

ALL SAINTS' CoFE JUNIOR SCHOOL BAR MODELLING

A bar model is a diagram; the purpose of which is to represent a mathematical problem. Especially one which might be quite difficult to solve without visualising it first. There are several variations of the bar model, but all of them follow the same basic principles:

- Bar models are constructed in a specific way, using rectangles to represent known and unknown amounts
- Bar models are designed to bring together all the relevant information from a problem, to contextualise any facts presented in a question. This helps children to begin working towards an answer

Bar models are not methods of calculation, in fact they are designed to pictorially present the information in a problem allowing the children themselves to decide on what operations to use.

Bar modelling helps children with one of the most essential parts to the learning process: visualising and making sense of a problem so they can then begin to move on to the more abstract part of calculating an answer.

Once children have learnt how to use and adapt bar models to their needs then this technique can be applied to almost all areas of mathematics. Because all that is needed for a bar model is a pencil and a piece of paper children are able to carry the resources with them that they might need when solving a problem wherever they are, in the classroom, working as part of a group or even in a test.

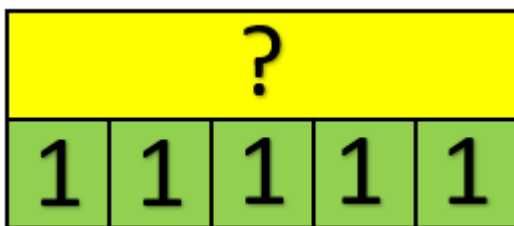
2 TYPES

There are 2 main types of Bar Model:

- Part/Whole Model
- Comparison Model

Part whole model:

Part Whole models are made up of parts and wholes. Where the whole represents the sum on the parts



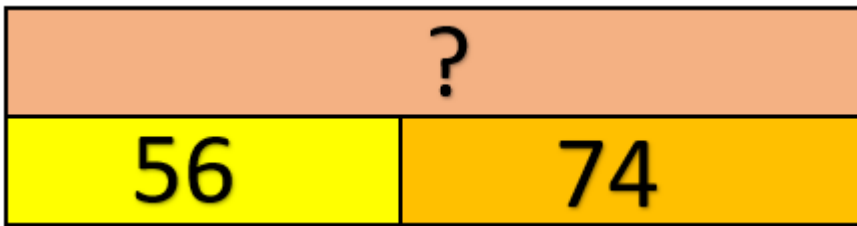
Bar models can show individual parts where each bar represents 1 unit



They can also show more than one unit and represent a larger number.

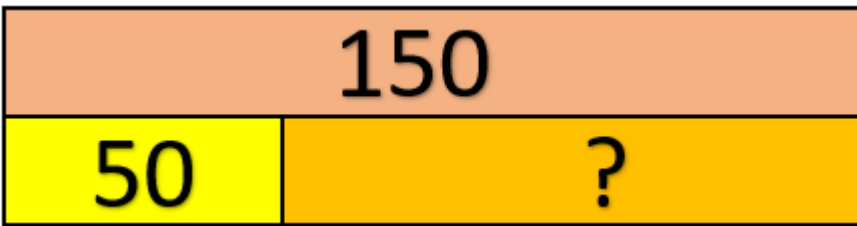
When drawing a bar models the bars must be roughly proportional to each other. For example, a rectangle representing 6 must be roughly twice as big as a rectangle representing 3 in the same representation.

Examples of bar modelling using the 4 operations:



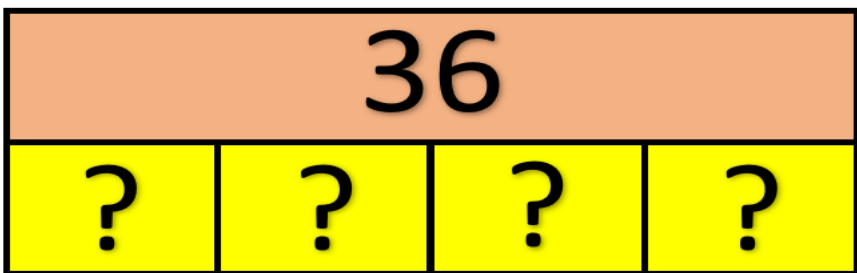
Addition representation for

$$56 + 74 = ?$$



Subtraction representation for:

