Grange Park
Primary School

Maths: practical strategies for home learning

PARENT WORKSHOP: Thursday 11th July 2019

Aims for this session

- To share curriculum expectations
- To understand the skills and expectations needed at KS2
- To identify strategies that can support home learning in number
- To explore how the Concrete, Practical, Abstract approach supports learning
- To share the Bar Modelling approach for problem solving

Curriculum expectations

- The national curriculum for mathematics aims to ensure that all pupils:
- become **fluent** in mathematics

- develop **conceptual** understanding and the ability to recall and apply knowledge rapidly and accurately

- **reason** mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

- can **solve problems** by applying their mathematics to a variety or **routine** and **non-routine** problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions

Skills in Maths and across the curriculum

- Use Mathematical vocabulary
- Explain ideas and evaluate outcomes
- Make connections
- Use fluency and recall
- Predict and Justify
- challenge ideas
- Work systematically
- Trial and improvement
- Logical thinking
- Be independent
- Learn from mistakes
- Collaborate with others
- Spot patterns
- Show resilience
- Correct mistakes

Expectations by the end of Year 6

Place Value Algebra	Four Operations	Fractions Ratio Proportion	Fractions Decimals Percentages

Measurement	Geometry –Shape, Position and Direction	Statistics

I can use, read, write and convert between standard units of measure — time		I can find missing angles where they meet at a point, are on a straight line or are vertically opposite	I can calculate and interpret the mean as an average
I can use, read, write and convert between standard units of measure – length, mass and volume (up to 3dp)		I can find unknown angles in any triangle, quadrilateral and regular polygon	I can construct line graphs
I can calculate the area of parallelograms and triangles		I can compare and classify geometric shapes based on their properties	I can interpret line graphs
I can recognise that shapes with the same areas can have different perimeters (and vice versa)	I can recognise where it is possible to use formulae for area of shapes	I can recognise, describe and build 3-D shapes including making nets	I can construct pie charts
I can solve simple problems involving the calculations and conversion of units of measure (up to 3dp)	I can recognise where it is possible to use formulae for volume of shapes	I can draw 2-D shapes using given dimensions and angles	I can interpret pie charts
Measurement	Measurement	Geometry –Shape, Position and Direction	Statistics

Expectations by the end of KS2

Lower key stage 2 – years 3 and 4

The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. Teaching should also ensure that pupils draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties, and confidently describe the relationships between them. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number.

By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling.

Strategies to support your child with timetables

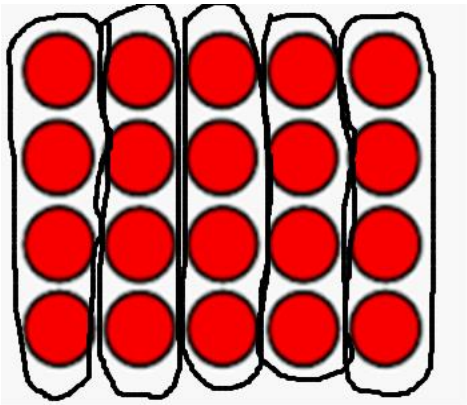
Teaching Times Tables Facts First

1. Repeated addition

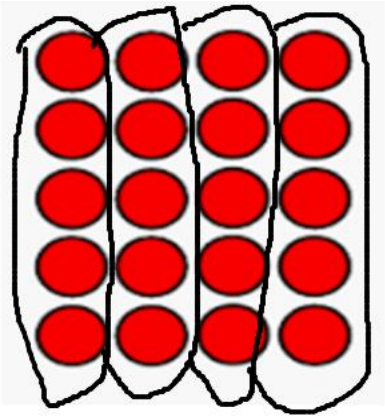
4 x 5 is the same as 5 + 5 + 5 + 5.

Children need experience of using concrete manipulatives such as counters or multilink cubes and pictorial representations of objects, forming arrays.

5 groups of 4



4 groups of 5



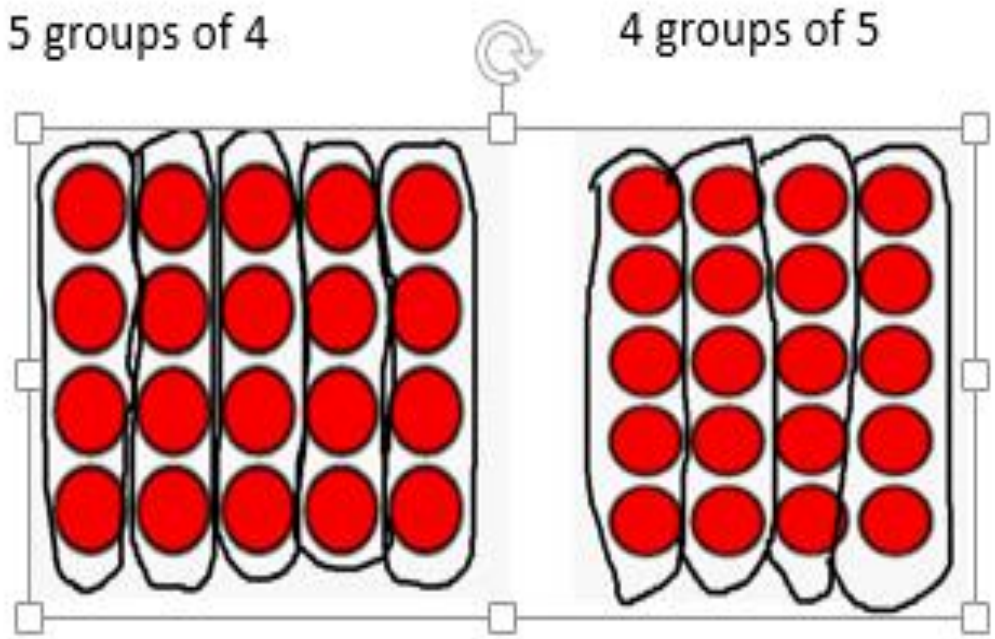
What is the same?
What is different?
How many counters in each group in the first example?
How many counters in each group in the second example?

