INTRODUCTION TO ALGEBRA

Oh no. Not algebra. I can already see you click the back button but hold it there. Stay with me. Take your hand off the mouse, sit back and get ready. You're about to find out that algebra isn't that hard, in fact you already know how to do it. You just don't realise it. Stick with me, we'll get there.

Starting at the start is always the best thing to do. What is algebra? That's simple, it is when you take a sum and replace it with letters or symbols. That is literally all it is. You take some of the numbers away (sometimes all of them) and replace them with letters or symbols.

That is what the dictionary tells us, but that's not the whole truth really. You see algebra really is used all of the time in real life. You don't even know you're using it sometimes. Don't believe me? Yeah, I probably wouldn't either, so let's prove it.

If you walk into a shop with £10 and pick up 3 bags of crisps, how do you know what they will cost and how much change you will have left? Well first off each bag of crisps costs 50p, a lot I know but prices are getting silly these days. So if you have 3 bags of crisps and they cost 50p each, what do you do to work out the total price? You do 3 X 50p don't you? You just know that it costs £1.50 because your head instantly works it out. So let's try and put down what we know now.

= 50p

One bag of crisps is worth 50p. So as we have already said.

= £1.50

That's pretty easy to understand, isn't it? A picture is worth a thousand words and all that. How about if I put it across in a different way?

3C = 1.5

If I put that in front of you, could you tell me what 1c is worth? (Just a note, from here on instead of saying 1c, or any letter for that matter, I will just write c, it's easier that way) It's quite simple really,

isn't it? There are 3 lots of c, and that is worth 1.5, so we share 1.5 by 3. That means that c = 0.5. Or to put it as we said earlier, 3 bags of crisps costs £1.50 so 1 bag costs 50p.

Do you see how once letters become involved it seems a lot more complicated? It is just the same as with the pictures, or before that talking about going into a shop for some crisps. Our descriptions don't end there though, let's go back to the shop.

Okay, so you remember that we went in there with £10. We already know that we're going to be spending £1.50. So what change will we get after we have bought our crisps? £10 – £1.50 is £8.50. Not so hard is it? What we don't realise though is that when we put together everything we have done together, it is algebra.

10 – 1.5 = ?

Working out the missing number in algebra. If we want to take an even bigger step.

10 – 3C = 8.5

That is the full calculation that we did in our head when we bought those crisps, but the moment you see it on paper with letters it turns into something terrifying. Let's try and work out how to change all of that.

As we have already seen, in its most simple form algebra is just a missing number problem. So, let's have a look at a missing number problem to get ourselves in the mood. It's always important to warm up before you start on the hard stuff, everyone knows that.

15 + □ = 22

So we look at what needs to be done to find the missing number. There are a number of ways we could approach this, but the way I am going to do it is the way that helps us the most in the future.

Look at the sum we are being asked to do. 15 add something gives us 22. What we're going to do to solve this is we are going to remove things until we can easily see what the empty box is worth.

How can we do that though? Well, the easiest way to view it is to see the equals sign as a balance or a set of scales. Everything on the left-hand side of it is exactly the same as what is on the right-hand side. How does that help us to solve this sum though? Let's take a look.

15 + □ = 22

IF THERE IS 15 AND SOMETHING EXTRA ON THE LEFT-HAND SIDE AND 22 ON THE OTHER, WE CAN JUST REMOVE 15 FROM BOTH SIDES TO TELL US WHAT THE SOMETHING EXTRA IS.

So 15 + □ – 15 = □ so on the left-hand side we are just left with □ now. That means the scale is lopsided now though. Remember whatever we do to one side of the equals sign we must do the same to the other.

Currently, our sum looks like this.

□ =

22

Notice how the 22 is significantly lower than the ? That's because we have only taken 15 from the one side. Unless we take 15 from the other side too, we're going to be stuck with an unbalanced equation. That doesn't help us solve anything. We know that □ doesn't equal 22, because earlier on 15 + □ was worth 22. So what do we need to do in order to balance it?

That's easy, we have to take 15 from the other side too. So if we have 22 and take 15 from it, we are left with 7. So our sum in its final state is.

= 7

Now it would have been really easy for us to just realise that 7 added onto 15 makes 22, but by doing it this way it allows us to see what the process we are actually going through to get the answer. By removing the extra number from each side we see quite clearly just exactly what the missing number is worth.

How is this all related to algebra though? Algebra is all numbers and letters isn't it? Yeah, I suppose it is, what if we changed that sum just slightly then?

15 + X = 22

Looks scary now, doesn't it? Shall we just give up? Remember what I said at the start of this, don't click that back button. Stick with me and we'll get there. This is exactly the same sum as we saw before, the only difference is instead of a missing number we have a letter. The way we would solve this is exactly the same way we solved the previous sum. We remove 15 from each side, and at the end, we are left with x = 7.

Do you see how it is exactly the same whether we have a missing number or a letter? All we need to do is ensure that whatever we do to one side of the equals sign, we do exactly the same to the other side.

Let's take a look at some more problems to really hammer home our point. Let's make this one a little more difficult though.