$$150 - 50 = ?$$



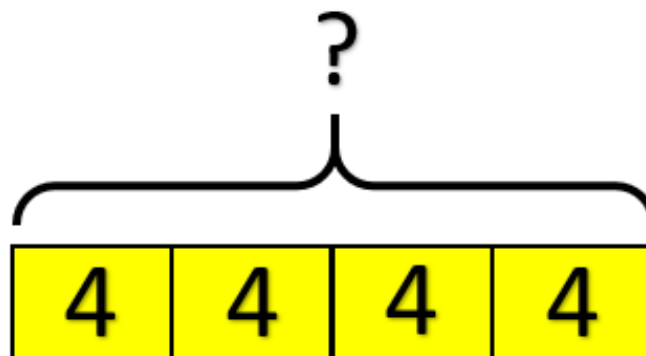
Division representation for:

$$36 \div 4 = ? \text{ or}$$

The multiplication representation for $4 \times ? = 36$

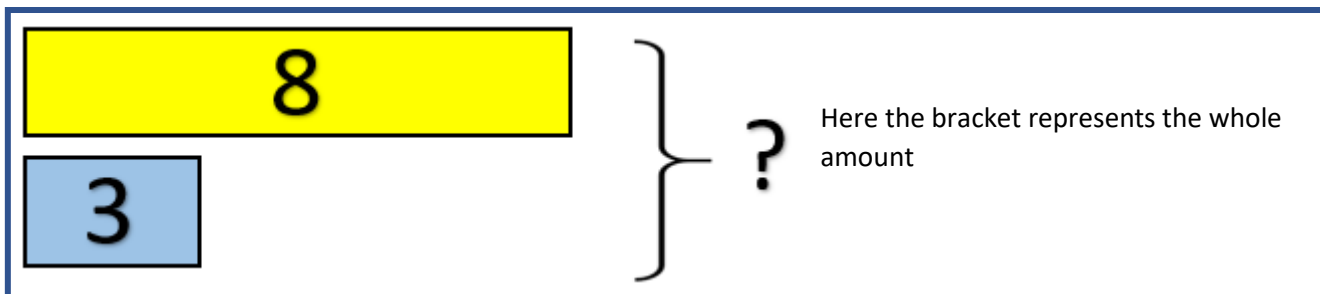
The role of the ? is important in all of these diagrams. It helps the children to focus on the unknown amount; the part they are trying to figure out by solving the problem. If children concentrate on the answer that should appear on their diagram then they can find a route by which to provide it.

Some models replace the whole part with a bracket such as this:

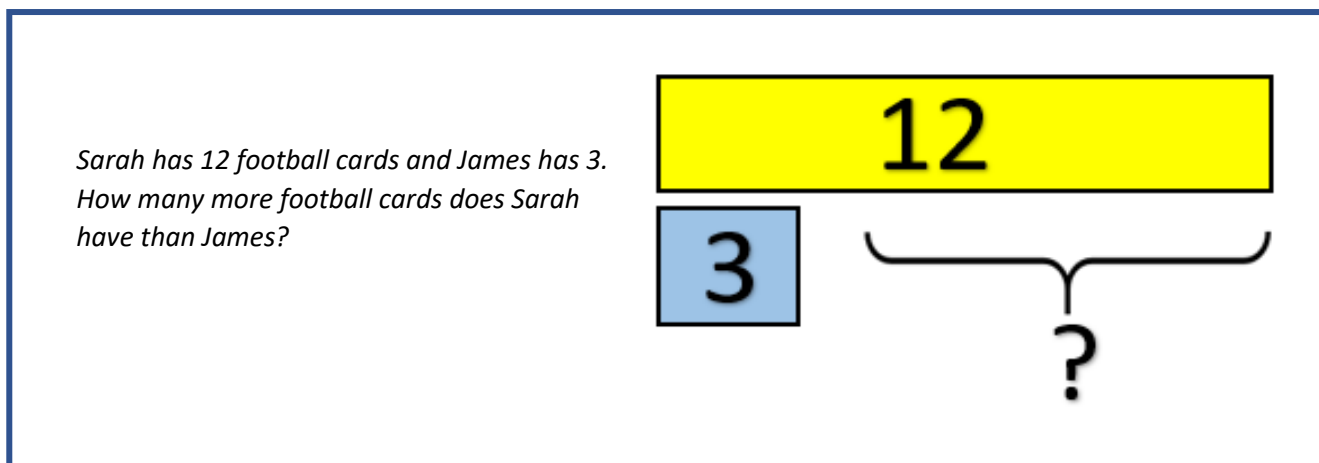


Examples of bar modelling - Comparison:

Rather than have a part and a whole in this model two or more bars are drawn vertically so that children can compare the amounts:

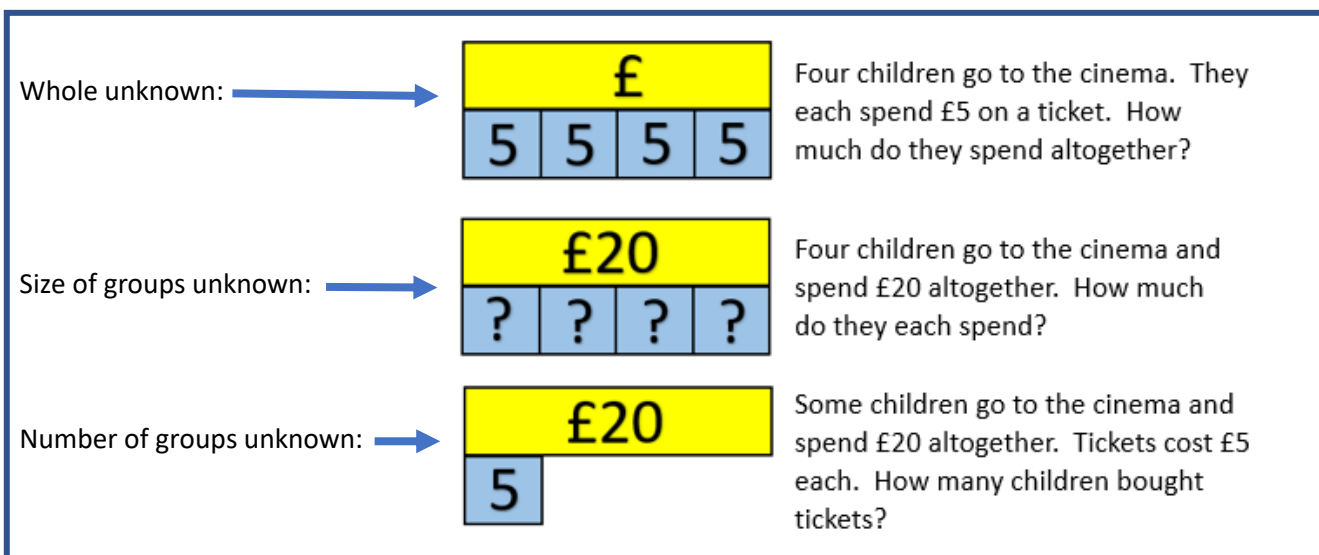


Comparison models can be very useful for finding the difference between amounts:



The importance of language when bar modelling:

It is important that we use the words **whole** and **part** when talking about bar modelling and solving problems. All one step mathematical problems will fall into one of the following categories:



At All Saints' we encourage children to use bar models when appropriate to their problem solving needs.

However, if the child is new to bar modelling then they can use them constantly to help reinforce the idea. The more children use bar modelling the more they will find it useful and be able to adapt the tools when coming across more complex problems.

Staff challenge children to use and adapt bar models across all areas of the maths curriculum.

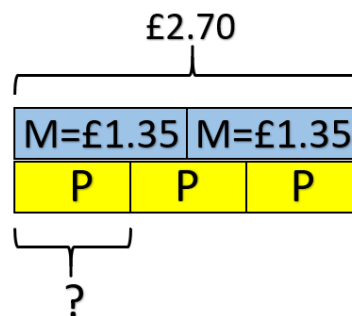
Bar modelling is an incredibly flexible approach which pupils can use to represent problems involving fractions, missing numbers, time, ratio, money and place value.

Drawing a bar model can be a great way to support pupils who struggle to 'talk' about maths as it gives them a visual on which to base their explanations.

Examples of bar modelling:

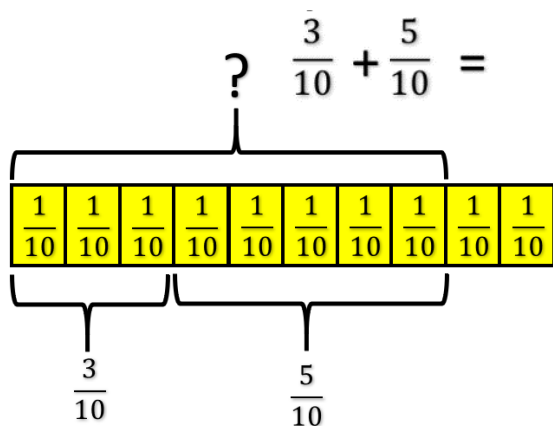
Question 14 from the 2017 SATs Reasoning Paper 3:

3 pineapples cost the same as 2 mangoes.
One mango costs £1.35.
How much does one pineapple cost?