Strategies to support your child with timetables

2. Multiplication is commutative

4 x 5 is the same as 5 x 4.

$$4 \times 5 = \boxed{20} = 5 \times 4$$

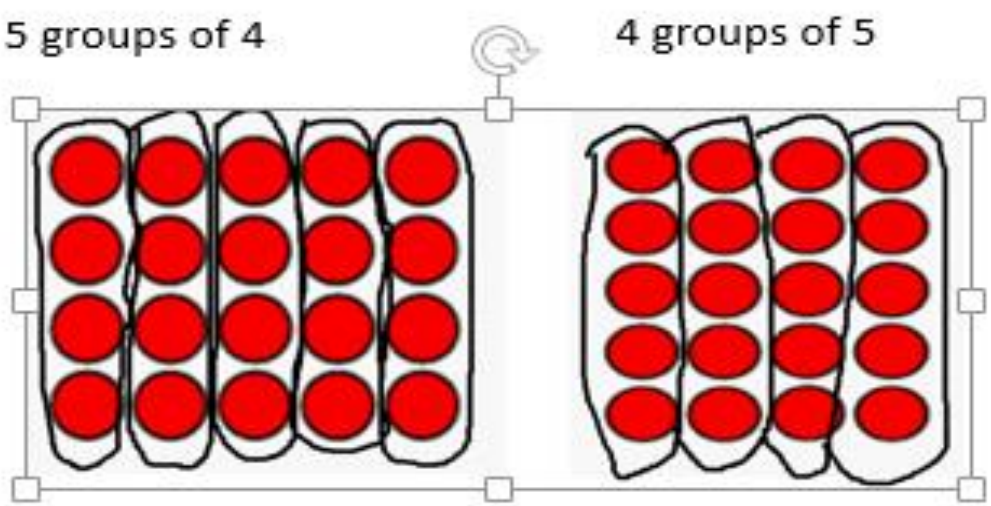


Children build on their existing understanding using arrays, turning the arrays around to show that you now have 5 groups of 4 and they will still total 20. This can then be linked to recalling multiplication facts, i.e. if they know their 5 times table as facts but not their 4 times table, they can use 4 x 5 to work out 5 x 4. This link needs to be made explicit.

3. Multiplication is the inverse of division

20 ÷ 5 = 4 can be worked out because 5 x 4 = 20.

Again, the use of arrays is key. Children need experience of pulling arrays apart into groups or sharing. After basic experience has been gained, the children should start to 'see' an array structure as 5 groups of 4 equal 20 **and** 20 can be split into 5 groups of 4.



4. Number families

$4 \times 5 = 20$, $5 \times 4 = 20$, $20 \div 5 = 4$, $20 \div 4 = 5$

Due to their commutative understanding, by now children should also be able to see whole number families. For many children this will need to be pointed out and discussed. Most children will be able to explore this in its abstract form but if in doubt, go back to arrays.

From here it is only a short jump to understanding that any missing number can be worked out through knowledge of number families, e.g. $4 \times [\ ] = 20$ or $[\ ] \div 4 = 5$. There are other methods children can use to work out missing numbers but our goal is to increase working memory in order to increase instant recall from long term memory.

A few multiplications, divisions, products of the same times table.
The children shout out the answer as they hop along

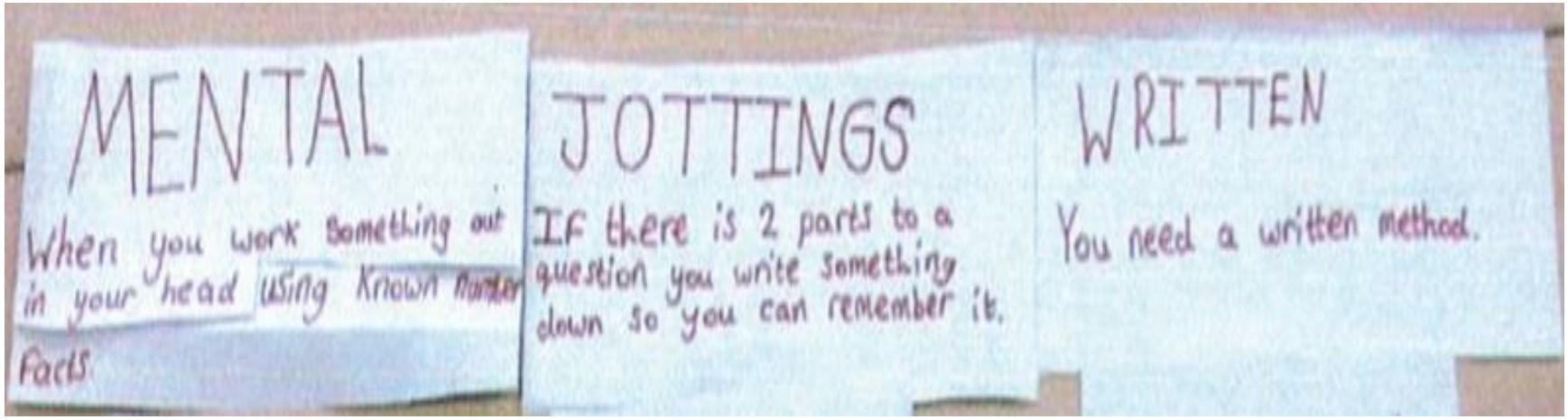
Upper key stage 2 – years 5 and 6

The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.

At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems. Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them.

By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

Knowing when to use efficient and appropriate strategies to calculate an answer



Use three post it notes and jot down the headings as above.
On other post it notes, write one calculation per post it note
Decide on your tables whether the most appropriate method would be mental, a quick jotting or formal written method.
Consider:
Why have you placed this calculation there?
Could you have used your knowledge of other facts to do it mentally? Or jottings?
Are there lots of different ways to solve the calculation?
Are some methods more efficient and appropriate than others? Why?
Can you explain why and how you placed the calculation in that pile?

