

Goldenhill Primary Academy



Bar Model Policy September 2025

“Everyone Shines At Goldenhill”.

Mission statement:

Goldenhill Primary Academy provides a happy, friendly, secure and respectful environment; where everyone achieves their potential and develops a lifelong love for learning.

Goldenhill Primary Academy Bar Modelling Calculation Policy



The purpose of this document is to illustrate progression within the bar model and is Goldenhill Primary Academy's attempt to show where it could fit within the new national curriculum. Please note that use of the bar model is not statutory and is designed to help children visualise maths problems, rather than do the maths for them.

Maths Bar Model Calculation Policy

Rationale:

The bar model was introduced in Singapore in the 1980s alongside an increased emphasis on problem solving in the curriculum. A new curriculum was devised based heavily on the Cockcroft report (1982) and 'Agenda in Action' (1989) – with the latter being an American report. It fits a maths mastery model, which involves spending more time on a topic. This allows students opportunities to explore maths in-depth. Such a concept has also been stressed by Jane Jones; lead HMI for mathematics, when she talks about 'milking the maths.'

The bar model helps students to visualise the relationships between the numbers given and the amount you are looking for in a word problem. The model starts with addition and subtraction problems and then can be further developed to support multiplication, division, fractions, ratios and percentages problems. The model is incredibly useful when learners need to make sense of given information and decipher how they are going to solve problems.

CPA and how it relates to the bar model

Background to the CPA framework

- Children (and adults!) can find maths difficult because it is abstract. The CPA approach builds on children's existing knowledge by introducing abstract concepts in a concrete and tangible way. It involves moving from concrete materials, to pictorial representations, to abstract symbols and problems. The CPA framework is so established in Singapore maths teaching that the Ministry of Education will not approve any teaching materials that do not use the approach.

The Concrete Step of CPA

- Concrete is the “doing” stage. During this stage, students use concrete objects to model problems. Unlike traditional maths teaching methods where teachers demonstrate how to solve a problem, the CPA approach brings concepts to life by allowing children to experience and handle physical (concrete) objects. With the CPA framework, every abstract concept is first introduced using physical, interactive concrete materials.

The Pictorial Step of CPA

- Building or drawing a model makes it easier for children to grasp difficult abstract concepts (for example, fractions). Simply put, it helps students visualise abstract problems and make them more accessible.
- Pictorial is the “seeing” stage. Here, visual representations of concrete objects are used to model problems. This stage encourages children to make a mental connection between the physical object they just handled and the abstract pictures, diagrams or models that represent the objects from the problem.

The Abstract step of CPA

- Abstract is the “symbolic” stage, where children use abstract symbols to model problems. Students will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem. The abstract stage involves the teacher introducing abstract concepts (for example, mathematical symbols). Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols (for example, $+$, $-$, $\times$, $\div$) to indicate addition, multiplication or division.

Importance of CPA and apparatus used:

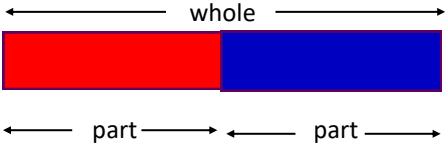
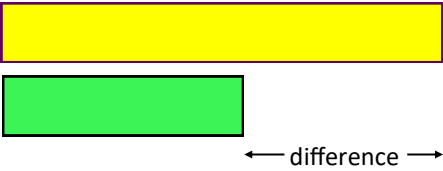
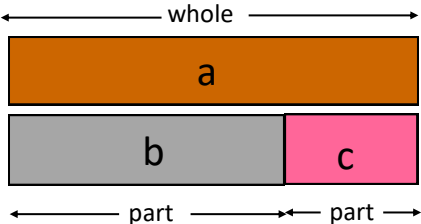
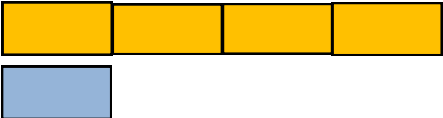
- The [MNP Primary Series](#) approach encourages teachers to vary the apparatus that children use in class. For example, students might one day use counters, another day they might use a ten frame. Likewise, children are encouraged to represent the day's maths problem in a variety of ways. For example, drawing an array, a number bond diagram or a bar model. By systematically varying the apparatus and methods used to solve a problem, children can craft powerful mental connections between the concrete, pictorial, and abstract phases. It is important to recognise that the CPA model is a progression. By the end of KS1, children need to be able to go beyond the use of concrete equipment to access learning using either pictorial representations or abstract understanding. What is important, therefore, is that all learners, however young, can see the connections between each representation.

