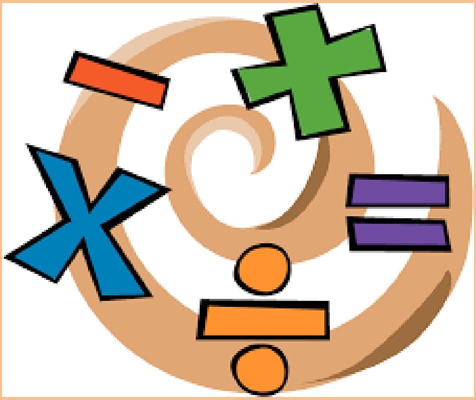

Maths Mastery within Willowbrook

Maths Work With Me 05.02.2025

Introducing Mastery

Aims:

- To gain an understanding of the meaning of the term, 'maths mastery'
- To know what maths mastery looks like at Willowbrook
- To visit your child in their maths lesson

Timings:

- 08:40-09:00- Arrival. Refreshments.
- 09:00- Presentation in the hall.
- 09:30/40- Visiting classrooms.
- 10:00- Leave via the hall with opportunity to feedback on the workshop (WWW/ EBI)

Maths national curriculum aims:

The national curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils 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 of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

What is mastery?

What does it mean to master something?

- I know how to do it
- It becomes automatic and I don't need to think about it- for example driving a car
- I'm really good at doing it – painting a room, or a picture
- I can show someone else how to do it.

What is mastery?

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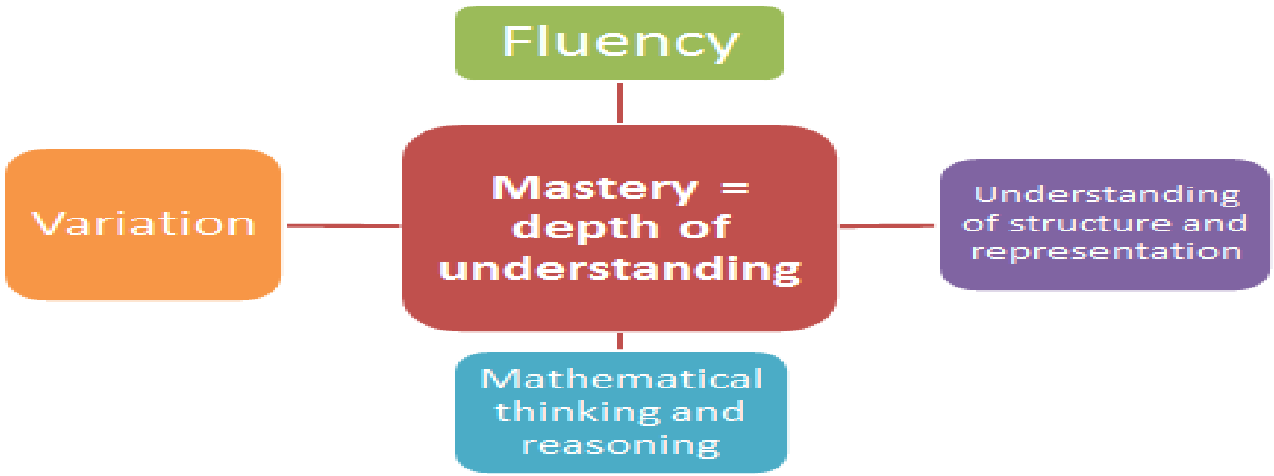
Mastery of Mathematics is more…..

- Achievable for all
- **Deep** and sustainable learning
- The ability to build on something that has already been sufficiently mastered
- The ability to reason about a concept and make connections
- Conceptual and procedural fluency

Shallow mathematical understanding =

- Able to do examples when shown but doesn't know why or how it works.
- Struggles to apply in problems / contexts.
- Forgets next time.
- Can't cope with variation.