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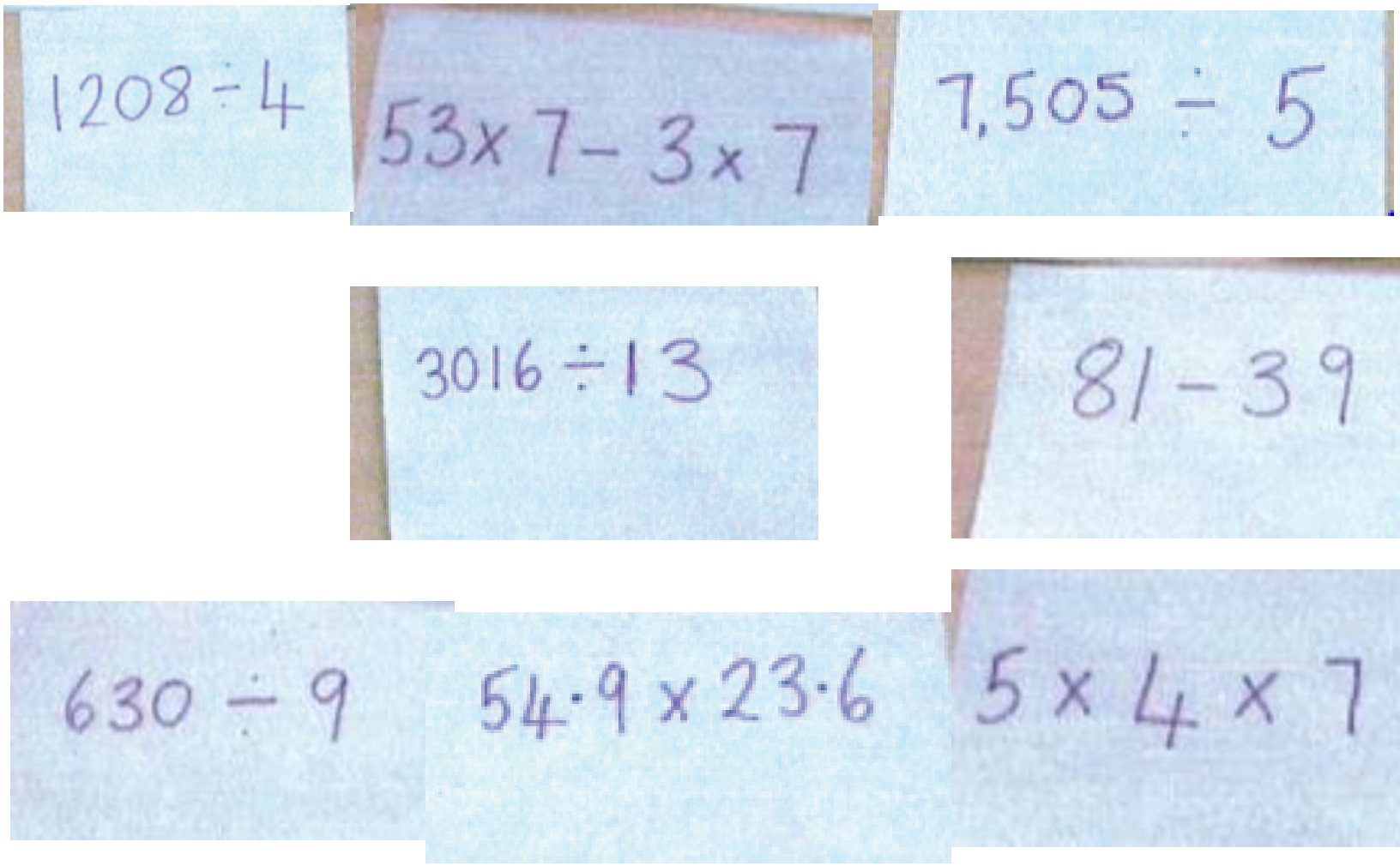


MENTAL

When you work something out in your head using known facts.

JOTTINGS

If there is 2 parts to a question you write something down so you can remember it.

WRITTEN

You need a written method.

81 − 39

1208 ÷ 4

54·9 × 23·6

630 ÷ 9

7,505 ÷ 5

3016 ÷ 13

5 × 4 × 7

53 × 7 − 3 × 7

MENTAL JOTTINGS

When you work something out in your head using known number facts.

If there is 2 parts to a question you write something down so you can remember it.

81 − 39

In my head I would
81 − 40 = 41
41 + 1 = 42

near multiple of 10

1208 ÷ 4

÷2 = 604
÷2 = 302

630 ÷ 9

In my head I would...
63 ÷ 9 = 7
make 10 times bigger
70

7,505 ÷ 5

÷10 = 750.5
×2 = 1501

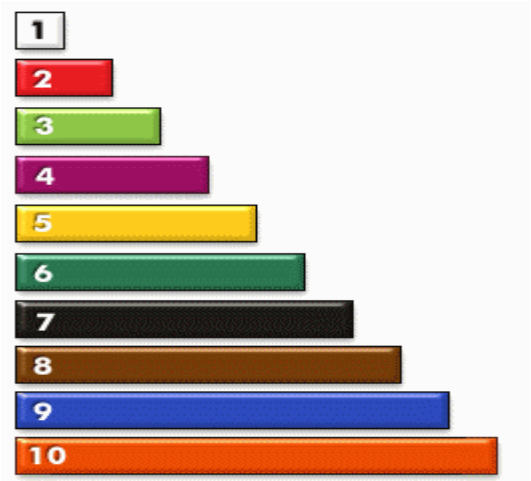
53 × 7 − 3 × 7

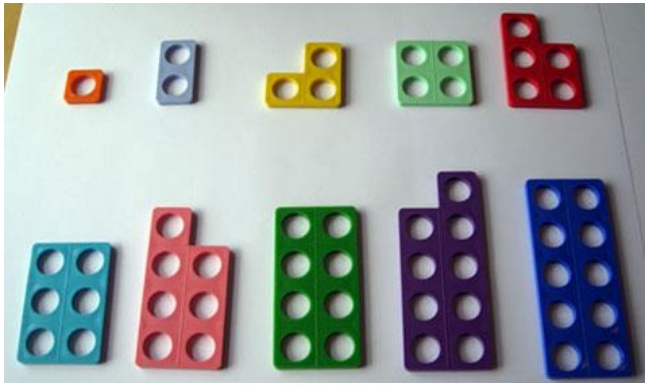
50 × 7 = 350

5 × 4 × 7

20 × 7 = 140

Manipulatives used in class to support understanding





Year 6 programme of study

Number – number and place value

Statutory requirements

Pupils should be taught to:

- read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- round any whole number to a required degree of accuracy
- use negative numbers in context, and calculate intervals across zero
- solve number and practical problems that involve all of the above.

Year 6 programme of study

Number – number and place value

Statutory requirements
Pupils should be taught to: ▪ read, write, order and compare numbers up to 10 000 000 and determine the value of each digit

Using dienes , create an even number between 50 and 90 and add 10 or 100 or 1000 each time. Read the number, say the number and explain what each value of each digit is.