Maths Bar Model Calculation Policy

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What does the bar model look like?

There are different representations of the bar model which can be used to represent a given problem.

PART-WHOLE MODEL	COMPARISON MODEL	EQUIVALENCE MODEL
Addition and subtraction  <i>part + part = whole</i> <i>whole – part = part</i> <i>E.g Dev has 5 red marbles and 8 blue marbles. How many does he have altogether?</i>	Addition and subtraction  <i>larger quantity – smaller quantity = difference</i> <i>larger quantity – difference = smaller quantity</i> <i>smaller quantity + difference = larger quantity</i> <i>E.g Tom has £20. He has £6.50 more than James. How much money does James have?</i>	The part-whole model can be reorganised in order to help consolidate equivalence.  <i>b + c = a</i> <i>c + b = a</i> <i>a – b = c</i> <i>a – c = b</i>
Multiplication and division  <i>one part x number of parts = whole</i> <i>whole ÷ number of parts = one part</i> <i>whole ÷ one part = number of parts</i> <i>E.g Sarah buys 3 boxes of cakes. Each box has 4 cakes inside. How many cakes does she buy altogether?</i>	Multiplication and division  <i>larger quantity ÷ smaller quantity = multiplier</i> <i>larger quantity ÷ multiplier = smaller quantity</i> <i>smaller quantity x multiplier = larger quantity</i> <i>E.g Emily has 5 pints of water. Joe has 4 times as much water as Emily. How much water does he have?</i>	

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What does the bar model look like?

A bar model is used to **represent** a given problem. We set out a bar model in the same way, regardless of year group, and use specific language and symbols.

