S4

Quadratic Equations 1

What you will learn today

What is a quadratic equation

What does solving an equation mean

A method of solution

We know how to solve simple equations

e.g. $5x - 3 = 2x + 6$

$3x - 3 = 6$

$3x = 9$

$x = 3$

$3x + 7 = 13$

$3x = 6$

$x = 2$

How do we go about solving this one

$$x^2 + 5x + 6 = 0$$

This is called a quadratic equation

We have seen these sort of equations before

$$(x + 2)^2 + 4 = x^2 + 3x - 2$$

We have seen these when solving problems with lines in circles

$$x^2 + 4x + 4 + 4 = x^2 + 3x - 2$$

$$x^2 + 4x + 8 = x^2 + 3x - 2$$

Notice x^2 term will cancel out

leaving a simpler equation

$$x^2 + 4x + 8 = x^2 + 3x - 2$$

$$4x + 8 = 3x - 2$$

$$x + 8 = -2$$

$$x = -10$$

How do we go about solving this one

$$x^2 + 5x + 6 = 0$$

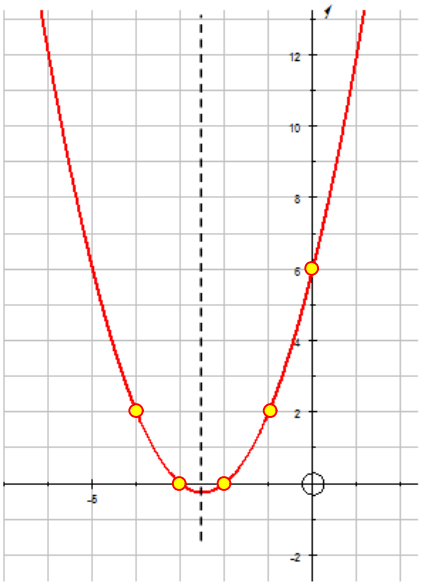
This is called a quadratic equation

Before we try to solve it - we should investigate what the graph looks like

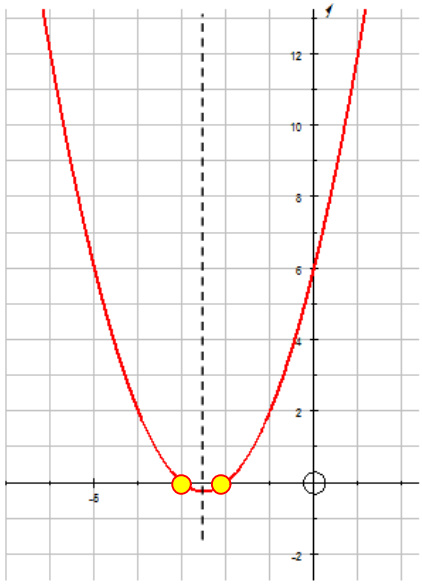
$$y = x^2 + 5x + 6$$

$$y = x^2 + 5x + 6$$

x	−4	−3	−2	−1	0
x^2	16	9	4	1	0
$+ 5x$	−20	−15	−10	−5	0
+6	6	6	6	6	6
y	**2**	**0**	**0**	**2**	**6**



(-4, 2)
(-3, 0)
(-2, 0)
(-1, 2)
(0, 6)



The graph is called a parabola.

It is symmetrical about the dotted line.

Where the graph cuts the x-axis
we call the roots of the equation

$x^2 + 5x + 6 = 0$

because this is where y = 0

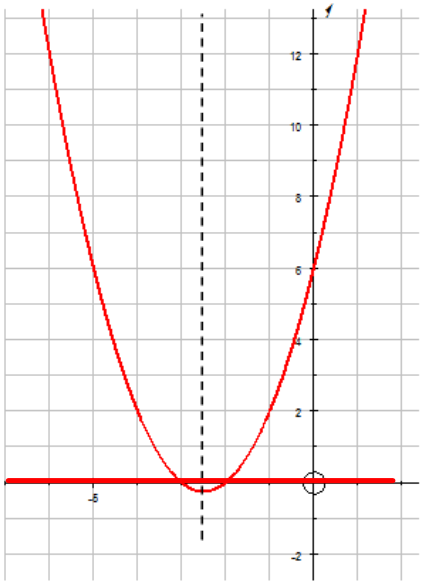
The roots of this equation are x = -2 and x = -3

We can see this from the table and from the graph

The axis of symmetry ;lies mid-way between the roots

If the graph is always above the x-axis, we say there are no real roots.