With place value counters, make record & say numbers of your choice… e.g.

1,250,000

1, 325, 200

One million, three hundred and twenty thousand and fifty four.

hundred thousands	ten thousands	thousands	hundreds	tens	ones
100,000	10,000	1,000	100	10	1

x 10 x 10 x 10 x 10 x 10

Strategies to support home learning in Number

- Ask your child to get a handful of 5p coins. Use to model structure of times tables, e.g. show 10 lots of 5p, what is 5 groups of 12p? 5p times 13 ?

http://www.bbc.co.uk/skillswise/topic/times-tables

Singing times tables songs with modern pop songs

https://www.youtube.com/playlist?list=PLb7Q5jsm9eh_fdDPQmVpyp4XRu-raUbHc

Practising games can be accessed on these websites:

https://www.stem.org.uk/resources/elibrary/resource/29648/multiplication-and-division

http://www.primaryhomeworkhelp.co.uk/maths/timestable/interactive.htm

https://www.topmarks.co.uk/maths-games/7-11-years/multiplication-and-division

Expectations by the end of Year 6

I can divide up to 4 digits by 2 digits using a formal method

I can multiply up to 4 digits by 2 digits using a formal method

Four Operations

Find the mistakes in the calculation below. Correct it and explain what you have done.

```
    4 6 2 9
x       1 2
-----------
      1 0 8
        2 4
      7 2
      3 6
-----------
  2 0 4
```

Why do we ask children to place a 0 when calculating the second line?

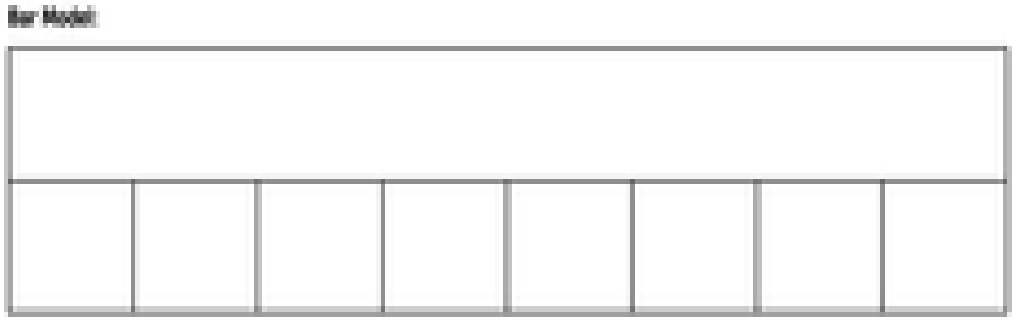
Strategies to support home learning in Number

Sam added together two fractions and got 3/6 as the answer. Write down two fractions that could have been added which are <u>not sixths</u>.

A teacher might show the children a fraction board or even a strip of paper for this exercise. How might you begin to approach this problem?

Consider:

Are there equivalences that could be used? How might you show this?



Strategies to support home learning in Number

Sam added together two fractions and got 3/6 as the answer. Write down two fractions that could have been added which are not sixths.

The teacher might then explain that as the answer doesn't allow sixths to be used, what other equivalences are there? By folding the paper into 12ths or halves, children will see that perhaps a simple answer of 1/6 + 2/6 = 3/6 can become
5/12 + 1/12 = 6/12 = 3/6 = 1/2

Or a fraction board can easily show as a visual these equivalences in quarters for example

Key stage 2 subtraction – decomposition method

$$\begin{array}{r} 6\ 4\ 8 \\ -\ 2\ 7\ 9 \\ \hline \end{array}$$

What sort of mathematical language would you use with your child to help them solve this calculation?

What might they need to understand in order to solve this subtraction?

How can we link knowledge of place value to make connections and help support deep understanding rather than procedural?

Key stage 2 subtraction – decomposition method

H	T	1
5 ~~6~~	13 ~~4~~	1 8
- 2	7	9
3	6	9

What sort of mathematical language would you use with your child to help them solve this calculation?

What might they need to understand in order to solve this subtraction?

How can we link knowledge of place value to make connections and help support deep understanding rather than procedural?

Does the child know that when they take 1 hundred from the hundreds column and bring it over to the tens column, they are actually still bringing over 1 hundred but because its in the tens column it is really broken down into ten tens which makes a hundred? This is because you can only have tens in the ten column. And actually you have 13 tens in the 13 column which is 130 – 7 tens which is 70? Giving you an answer of 6 in the tens column which is 60?

Concrete, pictorial, abstract approach

Concrete
Actual objects to illustrate the problem

Generic concrete
Materials such as multilink & Cuisenaire, post it pads.

Pictorial representations
Individual squares, joined squares and then rectangular bars

Abstract
Written methods

Build it … Draw it… Write it…..Say it.

