

What is the point of the bar model?

The bar model will help us all to understand *which bit of maths* to do when we are solving tricky work maths problems.

Children still need to be able to do the calculations - the times tables, the addition, subtraction, multiplication and division..... but it helps us to see *which sort of calculation to do*.

Over the next few weeks, we hope to demonstrate to you the power of the bar model. Ever had a 'light bulb moment'? in maths? **All our teachers** have had a light bulb moment when trying to solve maths problems by using this method- it really works. It works from YR to GCSE and beyond! Please keep reading these examples and we will show you how. It will help you to help your children now and at secondary school.

Take things step by step and use the bar model – think 'part, part whole'. If you can work out two of these aspects, you can find the answer to the question.

Addition and Subtraction

The **bar model** helps us to understand the relationship between addition and subtraction. It helps us to see different ways of looking at the same relationships.



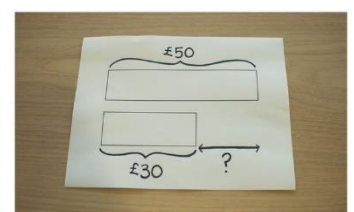
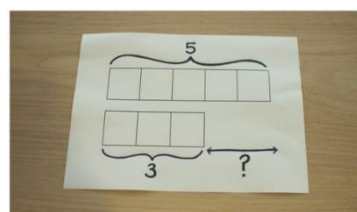
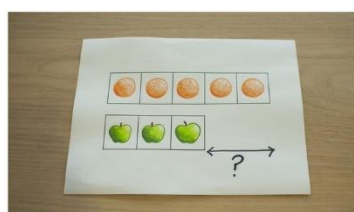
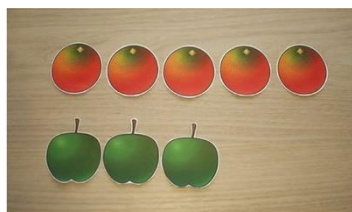
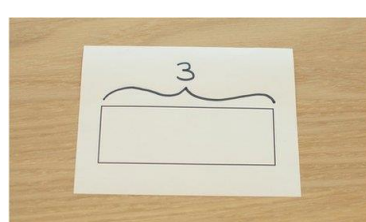
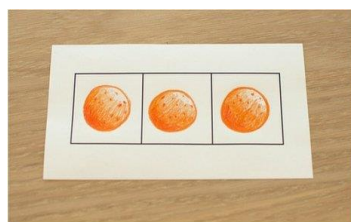
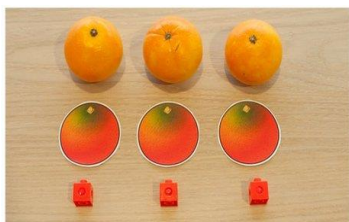
This diagram shows all these relationships;

$$a = b + c ; a = c + b ; a - b = c ; a - c = b$$

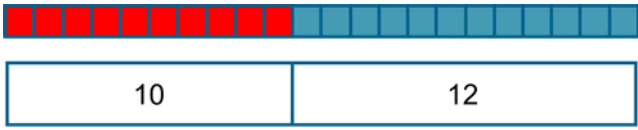
This is not always obvious to every mathematician!

To prepare young children for the bar model it is a good idea to encourage them to line up objects in a linear arrangement when representing addition and subtraction problems.

This will also help children to organise their counting. The physical objects can then be replaced, in time, with linking cubes and then with a bar drawn next to it.

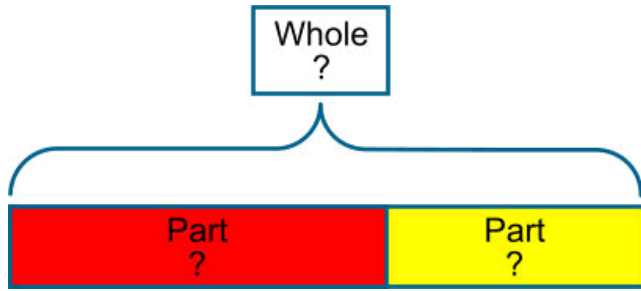


The question can then be asked "what's the same, what's different?" to support the children in their reasoning and in making sense of the bar as an abstract representation of the physical objects. In school, children often work in pairs with one manipulating the cubes, while the other records by drawing the bars and then writing the number sentence underneath. The children then swap roles.