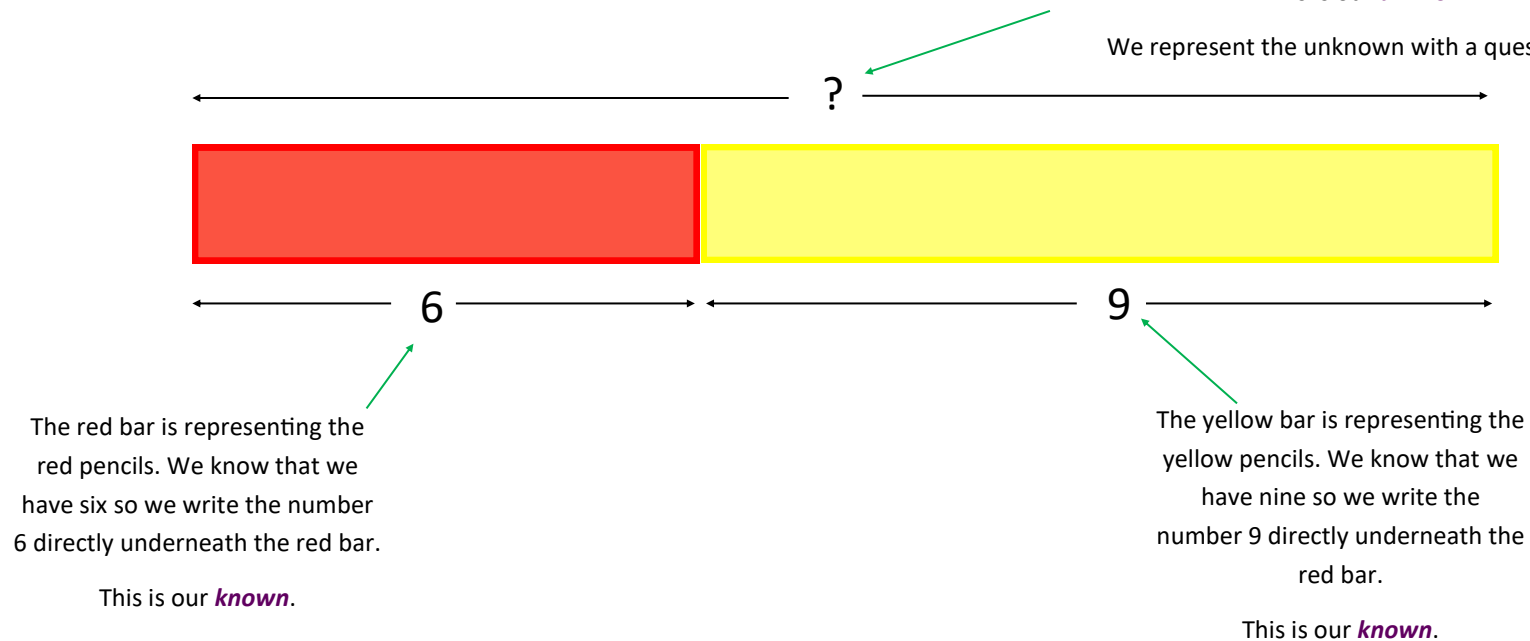
For example,

I have six red pencils and 9 yellow pencils. How many do I have altogether?

We do not know how many pencils we have altogether—that is what we need to find out.

This is our **unknown**.

We represent the unknown with a question mark.



Maths Bar Model Calculation Policy

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Another example is of a **comparative problem**. The layout of this representation is slightly different; however, the same symbols and language is used to show the known and unknown.

Tom has 10 pencils. Mark has 6 pencils. How many more pencils does Mark have than Tom?

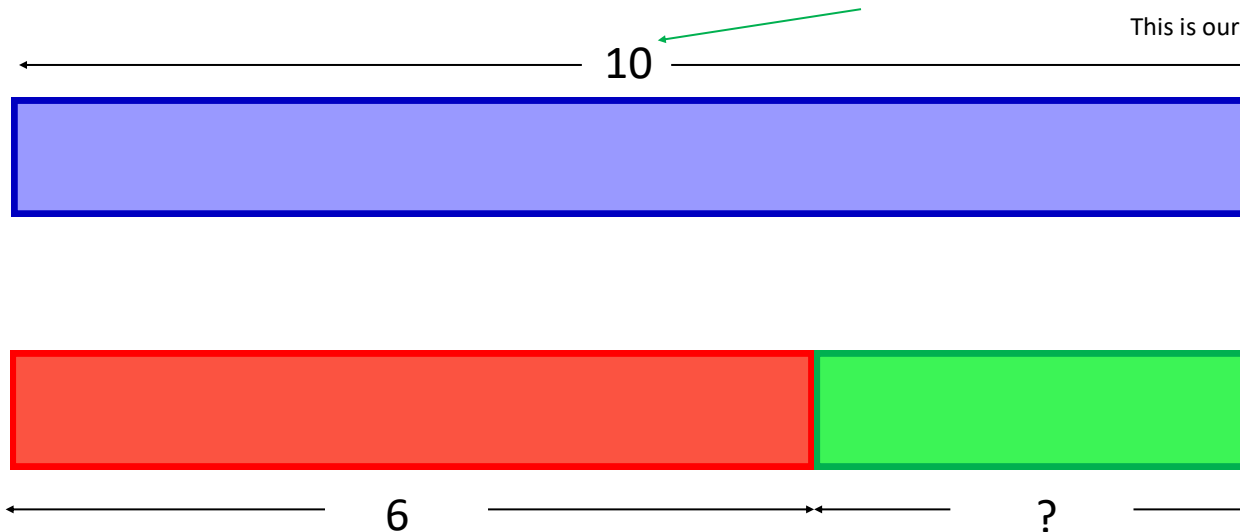
The blue bar is representing how many pencils Tom has. We know that he has ten so we write the number 10 directly above the blue bar.

This is our **known**.

Because we are using two different bars, we need to label the bars to show what they are representing. In this case, they are representing the people so we use names.

Tom

Mark



Because we are comparing, we need to use **two bars**.

The red bar is representing how many pencils Mark has. We know that he has six so we write the digit 6 directly underneath the red bar.

This is our **known**.

We do not know how many more pencils Tom has than Mark. We show this by using an additional bar.

This is our **unknown**.

We represent the unknown with a question mark.

