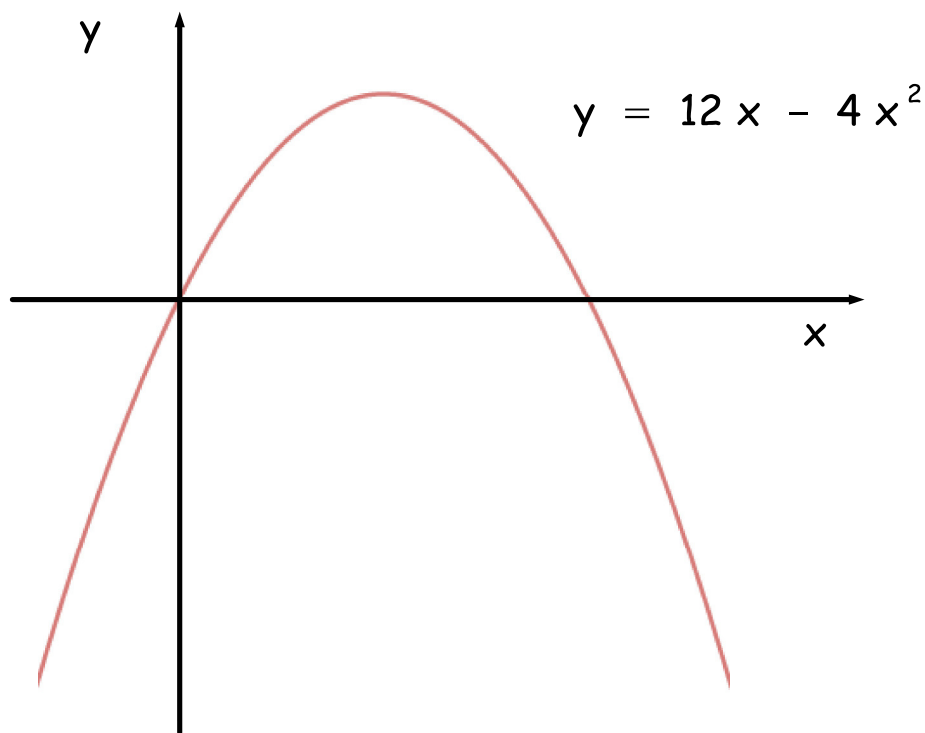
$$(x - 5)(x - 3) = 0$$

$$x - 5 = 0, \quad x - 3 = 0$$

$$x = 5, \quad x = 3$$

Example 2

Find where the following curve cuts the x - axis.



For intersections with the x - axis,  $y = 0$  :

$$12x - 4x^2 = 0$$

$$4x(3 - x) = 0$$

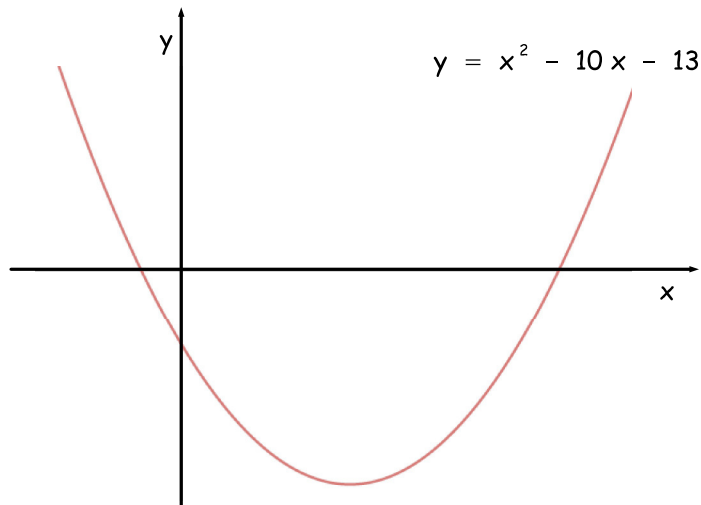
$$\begin{array}{ccc} & \swarrow & \searrow \\ 4x = 0, & & 3 - x = 0 \end{array}$$

$$x = 0, x = 3$$

Roots by Quadratic Formula

Example 3

Find, to 1 d. p., where the following curve cuts the x - axis.



For intersections with the x - axis,  $y = 0$ :

$$x^2 - 10x - 13 = 0$$

$a = 1,$   
 $b = -10, \quad b^2 - 4ac = (-10)^2 - 4(1)(-13) = 152$   
 $c = -13$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-10) \pm \sqrt{152}}{2(1)}$$

$$x = \frac{10 \pm \sqrt{152}}{2}$$

$$x = \frac{(10 + \sqrt{152})}{2}, \quad x = \frac{(10 - \sqrt{152})}{2}$$

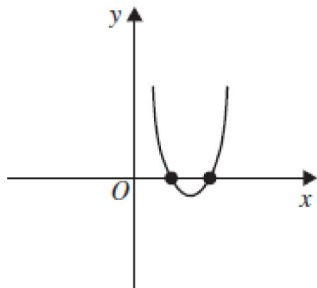
$$x = 11.16 \dots, \quad x = -1.16 \dots$$