Sam had 10 red marbles and 12 blue marbles. How many marbles did he have altogether?

$$10 + 12 = 22$$



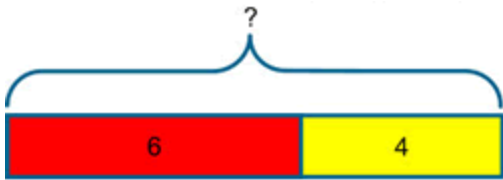
In problems involving addition and subtraction,

there are **three possible unknowns** as illustrated here

and given the value of any two of them **the third can be found**.

The examples below illustrate a variety of ways that the bar might be used for addition and subtraction problems. A question mark is used to indicate the part that is unknown.

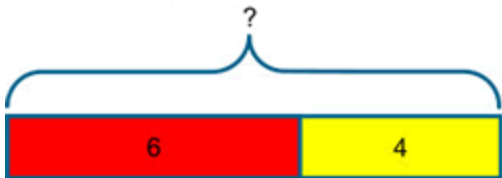
I have 6 red pencils and 4 yellow pencils. How many pencils do I have? (I combine two quantities to form the whole)



- two quantities combined

$$6 + 4 = 10 \text{ or } 4 + 6 = 10$$

I have 6 red pencils and I buy 4 yellow pencils. How many pencils do I have? (The bar I started with increases in length)

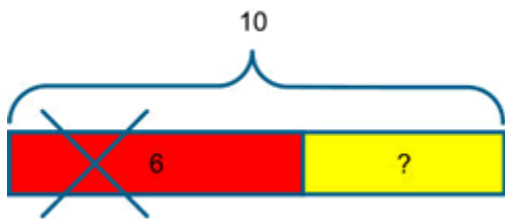


- a quantity is increased

$$6 + 4 = 10$$

I had 10 pencils and I gave 6 away, how many do I have now? (This time we know the whole but only one of the parts, so

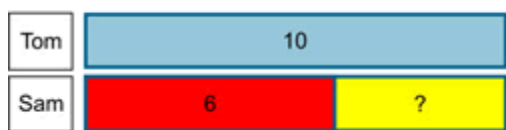
the whole is partitioned and one of the parts removed to identify the missing part)



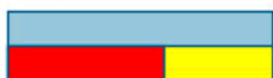
- Subtraction - Take Away

Tom has 10 pencils and Sam has 6 pencils. How many more does Tom have?

(The bar is particularly valuable for seeing the difference between the two quantities)



Subtraction
- Comparison or Difference



Equivalence



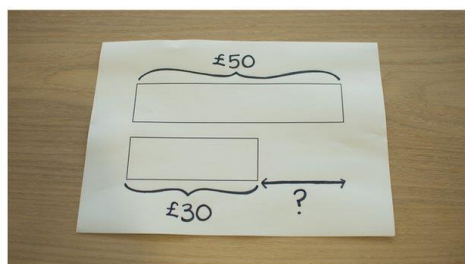
The model can be **rearranged** to demonstrate equivalence in a traditional layout

Pupils need to practise and develop fluency in using this model to represent addition and subtraction problems in a variety of contexts.

The model will help children to see that different problems share the same mathematical structure and can be visualised in the same way.

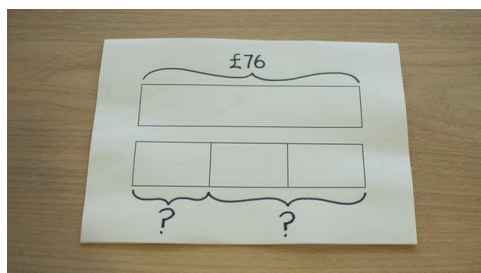
Asking children to write their own problems, using the bar as the structure will help to consolidate this understanding.

Take a look at these examples of trickier questions:



How much change if you pay for a £30 shirt with a £50 note?