Concrete, pictorial, abstract approach

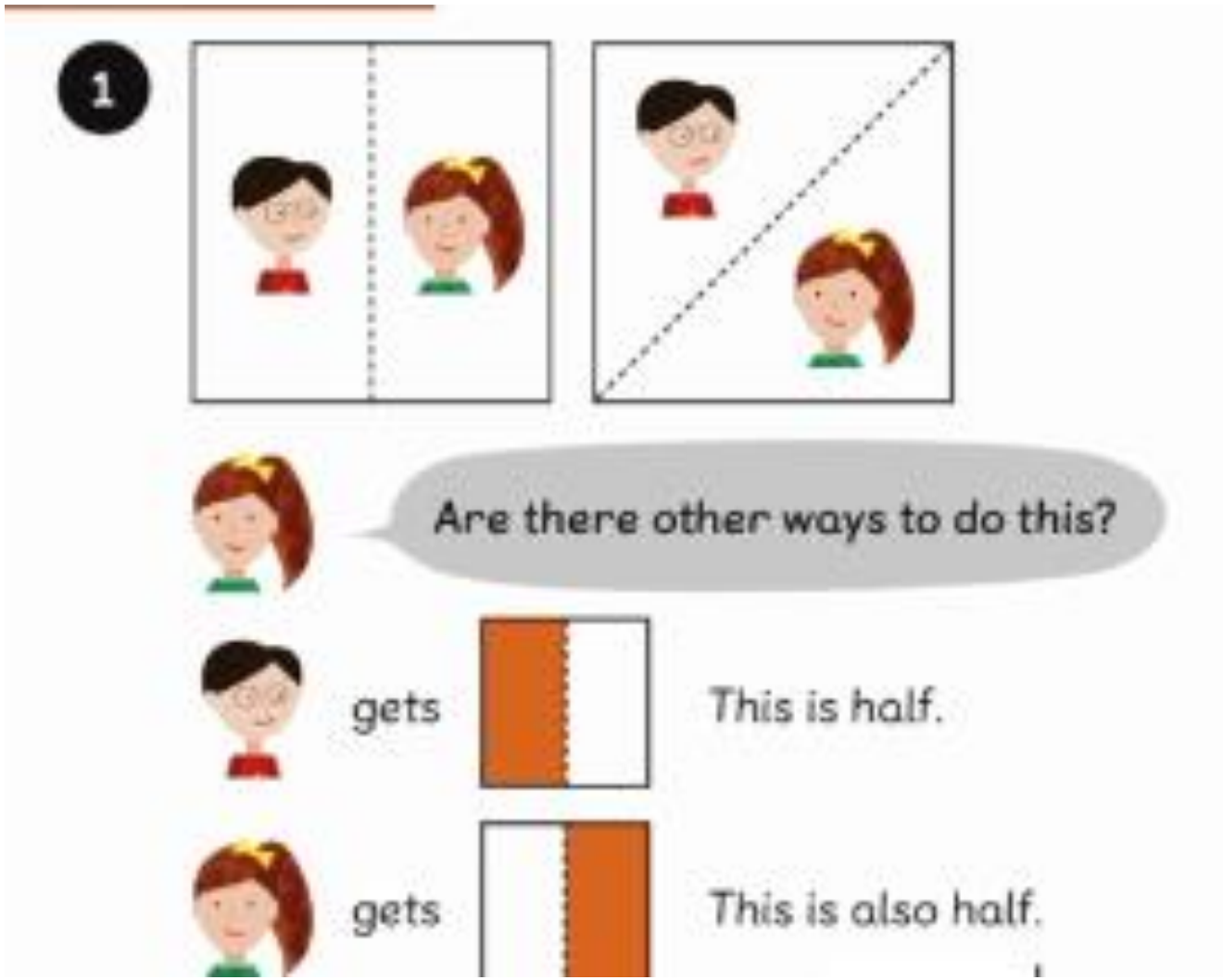
Have a go at using the post it notes (concrete) on the table to illustrate the problem

Now try to solve using the post its or any other pictorial representation if you wish to draw it

Can you find more than 3 ways?

Build it … Draw it… Write it … Say it

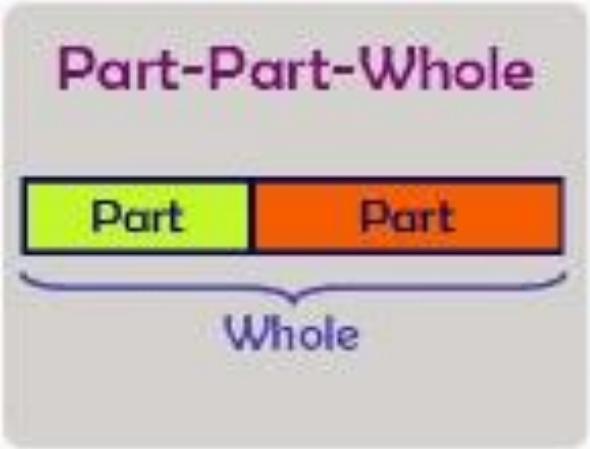
You may have started to fold you paper vertically and or horizontally/ diagonally.

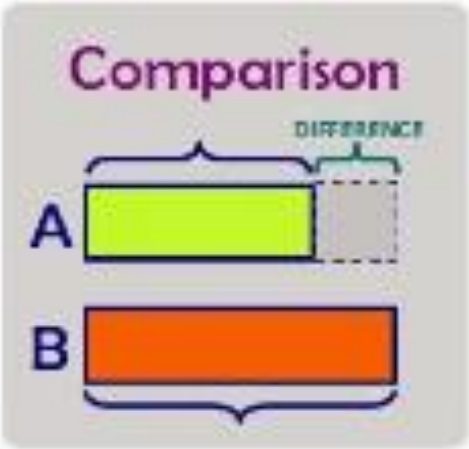


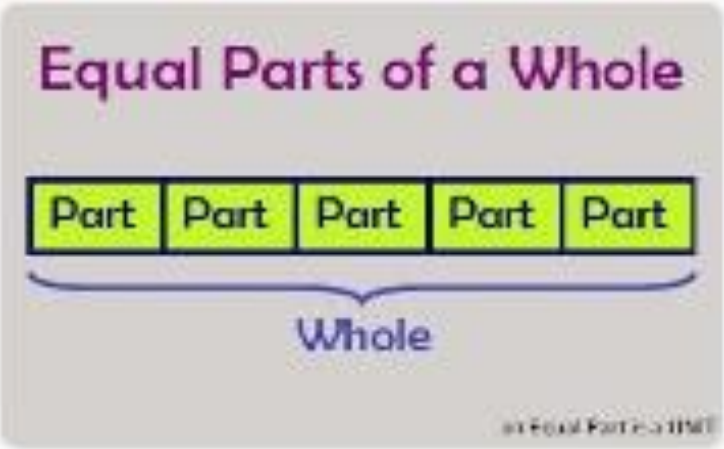
Most of us considered splitting the post it note to make a half but did we consider halves in other ways?

