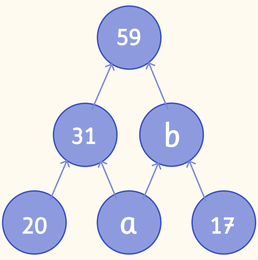
Two Unknowns

What do you need to know?

In maths, we sometimes use letters to represent missing numbers. We call these **unknowns**. When you're solving a question that includes unknown numbers, it's important to look at all the information provided very carefully. The numbers that you are given will help you to find the unknown numbers.

For example, in this **addition tree** each number is the sum of the two numbers below it. But there are two unknowns: a and b! To find the value of the b, we must use the information we've been given. There are **two ways** to work this out.



If we start from the bottom:

1- We can see that 20 + a = 31

2- So we subtract 20 from both sides to find that a = 11 ✔

3- We can see that a + 17 = b

4- Because we know the value of a, we can substitute it into the equation 11+17=b

5- So b = 28! ✔

We can also work from the top down:

1- We know that 31 + b = 59

2- So we can subtract 31 from both sides to find that b = 28!

But it's not always possible to work out an exact value for an unknown number. Instead, sometimes we'll need to work out a series of possible pairs of numbers that could work in the equation. We call this ***enumerating pairs***. For example, in this equation we haven't been given enough information to say for sure what the value of x and y are.

$$x + y = 15$$

But we can work out what they **could** be, given that we know that x and y are both **positive integers.**

So x could be 4 and y could be 11, for example. You easily check that your pairs of numbers are correct by adding them together.

If they total 15, then you've got a correct pair!

x	y
1	14
2	13
3	12
4	11
5	10
6	9
7	8

Let's see this in action...

A diver counted the number of sharks and turtles he saw when he was exploring a wreck. There were T turtles and S sharks. The total number of sharks and turtles was 32. If the diver saw 10 more sharks than turtles. What is the value of T?

1- First, let's write this information we know out as equations. We know there were 32 sea creatures in total so T + S = 32. We also know that there were 10 more sharks than turtles so S = T + 10

2- Now, we can substitute S for T + 10

T + T + 10 = 32

In other words 2T + 10 = 32

3- By subtracting 10 from both sides we're left with 2T = 22

4- Finally, we divide both sides by 2 to find T

T=11 ✔

So the diver saw 11 turtles!

Let's look at a different example:

This image shows a balanced scale, what expression should replace the red question mark?

b = ?

1- Just like the previous questions, we have two unknown values. But, this time, we don't have any other information. So we need to work out the expression in its **simplest form**.

2- We know that 8 of the weights labelled 'a' weigh the same as 2 of the weights labelled 'b'. So we can write this as 2b = 8a

3- Now, we need to simplify the equation. We know that both 2 and 8 are divisible by 2, so we should divide each side of the equation by 2.

4- So b = 2a! We can't simplify this any further, so the red question mark should be replaced with 2a.

Watch out!

Equations are always balanced (remember the scales!) so every operation you do, whether that's addition, subtraction, multiplication or division, must be done to **both sides!**

Tips!

You might see questions that ask you to work out the missing side of a shape. Remember to use what you know about shapes, their area and their perimeter to work these out.