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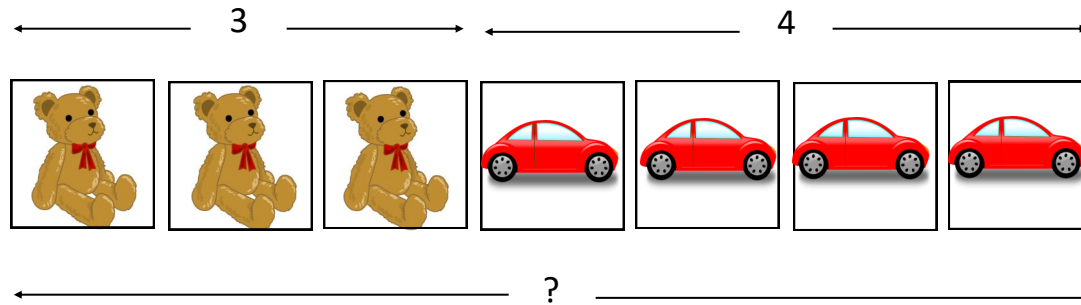
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Using the bar model in the EYFS:

Children should be using concrete objects related to a given problem which are laid out on top of a bar strip. Once confident with this, children should be moving on to using pictures to act as the concrete apparatus.

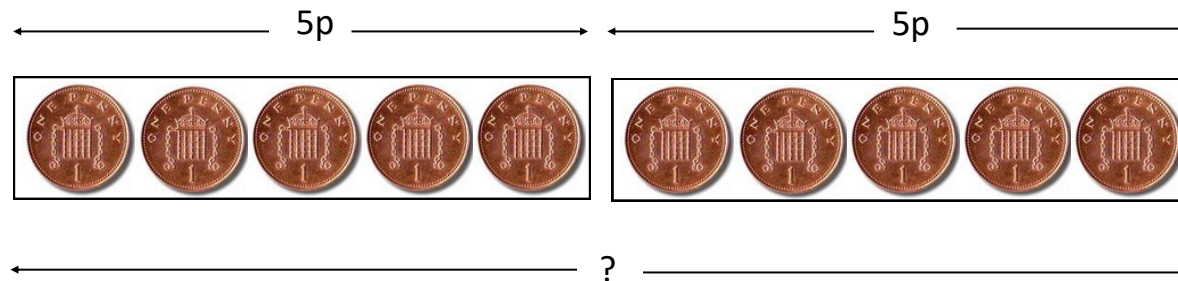
Addition and subtraction

Sam has 3 teddy bears and 4 cars. How many toys does he have altogether?



Multiplication and division

The shopkeeper gave me double 5p. How much did he give me?



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EYFS Problems:

1. Tom had 3 blue marble. Sam had 6 pink marbles. How many marbles did they have altogether?
2. Katie has 3 cupcakes. Joe had 2 more cupcakes than Katie. How many cupcakes did Joe have?
3. They were 5 balls on the playground. 2 of the balls were kicked over the fence. How many balls were left on the playground?
4. Charlie had 10p in his pocket. He halved it with his friend. How much money did he have left in his pocket?
5. One alien had 7 eyes. Another alien had 2 eyes. How many eyes did they have altogether?
6. There were 10 carrots in a bowl. Rupert the rabbit ate 5 of those carrots. How many carrots were left in the bowl?
7. I shared my sweets with my friend. I have 3 left. How many did I have to begin with?

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Using the bar model in Year 1/2:

Children should be using unifix cubes (Year 1) initially to represent a given problem, moving on to Cuisenaire rods (Year 2) when children are confident in using concrete apparatus as symbolic representation. Children should be working towards talking about relations, so that they are ready to start using paper strips in LKS2. If children are not

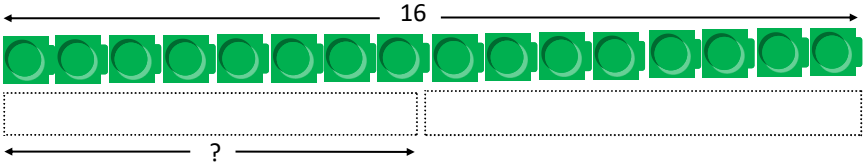
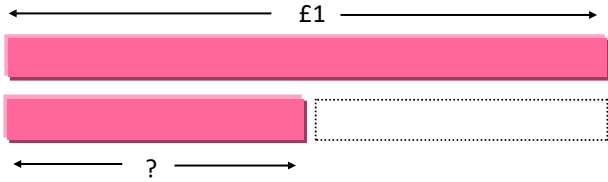
	Year 1	Year 2
Addition and subtraction <i>(the equivalence model can be used with these operations if appropriate)</i>	Year 1 <i>Ebony has 5p and Daniel has 8p. How much do they have altogether?</i>	Year 2 <i>Danielle's class visited the safari and went to 'Penguin Island'. She counted 16 Adelie penguins and her friend counted 22 Rockhopper penguins. How many penguins did they spot altogether?</i>
Multiplication and division	<i>How many fingers are there in 3 hands?</i>	<i>Pencils cost 3p each. Jack wants to buy 11 pencils. How much money will he need?</i>