We can find the solution to any quadratic by drawing a graph,
however it would be easier if we could solve the equation algebraically.



So why is it important that we can solve the equation

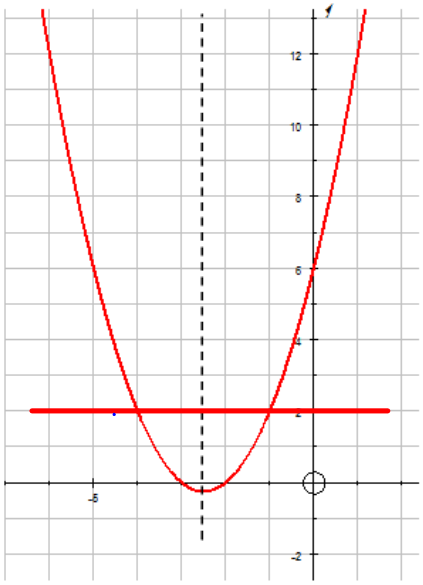
$$x^2 + 5x + 6 = 0$$

This is a specific value of y on the graph of:

$$y = x^2 + 5x + 6$$

$$y = 0$$

If we can solve this equation, then we can solve any other quadratic equation (providing there is a solution)



So why is it important that we can solve the equation

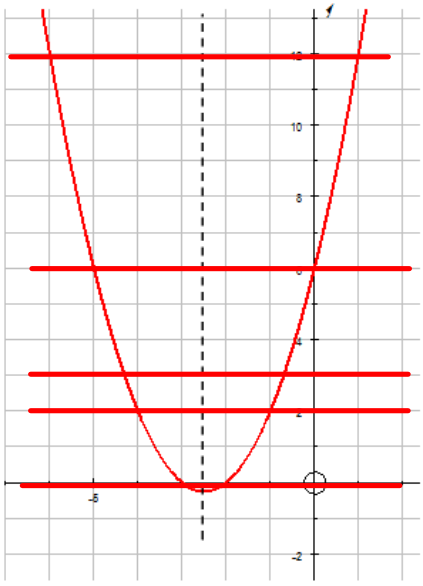
$$x^2 + 5x + 6 = 0$$

$$y = x^2 + 5x + 6$$

$$y = 0$$

$$x^2 + 5x + 6 = 0$$

We can find the solution to any quadratic by drawing a graph, however it would be easier if we could solve the equation algebraically.



Consider the solution to:

$y = x^2 + 5x + 6$

when $y = 0$

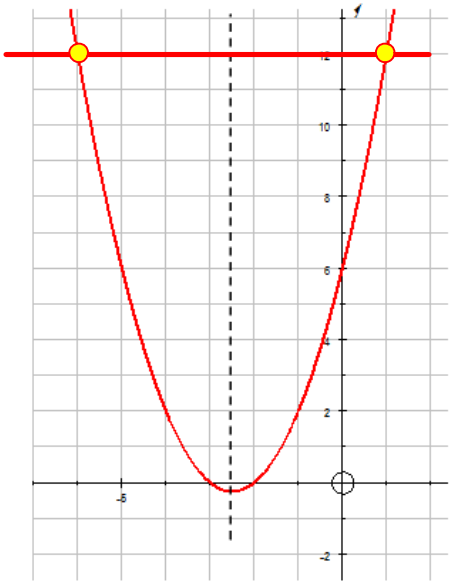
when $y = 2$

when $y = 3$

when $y = 6$

when $y = 12$

We can find the solution to any quadratic by drawing a graph,
however it would be easier if we could solve the equation algebraically.



Find the solution to:

$y = x^2 + 5x + 6$

when $y = 12$

$x^2 + 5x + 6 = 12$

$(x - 1)(x + 6) = 0$

$x - 1 = 0$ so $x = 1$

$x + 6 = 0$ so $x = -6$