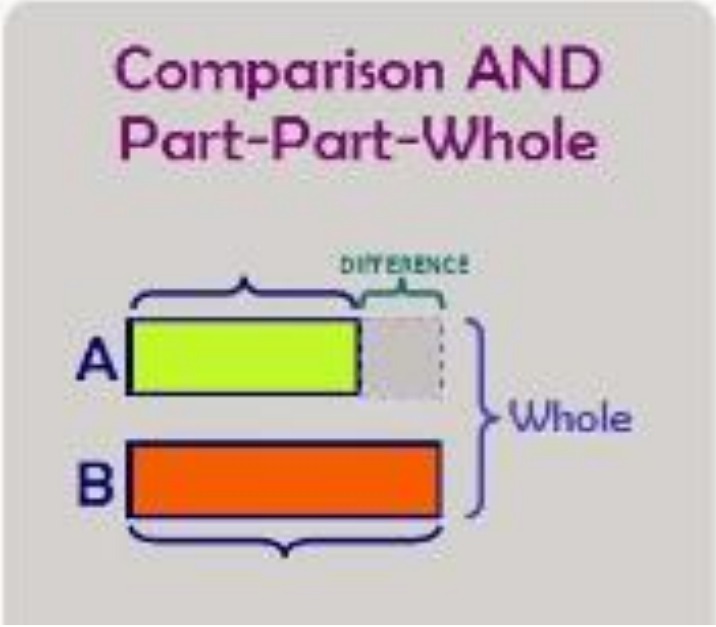
The last example shows how the triangles can be put together to make a half

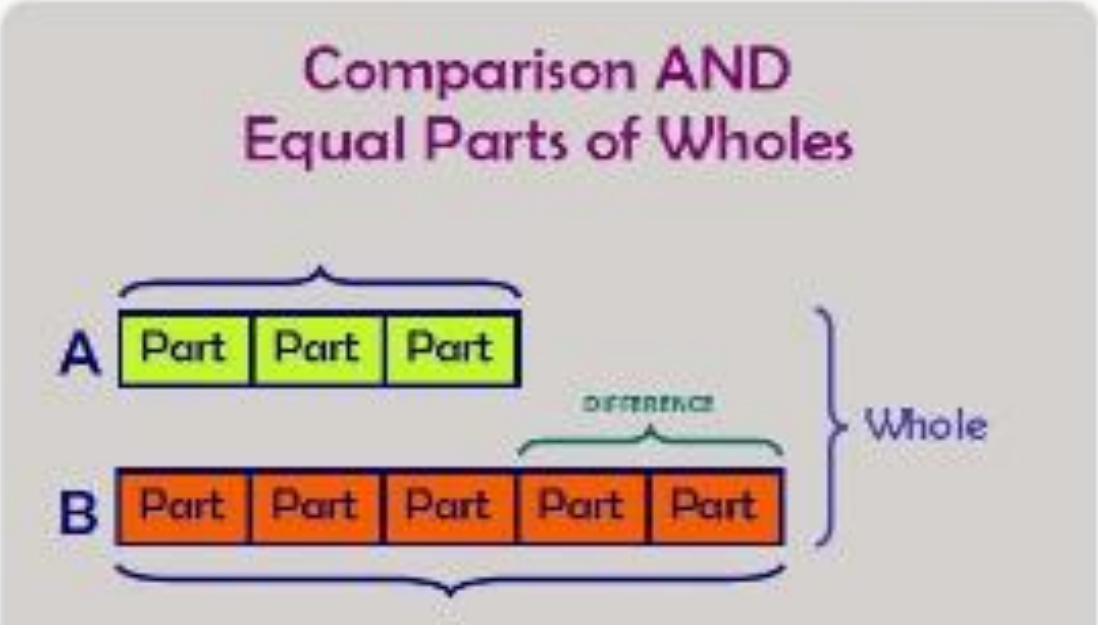
Bar modelling for problem solving as part of CPA approach







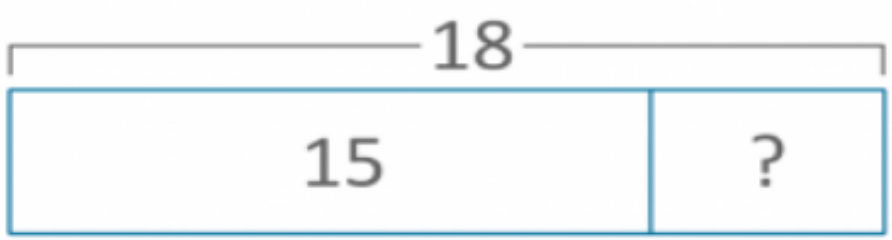




What is Bar modelling?

Bar models are pictorial representations of problems or concepts that can be used for any of the operations: addition, subtraction, multiplication and division. In word problems, bar models hold the huge benefit of helping children decide which operations to use or visualise problems.

Austin has 18 lego bricks. He used 15 pieces to build a small car. How many pieces does he have left?



