



Solving

$$ax^2 + bx = 0$$

and $x^2 = d$

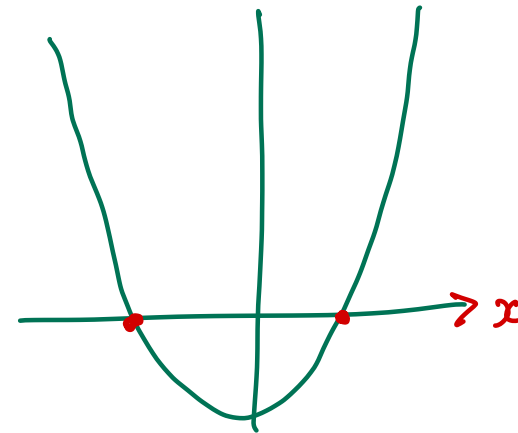
Year 9 Mathematics
Mainstream

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- Know what it means to solve a quadratic
- Know how to solve quadratics of the form:
 - $ax^2 + bx = 0$, and
 - $x^2 = d$
- Know how to factorise quadratics to allow us to use the Null Factor Law
- Know how to apply the learning to a range of complex problems.



RECAP

We have, in the previous lesson, looked at what a quadratic is.

It's a parabolic graph which has a 'U' shape.

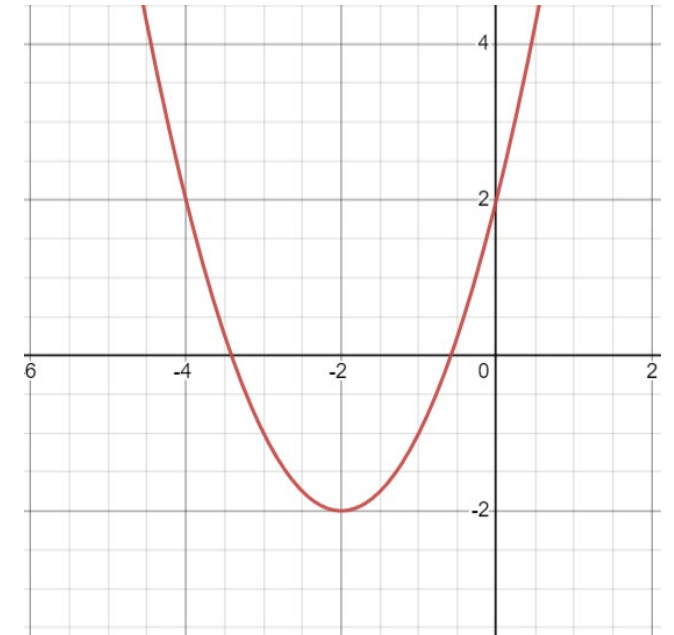
It is symmetrical about the turning point and can have solutions described by the points where the graph crossed the x-axis.

Quadratics are a massive part of the course.

It is highly recommended you spend a lot of time working on this topic.

To be able to do well you will also need to be able to **factorise** really well.

We are now going to look at how to solve simple quadratic equations using factorising.



Why do we only want the points where it crosses the x-axis?

We know that equations are generally written by starting them with a $y =$

Quadratics are no different. The actual form of a quadratic is:

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

Which can also be written as:

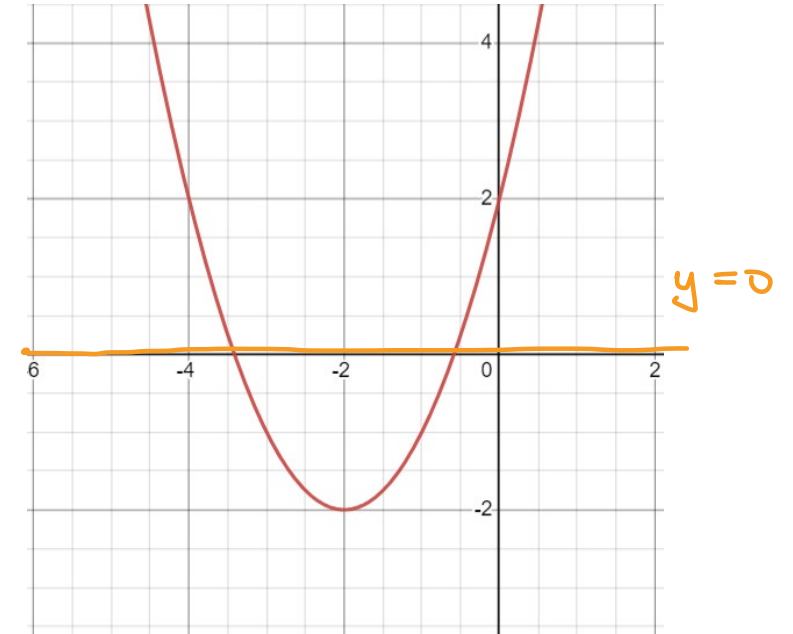
$$ax^2 + bx + c = y$$

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

All the questions we are going to deal with change the y into a zero. **But why?**

Well, what is the equation of the x-axis? Yup $y = 0$

Hence, we are looking to solve the specific equation of $ax^2 + bx + c = 0$



So, if we're trying to find the points where the graph cuts the x-axis, we are trying to find where the y -values are zero. We call these the solutions or roots of the equation.