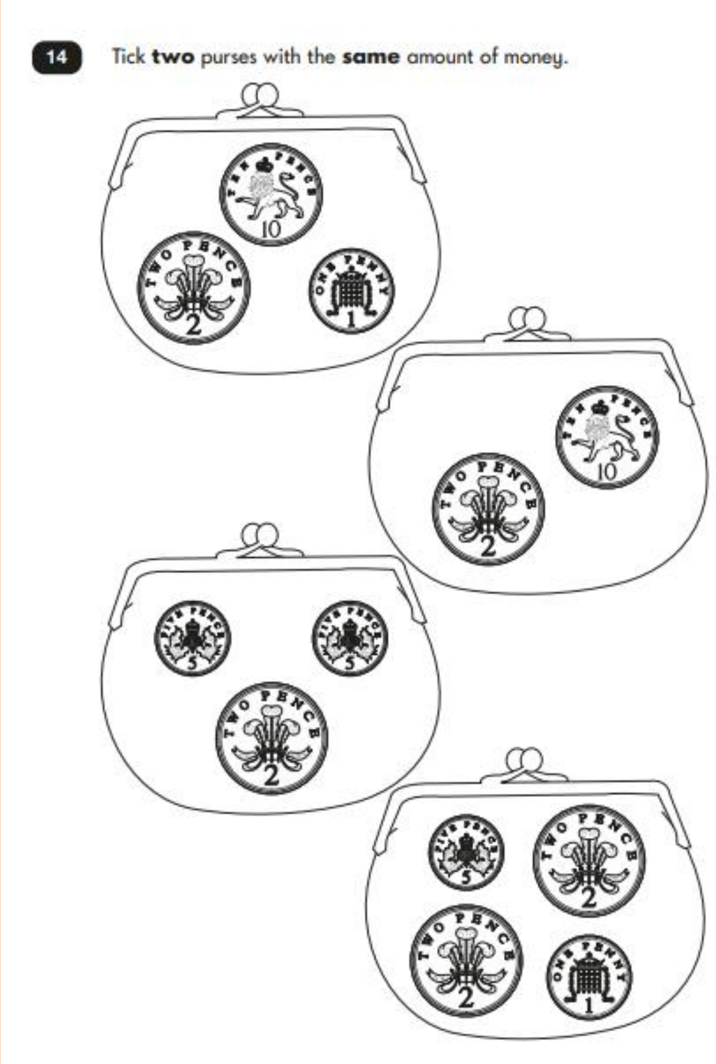


Mastery is for ALL children

Beyond MASTERY = Greater depth

Fluency	Variation	Representation and structure	Mathematical thinking and reasoning
• Quick recall AND understanding of number facts. • Procedural fluency – ie. carry out column addition MAKING CONNECTIONS	• Conceptual & procedural • Apply knowledge to varied questions ie. missing boxes, backwards questions, problems. MAKING CONNECTIONS	• Recognise patterns • Understand what a structure represents ie. the reason for columns or what the parts of a fraction represent. MAKING CONNECTIONS	• Able to explain how and why • Able to apply to a range of problems • Chains of reasoning – linking ideas • Mathematical discussions MAKING CONNECTIONS

To understand the question, what must they have mastered?



Children need to know the value of the different coins.
They then need to be able to add the amounts together for each purse before comparing the values.

To understand the question, what must they have mastered?

17 Seven children measured their heights.

Children	Height (cm)
Stefan	144
Lara	136
Olivia	142
Chen	143
Maria	152
Dev	148
Sarah	150

What is the mean height of the children?

Show your method

cm

Children need to be able to add, divide, understand mean, read and interpret a table. Children need to be secure in their understanding of a variety of a concepts to be able to answer this one question.

How do we achieve maths mastery?