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	Year 1	Year 2
Fractions	What is half of 16? 	Last week, Ellie got £1 pocket money. She spent half of it on a chocolate bar. How much pocket money does she have left? 

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Year 1 Problems:

1. Ebony has 5p and Daniel has 8p. How much do they have altogether?
2. A lolly costs 6p. Amrit paid with a 10p coin. How much change does he get?
3. Michael says that $16 + 5 = 21$. Is he correct?
4. I think of a number. I subtract 5. The answer is 4. What was my number?
5. How many gloves are there altogether in 6 pairs of gloves?
6. Twelve people are split into two groups. How many are in each group?
7. Mrs Morton puts five 5p coins into her purse. How much is in her purse altogether?

Year 2 Problems:

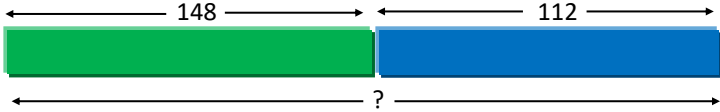
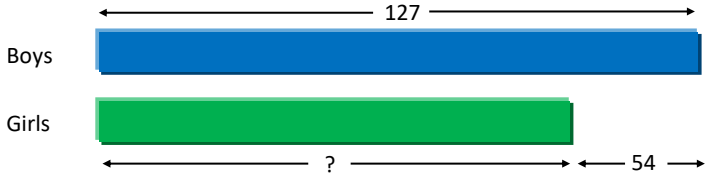
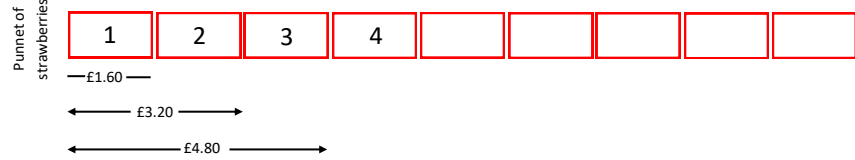
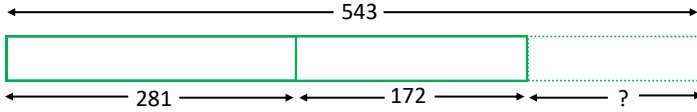
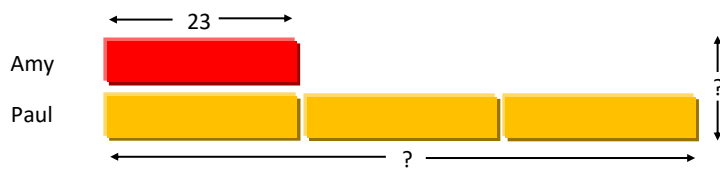
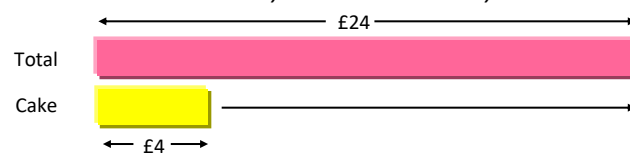
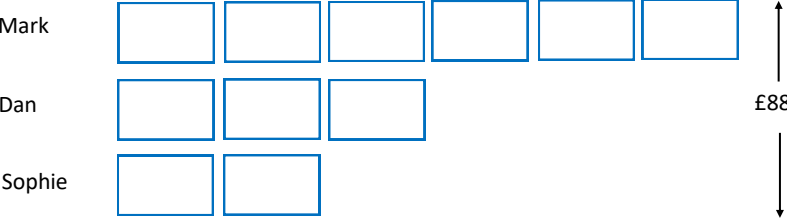
1. Dylan has 37 coloured pencils and he buys 30 more. How many does he have now?
2. Janie has 40 beads. She loses 25 of them. How many does she have left?
3. What is the difference between seventy six and thirty five?
4. I think of a number. I subtract 5. The answer is 4. What was my number?
5. Last week Ellie got £1.00 pocket money. She spent half of it. How much has she got left?
6. A tub contains 24 coins. Saj takes 5 coins. Joss takes 10 coins. How many coins are left in the tub?
7. Amelia writes the calculation below as a multiplication calculation? What might she write?
 $3 + 3 + 3 + 3 + 3 = 15$
8. Mr Siddique shares £18 equally between his three sons. How much does each son get?
9. Charlotte-May had to find a 14 of a number. Her answer was 4. What number did she start with?
10. Danny cuts his pizza into 8 equal slices. He eats $\frac{3}{4}$ of the pizza and gives the rest to his dog, Gruff. How many pieces does Danny eat?