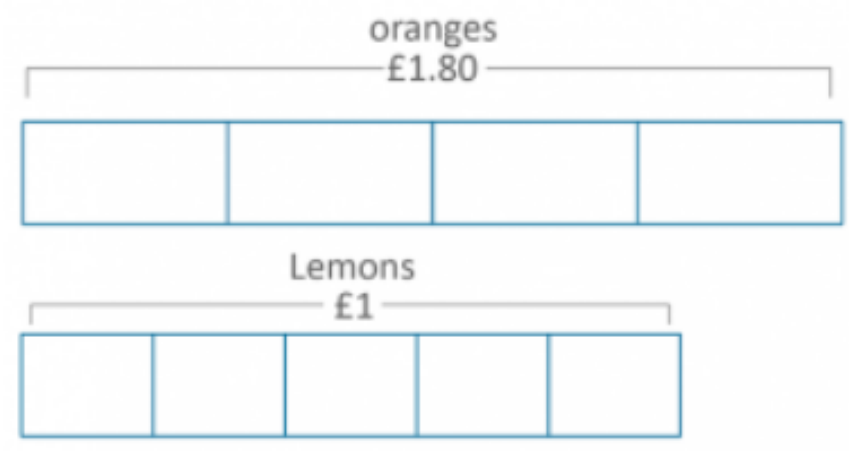
Calculation: 18 – 15 =

Find the difference

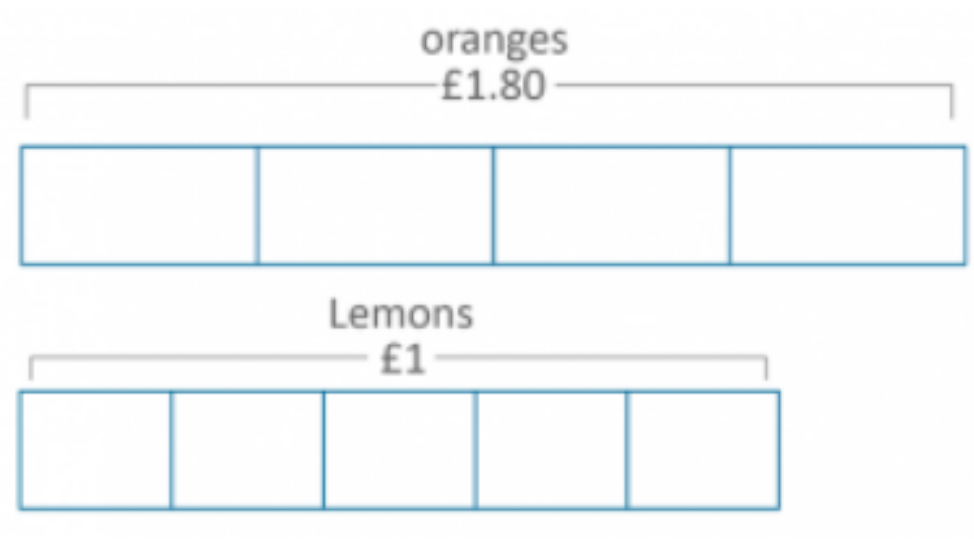
How can bar modelling support learning?

A bag of 5 lemons costs £1. A bag of 4 oranges costs £1.80.
How much more does one orange cost than one lemon?

Pupils could represent this problem in the below bar model, simply by asking and answering 'what do we know?'

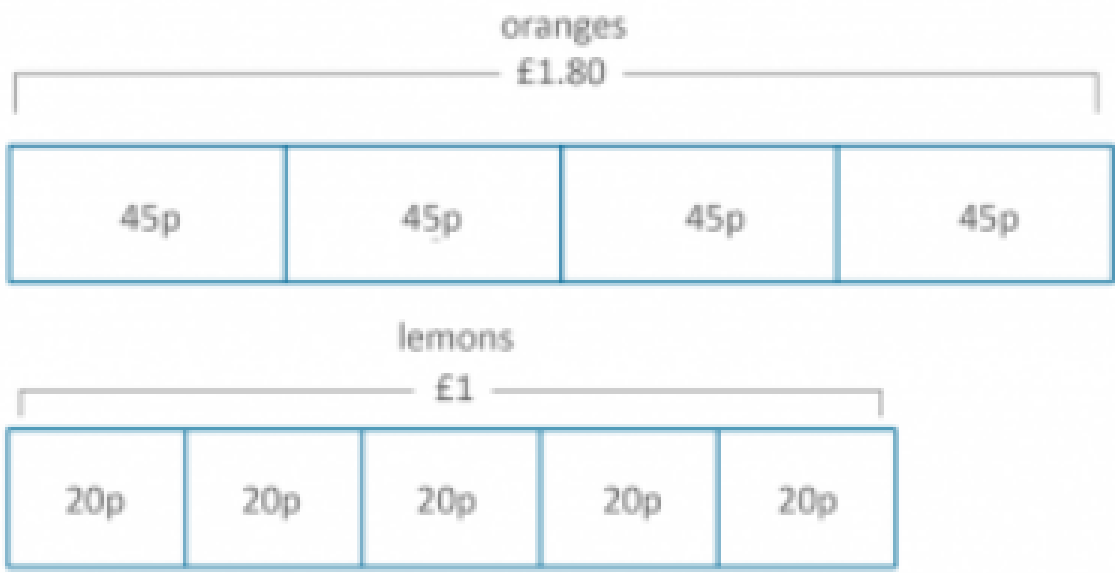


How can bar modelling support learning?



From here it should be straightforward for the pupils to 'see' or visualise their next step. Namely, dividing £1.80 by 4 and £1 by 5. Some pupils will not need the bar model to represent the next stage, but if they do, they would calculate and then allocate the cost onto the model:

How can bar modelling support learning?



Then those pupils that needed this stage, should be able to see that to answer the question, they need to calculate 45p – 20p. With the answer of 25p.

Example using bar model

Farmer Oats has 4 bags of sweetcorn and 4 extra sweetcorn. Each bag holds the same amount. Farmer Oats has 36 sweetcorn altogether. How many sweetcorn are in each bag?

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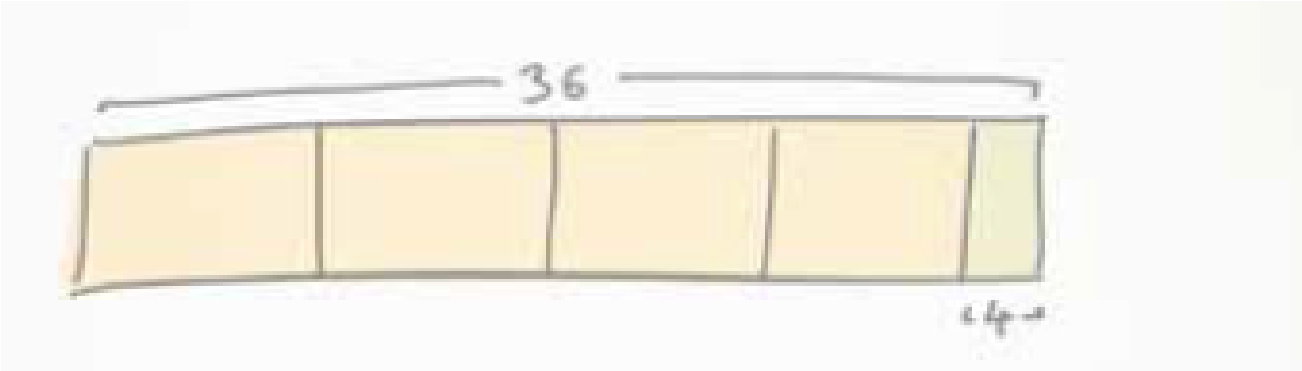


Multiplication and algebra

$c = 4a + 2b$

Where $a=7$ and $b=9$, what is c?

