Introduction to Algebra

Before You Watch

This video introduces algebra. It explains what algebra is, and reinforces how we can manipulate and rearrange algebraic equations around the equals sign. It's a good idea to watch this video before viewing the other algebra videos.

This video uses the 4-step problem-solving method we covered in **Introduction to Problem-Solving**. So, if you haven't watched that video yet, start there, then come back.

The Video Content

Algebra is all about using letters to represent values that we don't know. Sometimes those letters can be found in equations, and we need to rearrange the equation to work out what number the letter represents.

Consider this equation:

$$x + 15 = 2x + 3$$

First, let's look at what the equals sign in the middle means.

Step 1 Understand the question

An equals sign means that what is on *one side* of the symbol is equal to what is on *the other side* of the symbol.

An equation is like a balanced set of scales. Considering $x + 15 = 2x + 3$, we could say that the scales are balanced if we have one box and 15 kg of weights on one side, and two boxes and 3 kg of weights on the other side. We don't know what the boxes

weigh – we have called it x here – but it could be anything. We could just put an empty square there to fill in later, or even a smiley face.

We can do anything we want with the scales, *as long as we do the same to both sides*. We could add or subtract weight, or add boxes – anything – *as long as we do the same to both sides*.

Step 2 Develop a plan

To solve an equation – that is, to work out what the unknown quantity is – we need to have the unknown by itself on one side, and a number on the other.

Mathematically, like this:

x = *a number*

Step 3 Carry out the plan

What can we do that will get our equation closer to what we want, which is x on one side and a number on the other?

Let's start by removing the x from the left side. If we subtract x from the left side, we have to do the same to the right side or the scales won't be balanced:

$x + 15 - x = 2x + 3 - x$

The x's on the left cancel each other out, and $2x - x$ is just $1x$, so we have:

$15 = x + 3$

Now we subtract 3 from both sides:

$15 - 3 = x + 3 - 3$

$12 = x$

Therefore the answer is:

$x = 12$

Step 4 Reality check

Is our answer of 12 correct?

We can check by substituting x = 12 into the original equation to see if the sides match. The original equation was:

$x + 15 = 2x + 3$

After the substitution, this becomes:

$12 + 15 = 2 \times 12 + 3$

Adding up the numbers:

$27 = 24 + 3$

$27 = 27$

The two sides balance. Yes, 12 is the answer!

Did you know?

The letter x is often used in algebra, far more than any other letter (even though we can use any letter we like). Why do we use x so much? The popularity of x in algebra appears to have originated with the French Mathematician and Philosopher René Descartes, who, in his landmark work *La Géométrie*, used the letters at the start of the alphabet – a, b and c – to represent known values, and the letters at the end – x, y and z – to represent unknown values. Why did he do this? Nobody really knows. One suggestion is because x, y and z aren't used much in French, and so there were lots of spare x's for the printing press. Another suggestion is based on a poor translation of the arabic word "al-shalan", which means "the unknown thing". So, in essence, the reason we now use x so widely in algebra is because a Frenchman did so in his book a long time ago.

Some Practice Questions

Find the value of the letter in the following equations:

1. $x + 3 = 6$

2. $3k = 12$

3. $9p$ - 14 = $2p$

4. $3r$ + 3 = 23 - $2r$

5. $2t$ = 5

6. $6w$ + 34 = $3w$ - 11

7. n - 59 = $3n$ +27

8. $38q$ + 564 = $43q$ - 392

Answers

1. x = 3

2. k = 4

3. p = 2

4. r = 4

5. t = 2.5

6. w = -15

7. n = -43

8. q = 191.2

Take a look at the working out for each answer **here**.

Now What?

This video is the launching pad for the entire subject of algebra. Now you can move on, further developing your skills and learning different ways of manipulating algebraic equations. For instance, you can discover how **indices** or **fractions** work with algebra, or look at one of the most popular algebraic equation types, the **linear equation**.

But When Am I Going To Use This?

Algebra is one of the foundation areas of mathematics. It is essential for any study in science, mathematics, engineering and many other fields. You will find yourself using it consistently at university and beyond.

Other Links

Maths Is Fun has some great content that illustrates the set of scales analogy for the equals sign. It also covers how to add and subtract, and how to multiply and divide, from both sides of the equals sign.

- http://www.mathsisfun.com/algebra/add-subtract-balance.html
- http://www.mathsisfun.com/algebra/introduction.html
- http://www.mathsisfun.com/algebra/introduction-multiply.html

The **Khan Academy** has a comprehensive set of video tutorials covering a large range of mathematical and other concepts, as well as questions to test your knowledge. This link takes you to a chapter that covers introduction to algebra, as well as explaining the importance of doing the same thing to both sides of the equals sign.

- https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities/why-of-algebra/v/why-we-do-the-same-thing-to-both-sides-simple-equations