$$x = -1.2, 11.2 \text{ (1 d.p.)}$$

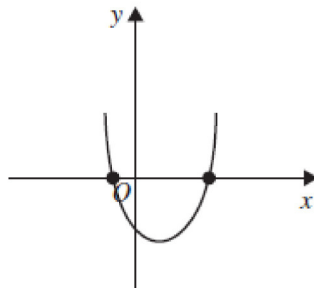
### Questions

1 Find where the following curves cut the x-axis.

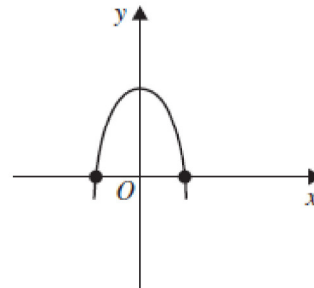
**a**  $y = x^2 - 10x + 24$



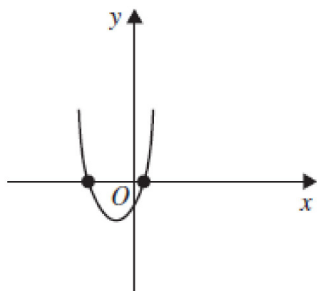
**b**  $y = x^2 - 3x - 10$



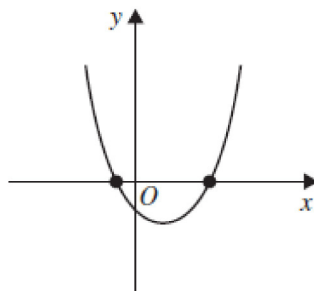
**c**  $y = 25 - x^2$



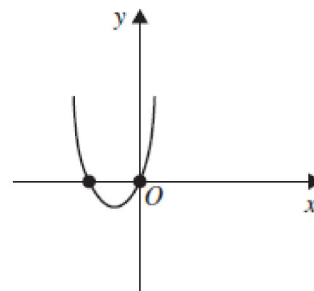
**d**  $y = x^2 + 4x - 12$



**e**  $y = 2x^2 - 7x - 15$

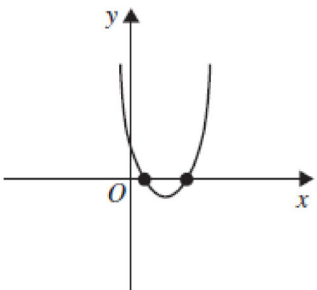


**f**  $y = 3x^2 + 12x$

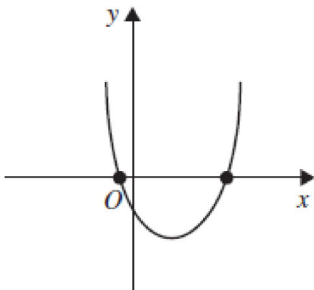


2 Find where the following curves cut the x-axis, correct to 1 decimal place.

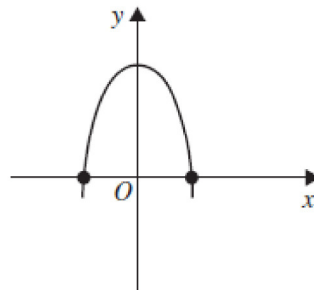
**a**  $y = x^2 - 10x + 1$



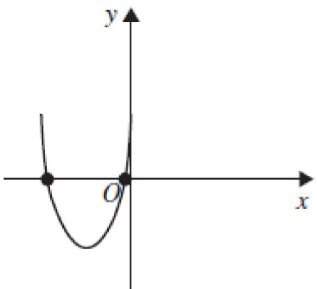
**b**  $y = 2x^2 - 3x - 10$



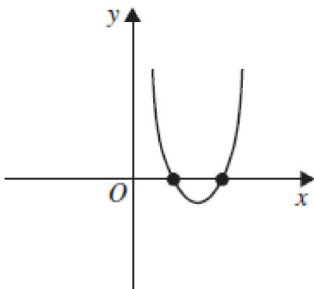
**c**  $y = 12 - 5x^2$



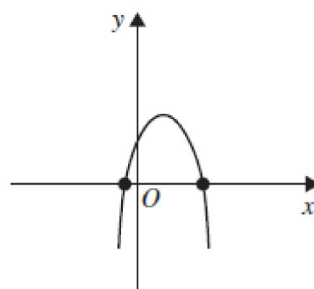
**d**  $y = 3x^2 + 5x + 1$



**e**  $y = 2x^2 - 7x + 4$



**f**  $y = 1 + 4x - 2x^2$



**Answers**

- 1 a**  $(x - 6)(x - 4) = 0$   
x-axis is cut at  $x = 6$  and  $x = 4$
- b**  $(x - 5)(x + 2) = 0$   
x-axis is cut at  $x = 5$  and  $x = -2$
- c**  $(x + 5)(x - 5) = 0$   
x-axis is cut at  $x = -5$  and  $x = 5$
- d**  $(x + 6)(x - 2) = 0$   
x-axis is cut at  $x = -6$  and  $x = 2$
- e**  $(2x + 3)(x - 5) = 0$   
x-axis is cut at  $x = -\frac{3}{2}$  and  $x = 5$
- f**  $3x(x + 4) = 0$   
x-axis is cut at  $x = 0$  and  $x = -4$

- 2 a**  $a = 1, b = -10, c = 1$   
 $x = 9.9$  and  $x = 0.1$
- b**  $a = 3, b = -3, c = -10$   
 $x = 3.1$  and  $x = -1.6$
- c**  $a = -5, b = 0, c = 12$   
 $x = 1.5$  and  $x = -1.5$
- d**  $a = 3, b = 5, c = 1$   
 $x = -0.2$  and  $x = -1.4$
- e**  $a = 2, b = -7, c = 4$   
 $x = 2.8$  and  $x = 0.7$
- f**  $a = -2, b = 4, c = 1$   
 $x = -0.2$  and  $x = 2.2$