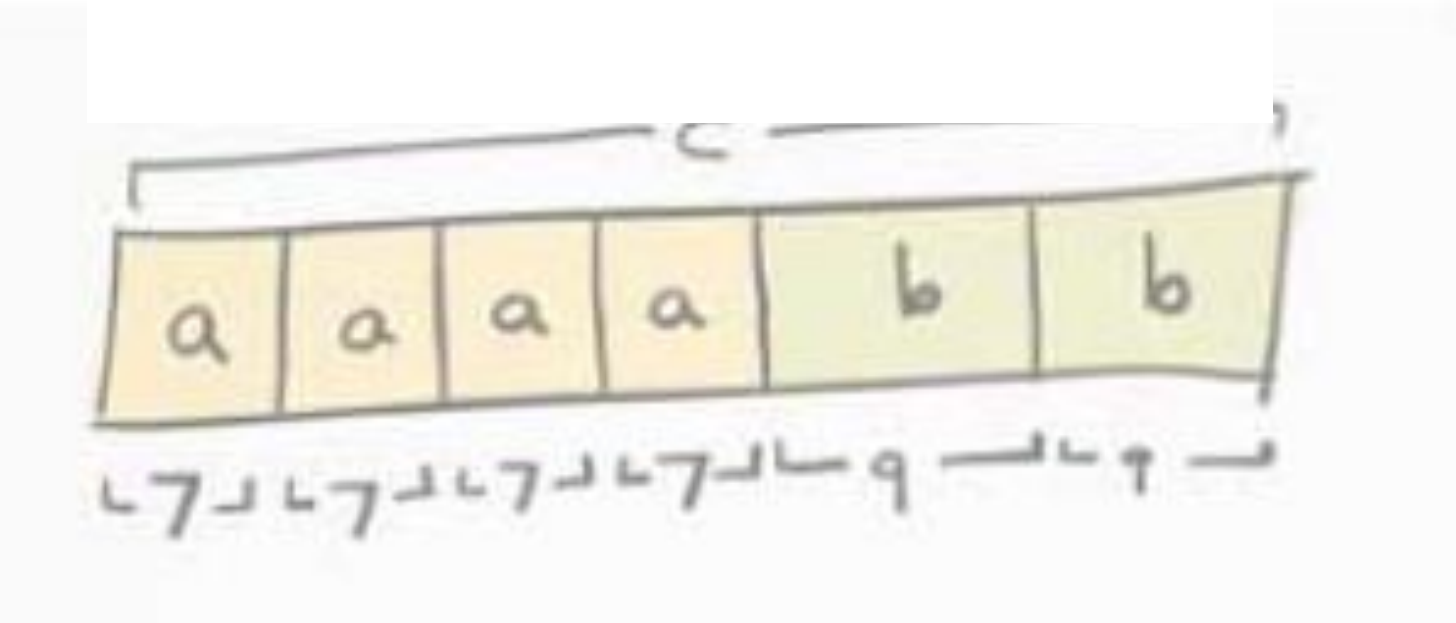
How could we use a bar model to represent this problem rather than use the abstract method of multiplication first eg

$4 \times a + 2 \times b =$

Multiplication and algebra

$c = 4a + 2b$

Where a=7 and b=9, what is c?



Bar modelling for problem solving as part of CPA approach

By the end of KS2 – a problem for children working at greater depth

Ben & Tom have some sweets

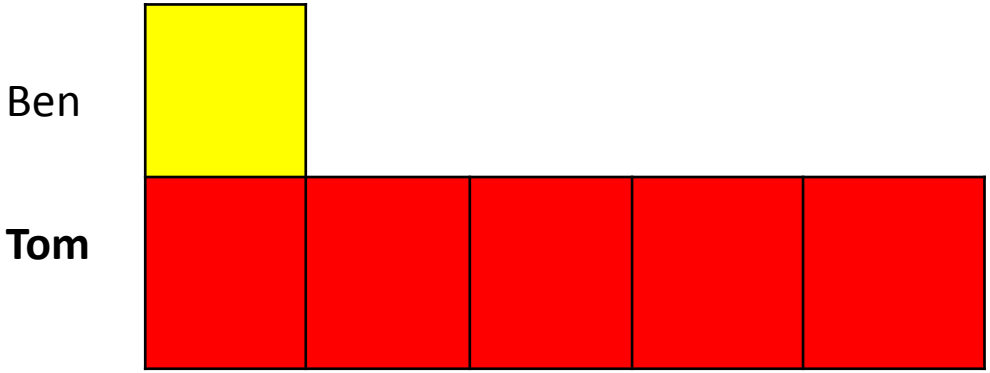
Tom has 5 times as many sweets as Ben

Tom gives 26 sweets to Ben.

They now have the same amount of sweets.

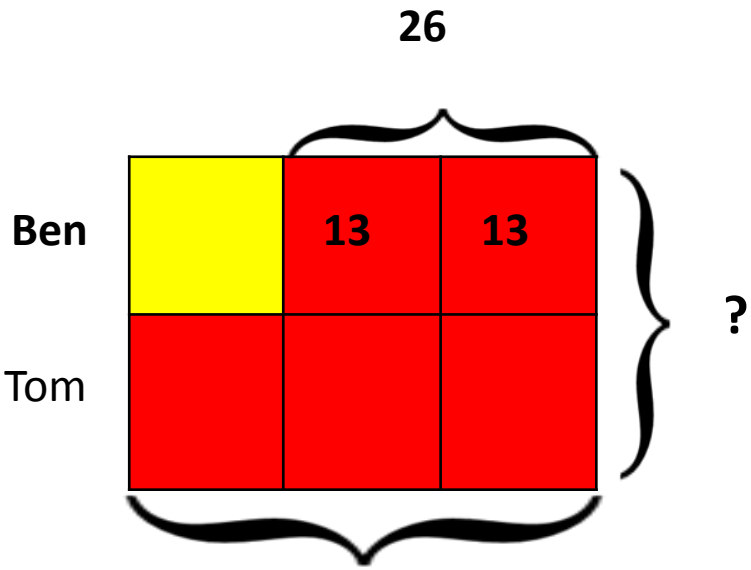
How many sweets were there altogether?

How many did they get each?



There were ___ sweets altogether.

Ben and Tom have ___ sweets each.



13 x 6 =

There were 78 sweets altogether.
Ben and Tom have 39 sweets each.

Language of Maths

- +, plus, add, how much more is.....?
- - , subtract, minus, how much less is.....?
- Half, halve
- =, equals, sign, tens, ones
- Counting up
- Number sentences
- Digits
- Double, halve, share, left over,
- Near doubles
- Count in 2s,5s and 10s
- Groups of

ICT Games to support learning

www.ictgames.com/soccer_subtraction.html

www.ictgames.com/football2.html

www.ictgames.com/airlineGrouping/index.htm

www.ictgames.com/airlineGrouping/index.htm

www.ictgames.com/arrowCards_revised_v6.html

Thank you for coming