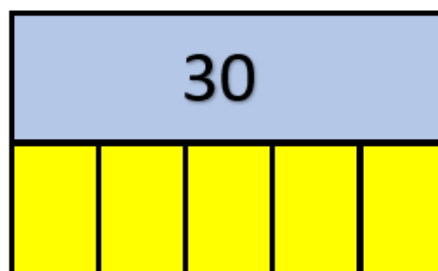


With the aid of a bar model, the children are able to see that dividing £2.70 by three will give them the cost of one pineapple and the answer that they want.

Modelling fractions using bar models is one of the most intuitive ways of showing fractions pictorially. It might even be that children will gain a greater understanding of bar modelling in general, giving them skills which are transferable to other areas of the Maths curriculum. As such, there are a wide range of contexts that a bar model can be used to represent fractions problems.



What is $\frac{3}{5}$ of 30?



Money problems start in Year 2 with addition and subtraction and gradually gets more difficult. By Year 5 children are asked to use the four operations to solve complex problems involving money, using decimal notation. If we look at a problem:

A boy has £3. He buys some crisps for 55p and a chocolate bar for 60p.
How much change does he get?

Bar models like this can help children to understand key (and often confusing) concepts in money problems. For example, by using a bar model children should be able to see that:

- When someone buys more than one thing the costs must be added
- When someone spends money subtraction is happening
- When sharing money equally division is happening
- When sharing money unequally there are multiple steps of subtraction

The language used in problems like these often confuses children but bar models can help them to visualise the Maths behind the words – acting out problems are a great precursor or accompaniment to bar modelling money problems.

Time problems can be a tricky thing for children to visualise as their go-to pictorial model is a clock which goes round and round. As far as we know time doesn't go round, it moves forward in a line so bar models can represent some time problems quite well.

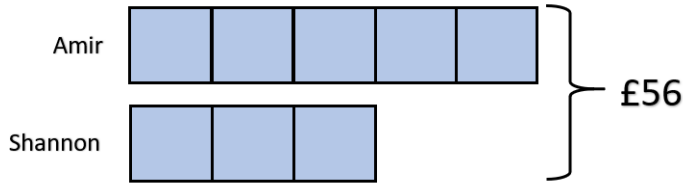
A film starts at 7:35 pm and ends at 8:55 pm.
There is an ice cream break of 10 minutes halfway through. How long is the film?

Once the children have a visual model, they can then add notes and rearrange the data to help them solve the problem:

Having crossed out the 10 mins and taken that off the finish time. The children can then count up from 7:35 to 8:45 to find the solution to the problem.

The comparison bar model is a gift when it comes to **ratio problems**, which is particularly significant given that ratio questions tend to be the most unanswered

Shannon and Amir share £56 in the ratio of 3:5.
How much money does each person get?



By representing this problem with a bar model, it makes it much easier to see that the whole amount is made of 8 equal parts (3 + 5). Therefore the £56 needs to be first divided by 8 before then being multiplied by the number of parts of £56 each person gets.

Bar Models can also be used to provide **explanations** to questions:

20

Adam says,

0.25 is **smaller** than $\frac{2}{5}$

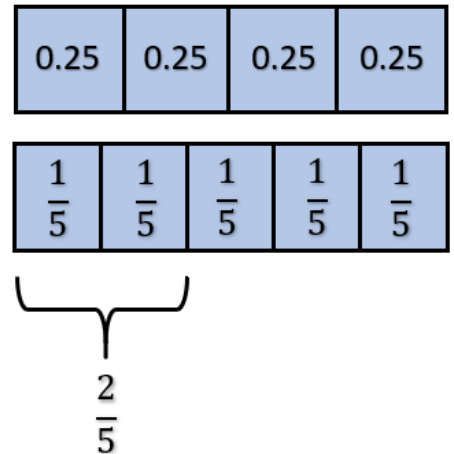


Explain why he is correct.

For this problem, children can model the decimal and the fraction in a comparison model and then use their drawings to help with a written explanation.

To draw this, children will need to have prior knowledge about how many lots of 0.25 are in a whole, and how many fifths are in a whole.

For a child who doesn't immediately equate one fifth with 0.2, the diagram they draw should prompt them to see that the whole is split into 5 equal parts and these parts could also be written as decimals in order to compare the fractions to the decimals.



At All Saints', bar modelling is an important part of our maths and as questions and calculations grow increasingly more complex (as children progress through the years), we are committed to ensuring children have all the tools they need to become successful mathematicians.