

Solving the Unknown: The Story of Algebra

Long before modern mathematics, humans faced simpler problems to the ones we tackle today. Instead of having to stress about your homework deadline or how you did in that test, they had to measure their land, count their cattle and figure out how to divide bread between the masses. Fortunately for them, they didn't need to use complex symbols to solve their problems; they needed words. But where did the word algebra even come from? I want you to go back to 9th Century Persia, to the time of the great mathematician Muhammad ibn Musa al-Khwarizmi, who wrote a revolutionary book, containing the foundations of algebra. Before x's and y's, we solved problems by saying "something plus something = something", but this can get tricky and can easily be misinterpreted, so we had to do something and behold, the introduction of the infamous 'X'; the 'X' allows us to easily manipulate simple equations and solve for it to find our missing number. So now you know where algebra's roots are (no pun intended) and understand the beauty of its origins.

But algebra isn't just used in physics classrooms and maths lectures, it is also used in everyday life by every human being. Going to the supermarket and wondering if you have enough time to make it there, you might end up using $\text{speed} = \text{distance}/\text{time}$, or if your on a walk, and wondering the fastest way to get to somewhere, you might use Pythagoras' Theorem! Algebra can look confusing and tricky, but when you truly understand the essence of it, you'll be able to see it everywhere you go.

However, algebra can seem trivial at times, but is used in even the most complex problems that mathematicians and physicists are still trying to solve today. For example, let's look at a blinding question to many in Physics today – why and how do galaxies travel so fast?

Stars orbit the centre of the galaxy because of gravity; this depends on mass, which is concentrated at the centre of the galaxy. Reasonably, we would assume that the stars at the far ends of the galaxy will feel less gravity and therefore move slower than stars near the centre. However, with extensive research and billions of dollars of funding, scientists have discovered that the stars at the edge of galaxies move at the same speed as the rest! So, there must be an extra force that results in this. Let me tell you what that is with some algebra. Let M = the total mass of the galaxy and let v = speed of the star. The basic idea is that a bigger M will give you a bigger v . But when astronomers dug deeper, they found that the actual speed was much greater than the predicted speed. So, they changed the expression from M to $M + x$. Now what is x you may wonder. It is a universal force you may have heard of, dark matter. Dark matter is a puzzle for even the brightest scientists, since we can calculate how much x there is, but we don't fully know what x even is. I know, it's fascinating!

Algebra is a conceptual topic that involves manipulating numbers and letters in long equations, but also is something used every day by billions across the world. It is the answer to everything, from doing the daily budgeting of households, to impossible problems in nuclear facilities. Algebra is beautiful.