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Using the bar model in Year 3/4:

Children should continue to use Cuisenaire rods to represent a given problem, moving on to using paper strips. If children are struggling with abstract representation, paper strips can be used with a pictorial drawing eg.  or continue to use concrete apparatus alongside abstract representations. If children are not working at Year 3/4 level then revise prior year groups as necessary.

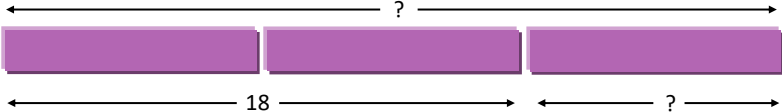
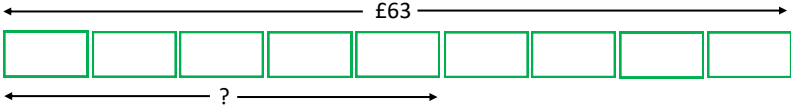
	Year 3	Year 4
Addition and subtraction	Robert sold 148 raffle tickets in one week. The following week he sold another 112. How many tickets did he sell?  There are 54 more boys than girls at Dinglewood Primary School. There are 127 boys. How many girl pupils are there? 	A punnet of strawberries costs £1.60. How many punnets can Mrs. Gray buy with £10?  John and his family went to Scotland for a holiday. They drove 281 miles on Monday and 172 miles on Tuesday. On Wednesday they drove the rest of their 543 mile journey. How many miles did they drive on Wednesday? 
Multiplication and division	One September afternoon, Amy and Paul went fruit picking. Amy picked 23 apples. Paul picked 3 times as many apples as Amy. How many apples did they pick altogether?  A whole cake costs £4. How many cakes could Anne buy with £24? 	Mark, Dan and Sophie baked jam tarts at the school fete. Mark baked three times as many as Sophie. Dan baked half as many as Mark. Altogether they baked 88 jam tarts. How many tarts did Mark bake? 

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	Year 3	Year 4
Fractions	Amy gave Libby $\frac{1}{3}$ of her shell collection. She had 18 shells left. How many shells did Amy have to begin with? 	Simon has £63 in his wallet. He spends $\frac{5}{9}$ of his money on a present for his Gran. How much did his Gran's present cost? 

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Year 3 Problems:

1. There are 334 children at Springfield School and 75 at Holy Trinity Nursery. How many children are there altogether?
2. Gemma collected 293 badges but she gave 45 of them to her friend, Rebecca. How many badges did she have left?
3. Aiden has seven marbles and Harvey has fifteen. They decide to share them equally between them. How many do they get each?
4. Seven people each put five pens into a pot. Carmen then takes out fifteen pens. How many pens are left?
5. If you spend 61p at the corner shop, how much change do you get from £1.00?
6. If five apples cost fifty pence, how much would two apples cost?
7. Emma buys seven markers for 30p each. How much change does she get from £3.00?
8. A bookcase in the library holds 5 shelves with 46 books on each shelf. How many books are there in the bookcase altogether?
9. How many 5p stickers can Alexis buy with his 55p pocket money?
10. Which is the larger amount, one third of £60 or one quarter of £88?