18 – X = 7

Not too difficult, but it's still not easy either. Remember what we did last time, we removed the same thing from both sides. So what are we going to choose to remove this time? We can get rid of the 7, the 18 or the x. It doesn't matter which one we do, it will always give us the same final answer.

What we're going to do, is all three. Each choice, although it gives us the same answer, takes a different number of steps and has a differing level of difficulty.

We'll start with the easiest choice, that makes the most sense right? So what we're going to remove is the 7. Remember, whatever we do to one side of the equals sign, we must do exactly the same to the other side. So if we remove the 7 from both sides, it gives us this.

11 – X = 0

(-7) (-7)

Notice the brackets in red underneath each side of the equals sign? That lets us know exactly what we have done. We removed the 7 from each side. What is remove another word for? Takeaway. So we took away 7, from each side. That leaves us with 11 – x = 0. From here we can easily see that whatever x is worth when taken away from 11 leaves us with 0. So 11 takeaway x leaves 0. What could the x be? It's quite obvious that x is worth 11. Meaning that our final answer is 11. We need to prove that x = 11 though. We can't just assume.

Well to do that we need to split up the 11 and -x. Or move the x over to the other side, where the 0 is. It's the same process as removing the 7 earlier on, we can't just make the x vanish, because whatever we do to one side of the equals sign, we must do the same to the other side. So that x can never be destroyed, like energy, or wasps at a picnic, it will always be there.

How can we move it over though? It's a little different to removing the 7, then x isn't a normal x. It is -x. Negative x! Let's just think about it logically, if removing the 7 (which was positive 7, even though the + sign was invisible, it was still there) involved taking away 7 from both sides, and we have -x, then we are going to have to add x to both sides. Adding an x cancels out the -x on the left-hand side, and adds an x to the right-hand side. This leaves us with.

11 = X

(+X) (+X)

Which is the same as.

X = 11

There is our final answer. Simple right? What about the other choices though, we need to check to make sure they give us the same answer. Let's go through them really quick then, just to make sure.

18 – X = 7

That is the original equation we want to work out. As always the objective is to find out what x is worth. This time, we're going to remove the 18.

18 – X = 7

(-18) (-18)

Taking away 18 from both sides leaves us with a different looking equation to when we took away 7, let's see what we're left with.

– X = -11

Here we see a very similar looking answer to our final answer last time. -x = -11. The thing about this is, you have a negative on both sides, then you can just turn them both into positives. This is because when you think about it, it makes sense. If I take away x from 0 and it gives me -11, it is obvious that x was worth 11. So if -x = -11, then it makes sense that x = 11. So our final answer is, once again.

X = 11

Okay, here we go. Time to see what answer the final choice gives us. Let's see the original equation one last time.

18 – X = 7

This time we are going to remove the -x. Remember on the first one when we were left with 11 -x = 0? We had to add an x to each side in order to remove the -x. Because the opposite of a negative is a positive. Simple.

18 = 7 + X

(+X) (+X)

Okay, so we are very close to our final answer now. We just have to remove the 7 from both sides now. Remember, our aim is to get the x (or whatever letter is being used) all alone.

11 = X

(-7) (-7)

That's pretty much our final answer, we just need to make it easier to read. We can do that by simply switching them around.

X = 11

There we go. Each choice had a varying number of steps to carry out, but they all came to the same answer in the end. That's the most simple type of equation you will be asked to solve, and if you're honest with yourself, it's pretty easy really isn't it? We're just going to look at one a little more difficult and then I'll leave you alone, I promise

3X + 7 = 19

It just looks difficult, I promise. We just need to use the same skills we used before. Before we do that though, we need to just recap our memories on something. Does anyone know what 3x means? 3x means 3 X x. 3 multiplied by x if seeing all the different sizes of x on the screen makes things difficult to read. 3x means 3 times x. Now we know that we can start on solving this equation.

We're not going to go with different choices this time. While we could reverse the multiplication first by dividing, it just makes things a massive pain in the neck. Whenever we see an equation laid out like this, we ALWAYS make sure that the x value (in this case 3x) is alone first. So in this particular example, we are going to remove 7 from both sides.

3X = 12

(-7) (-7)

Do you see how much neater that is than if we had divided both sides by 3 first? We would have been working with fractions or decimals if we had done that first. This time we have two nice and clean sides to work with. Simple.

So our next step is removing that annoying 3 from in front of the x. Once we've done that, we're all finished. Remember what 3x meant? That's right, 3x means 3 times x. So to remove those times, we are going to do the opposite (to both sides remember) and divide. So that gives us a final answer of.

X = 4

(÷3) (÷3)

There we have it. We're all finished. It wasn't that painful, was it? I might have lied a little, we're not totally finished, let's just go over the important things to remember. First off, don't panic. Algebra isn't going to kill you, it isn't going to trick you, as long as you remember to just use what we've learned you will be fine. Secondly, just remember that when it all boils down to it, it's just a missing number problem. You're not finding x, you're finding a missing number, named x. That's it. You know how to work out missing numbers, you do it every day when you go to the shop. Finally, and this is the most important part, remember that whatever you do you to one side of the equation, you must do exactly the same to the other side. As long as you remember all of this, you will be completely fine.