The model can be used to help visualise almost any maths problem.



Three people want to split a restaurant bill of £76. How much for a couple who want to pay together?

The model helps break the problem down.

First divide £76 by 3. Then times the answer by 2.

Top tips for trying the Bar Model method with your children:

Count things with objects

Try counting familiar things together like the number of people in the room, kids' ages, or goals in football matches, using concrete objects like counters, buttons or small stones, lining them up one by one. If nothing's to hand use fingers. Try carrying round a few to count things when you're out and about. They are also good for kids to play with to keep them occupied.

Use cut-out pictures

Draw pictures on paper and cut them out to use as counters with your kids.

Do basic arithmetic with objects

You can talk about most basic arithmetic using concrete objects, adding objects to the line, taking them away. 'Multiply' literally means 'many layers' and you can show times tables by layering rows one on top of the other.

Draw pictures

Give children pens and paper to draw things they count, lined up in a row. Encourage them to draw boxes around the pictures. The fact they have drawn the pictures gives them a sense of ownership and means they'll probably be more confident in talking about them.

Don't rush to use figures

Hold off from using number symbols until your child is really confident with concrete and pictorial representations and can make the link. Then they will always have a ready way of picturing what the symbol means as a fall-back.

Start with figures 1 to 9

When you do start using symbols to label drawn boxes, stick to 1 to 9 at first to build confidence, so one figure relates to one quantity. The leap from the figure 9 to the figure 10 involves concepts of place value and zero which can take time to understand.

Go slowly to build confidence

It takes time for children to get really confident with the basics. Some country's curricula actually cover less than the UK national curriculum in the first few years, instead taking more time to build confidence in the basics. This can pay off later on.

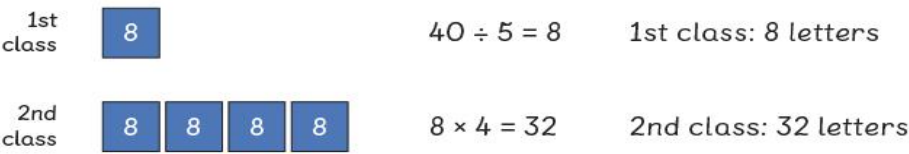
TOP TIP: Be positive

Above all be positive. Enjoy playing with and counting objects together, celebrate effort and praise often. Real learning involves making **lots of mistakes**. Try to see mistakes as positive things that highlight deeper misunderstandings. Why did I think that? Children have years of maths lessons ahead of them and every ounce of self-confidence helps them to succeed. **Boosting children's understanding with objects and pictures is key.**

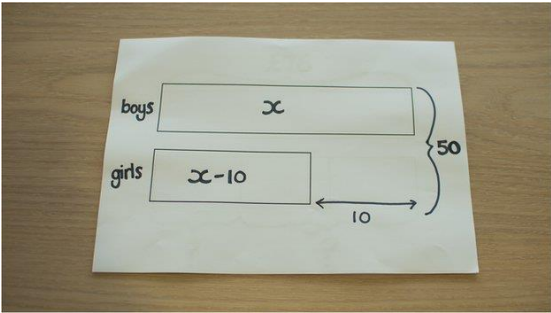
This model will help you to answer GCSE level questions!

This is an example of a GCSE Maths Higher paper, that becomes very straightforward once you know how to use the bar model. This has been tried out with primary school children in Year 5 and 6 and they managed it with ease, using the bar model:

Ralph posts 40 letters, some of which are first class, and some of which are second class. He posts four times as many second-class letters as first. How many of each class of letter does he post?



Here is another of the hardest ones.....



In a year group there are 50 children.
There are 10 fewer girls than boys.
How many boys?
The model can help visualise the unknown quantity.
You can see that $x + x - 10 = 50$.
If you add the 10, you get $x + x = 60$. So $x = 30$.

Total children altogether = 50	
B	G
x	$x - 10$

Try it at home. It's possible your children will take to it more easily than you do! After all, they haven't had a lifetime of abstract algebra to contend with. If you find it tricky, practise all the examples we are sending out, each week, until you are confident with using the bar model. It will help you and your children with your maths.