Year 4 Problems:

1. Martin has saved £6.78 and spends £4.69. How much does he have left?
2. Sally has 40 football cards. She gives $\frac{2}{5}$ of them away. How many does she give away?
3. Sally has 30 football cards. She gives $\frac{2}{5}$ of them to her friend. How many does she have left?
4. 8 children each download 59 songs to play on their iPod. How many songs do they have altogether?
5. Calculate how many fives there are in 85?
6. At the dressmakers, Debbie buys buttons weighing 3 grams each. If she has 81 grams of buttons, how many buttons does she buy?
7. Kelly buys $\frac{4}{5}$ of the shop's oranges. If the shop had 20 oranges, how many does she have?

Maths Bar Model Calculation Policy

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Using the bar model in Year 5/6:

Children should now be using paper strips as a scaffold and progressing on to drawing their bars independently. Cuisenaire rods and unifix cubes are still valuable resources that can be used alongside drawn representations of problems. If children are not working at Year 5/6 level then revise prior year groups as necessary.

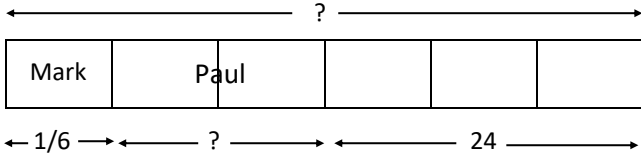
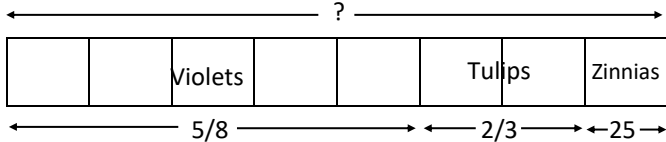
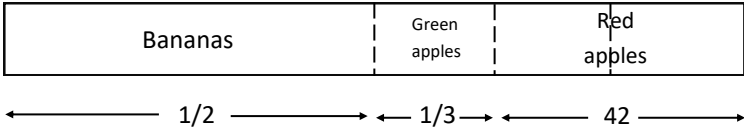
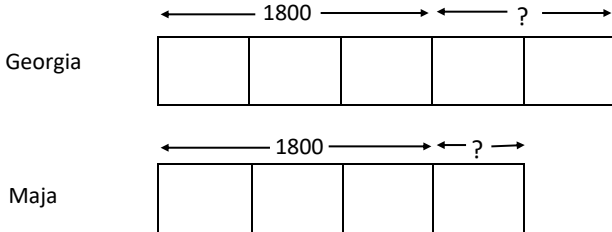
	Year 5	Year 6
Addition and subtraction	A phone, a pair of jeans and a magazine collectively cost £178. The jeans cost £83. The phone costs £8 less than the jeans. How much more do the jeans cost than the magazine?	Amy's football team went on a trip to Alton Towers. The children travelled in two coaches. At first, there were three times as many children on one coach than the other so Amy's teacher asked some of the children to move so that there were the same number in both coaches. After 10 children swapped coaches, there was an equal number of children in each coach. How many were in both coaches? <i>(N.B. This problem works really well using post-it notes)</i>
Multiplication and division	There is 20% off in a sale at Debenhams. Sally buys a pair of jeans for £36. How much were the jeans originally?	Four brothers bought a house together. Paul paid three times as much as Fred. Anthony paid half as much as Paul. Stephen paid £10,000 less than Fred. If Anthony's share cost him £45,000, what was the price of the house? <i>Stephen = Fred — £10,000</i>

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	Year 5		Year 6
Fractions	Mandy enjoyed baking for all of the family. One weekend she baked cookies for her two brothers. She gave Mark $\frac{1}{6}$ of the cookies and $\frac{2}{5}$ of the remainder to Paul. She had 24 cookies remaining. How many cookies did she bake altogether? 	Fractions	Mrs Lee carried out a survey in her school to discover which flowers the children wanted to plant in the school garden. $\frac{5}{8}$ of the children chose violets as their favourite flowers and $\frac{2}{3}$ of the rest chose tulips. The 25 children who were left chose zinnias. How many children were in the school? 
	In a fruit crate there are apples and bananas. Half of the fruits are bananas. One third of the apples are green. There are 42 red apples. How many fruits are there altogether? 	Ratio	Georgia and Maja live in different towns and were both driving to their Grandmother's house to celebrate her 70th birthday. The ratio of the distances that they needed to travel was 5:4. After they had both driven the same distance, Georgia had twice the distance left to drive that Maja had. The total distance that the two granddaughters had already driven was 3600km. How far did each girl have left to travel? 