Lots of forms of a quadratic equation

In the last lesson we looked at the fact that there are lots of quadratic equations. Some examples are shown below:

$$y = x^2$$

$$y = x^2 - 4$$

$$y = 2x^2 + 3x$$

$$y = 3x^2 - 4x + 5$$

If we are trying to find the roots of the above equations we would change the 'y' for a zero.

$$x^2 = 0$$

$$x^2 - 4 = 0$$

$$2x^2 + 3x = 0$$

$$3x^2 - 4x + 5 = 0$$

Each of these equations has a unique way of being solved. Today we're going to look at the following forms:

$$x^2 - 4 = 0$$

$$2x^2 + 3x = 0$$



Solving $ax^2 - d = 0$

There are lots of ways of writing the above equation!

$$ax^2 - d = 0$$

$$ax^2 = d$$

We have simply rearranged one to become the other (or vice versa)

Solving these are the simplest.

Example: Solve $x^2 - 4 = 0$

$$x^2 - 4 = 0$$

$$x^2 = 4$$

$$x = \sqrt{4}$$

$$x = \underline{\underline{2}}$$



IMPORTANT: Taking the square root gives us two values

When we look at the following we can see something interesting:

$$(2)^2 = 4$$
$$(-2)^2 = 4$$

Which would suggest that $\sqrt{4}$ has two solutions! When we take the square root we are asking, which number, when multiplied by itself gives 4 as an answer?

And there are two answers; 2 and -2. We have a funky way of describing this mathematically:

$$\sqrt{4} = \pm 2$$

Whenever you take the square root of a number you MUST write the $\pm$ or your answer is wrong.

$$\sqrt{4} = 2 \times 2$$
$$= -2 \times -2$$

$$\sqrt{4} = 2 \text{ and } -2$$
$$= \underline{\underline{\pm 2}}$$



Solving $ax^2 + bx = 0$

Writing one example of each form in your summary book will see you smash this section.

Maths is nothing more than **pattern spotting**. If you can spot the pattern in the question, you will apply the correct way of solving the questions and smash it every time.

The above requires you to:

- Put the two x-terms on the same side of the equals
- Factorise one 'x' outside of a set of brackets
- Use the Null Factor Law to solve.

Example: Solve $x^2 + 4x = 0$

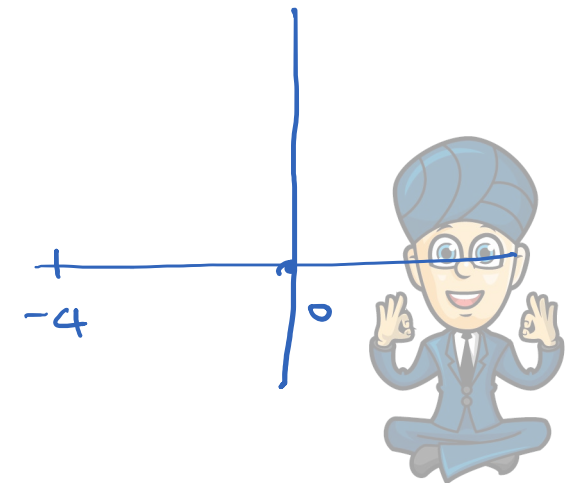
$$x^2 + 4x = 0$$

$$\underline{x}(x + 4) = 0$$

$$\therefore \underline{x = 0} \quad \text{or} \quad x + 4 = 0$$
$$x = \underline{-4}$$

$$ax^2 + bx = 0$$

$$x(ax + b) = 0$$



Other examples

Following are lots of other examples which take the two main cases and adapt them slightly. Remember, Maths is a Big Fat Trick.

Solve $2x^2 = 8x$

$$2x^2 = 8x$$

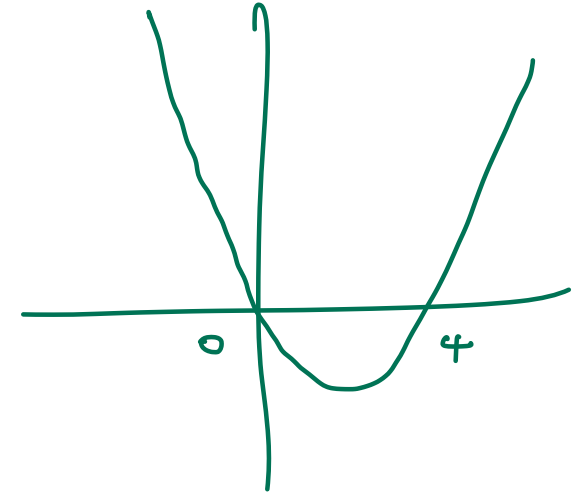
$$2x^2 - 8x = 0$$

$$2x(x - 4) = 0$$

$$\therefore 2x = 0 \quad \text{or} \quad x - 4 = 0$$

$$x = \underline{\underline{0}}$$

$$x = \underline{\underline{4}}$$



Other examples

Following are lots of other examples which take the two main cases and adapt them slightly. Remember, Maths is a Big Fat Trick.