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Year 5 Problems:

1. Every day for 4 days Helen scored 7.5 in a test. On the fifth day she scored 8. What was her total score?
2. I cut 60 cm from 3.3m of string and shared the rest between 3 friends. How much string did they get each?
3. How many jugs with a capacity of 250ml could you fill with 10 litres of water?
4. All the children in the school are going on a residential trip to the outdoor activity centre. They will be divided into 6 equal groups. If there are 246 children in the school how many will be in each group?
5. Robert calculated 25% of 600. What answer does he get?
6. Sam calculated 40% of 120. What answer does he get?
7. Rita worked out that one sixth of a number was 12. What was the number she started with?

Year 6 Problems:

1. Three quarters of a number is 54. What is the number?
2. Which is more; five ninths of 252 or four sevenths of 238?
3. There are 36 packets of biscuits. One half are chocolate, a ninth are digestive and a third are wafer biscuits. The rest are ginger nuts. How many biscuits are ginger nuts?
4. There is 20% off in a sale. How much would a track suit cost, if the normal price was £44.50?
5. There is 20% off in a sale. The reduced price of the jeans is £36. What was the original price?
6. At a dance there are 4 girls to every 3 boys. There are 63 children altogether? How many girls are there?
7. Seven in every nine packets of crisps in a box are salt and vinegar. The rest are plain. There are 63 packets of salt and vinegar crisps. How many packets of plain crisps are there?

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Further Challenges:

1. 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? (This question appeared on a GCSE higher tier paper.)
2. A computer game was reduced in a sale by 20% and it now costs £55. What was the original cost?
3. A computer game was reduced in a sale by 30% and it now costs £77. What was the original cost?
4. Sally had a bag of marbles. She gave one-third of them to Rebecca, and then one quarter of the remaining marbles to John. Sally then had 24 marbles left in the bag. How many marbles were in the bag to start with?
5. Peter is playing Space Explorer on his computer. He finished 13 of the levels last week and 25 of the remaining levels this week. He has 12 more levels to complete. How many levels does Space Explorer have?
6. Sam bakes a variety of biscuits.
one third are peanut, half are raisin, the remaining 12 were oat. How many biscuits are baked?
7. Tom spent 30% of his pocket money and put away 45% into his savings. He was left with £2.50. How much pocket money did he receive?
8. Two numbers are in the ratio 4:5. They both sum to 135. Identify both numbers.
9. Two numbers are in the ratio 6:7. They both sum to 169. Identify both numbers.
10. A herbal skin treatment uses yoghurt and honey in the ratio 5:3. How much yoghurt is needed to mix with 130 g of yoghurt?

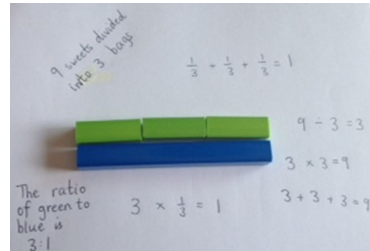
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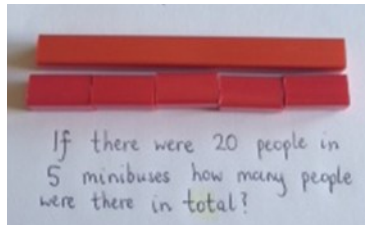
How can we use the bar model?

Open ended questions:

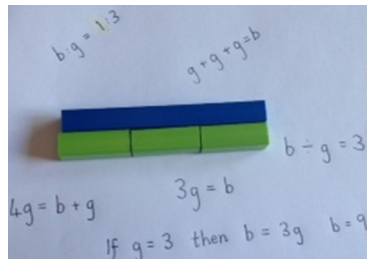
1. What could this bar model be showing?



2. Can you design a question that fits the bar model?



3. Playing with algebra



Are there other resources that could be used to represent a bar model?

1. Pictures
2. Unifix cubes
3. Double sided counters
4. Cuisenaire rods
5. Strips of paper
6. Post-it notes (an excellent resources for complex UKS2 problems)
7. Draw bars abstractly

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Web links:

<http://e2math.weebly.com/models-to-support-thinking/bar-model-singapore-math-model-method>