Solve $2x^2 = 18$

$$2x^2 = 18$$

$$2x^2 - 18 = 0$$

$$2(x^2 - 9) = 0$$

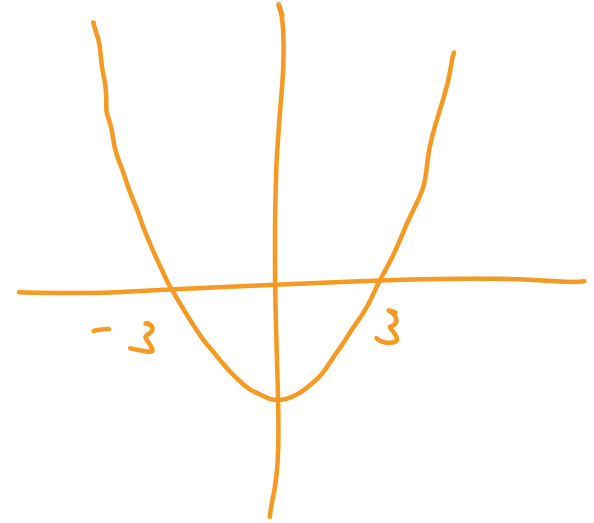
$$(x + 3)(x - 3) = 0$$

$$\therefore x + 3 = 0$$

$$x = \underline{\underline{-3}}$$

$$x - 3 = 0$$

$$x = \underline{\underline{3}}$$



Other examples

Following are lots of other examples which take the two main cases and adapt them slightly. Remember, Maths is a Big Fat Trick.

Solve $x - \frac{4}{x} = 0$

xx

$$x - \frac{4}{x} = 0$$

xx

$$x^2 - 4 = 0$$

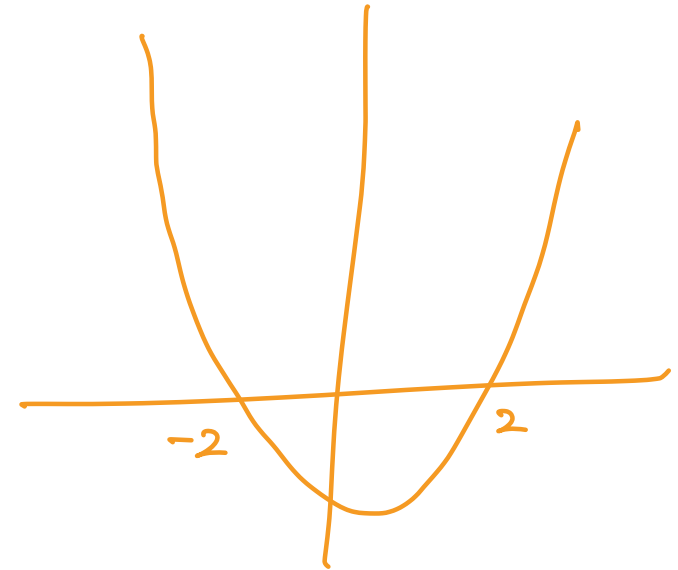
$$(x - 2)(x + 2) = 0$$

$$\therefore x - 2 = 0$$

$$x = \underline{\underline{2}}$$

$$x + 2 = 0$$

$$x = \underline{\underline{-2}}$$



The return of DOPS

Remember a long time ago we looked at something called the Difference of Perfect Squares. Well, it's back!

When two square terms are subtracted, we can factorise them really easily using the following rule:

$$a^2 - b^2 = (a + b)(a - b)$$

So, we need to look for patterns.

Example: Factorise $9x^2 = 16$

$$9x^2 = 16$$

$$9x^2 - 16 = 0$$

$$(3x)^2 - (4)^2 = 0$$

$$\underline{(3x - 4)} \underline{(3x + 4)} = 0$$

$$3x - 4 = 0$$

$$3x = 4$$

$$x = \frac{4}{3}$$

$$3x + 4 = 0$$

$$3x = -4$$

$$x = \frac{-4}{3}$$



Questions to complete:

The questions I would like you to complete for this lesson are:

Exercise 10B Solving $ax^2 + bx = 0$ and $x^2 = d$

Questions: 2acf, 3ace, 4abe, 5ace, 6acf, 7abefh, 8bce, 10,

Extension: 12



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