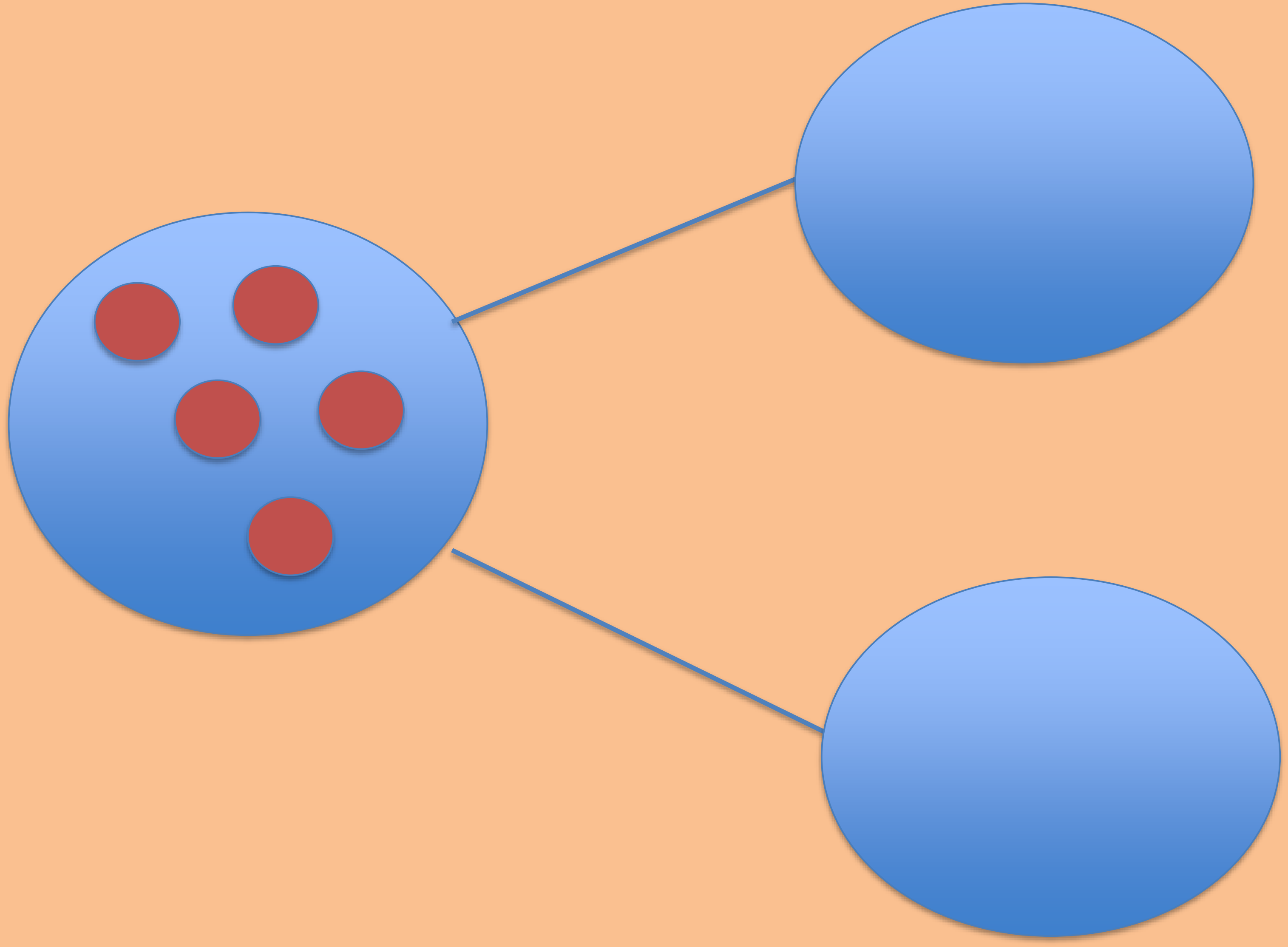
- We slow down the speed of moving through topics following a step-by-step approach.
- Develop fluency
- Depth of understanding (reasoning, contexts, representations)
  - Stretching sideways
- Emphasise mathematical vocabulary
- Questions to challenge thinking
- Using discussion and feedback

Modelling- a brief overview

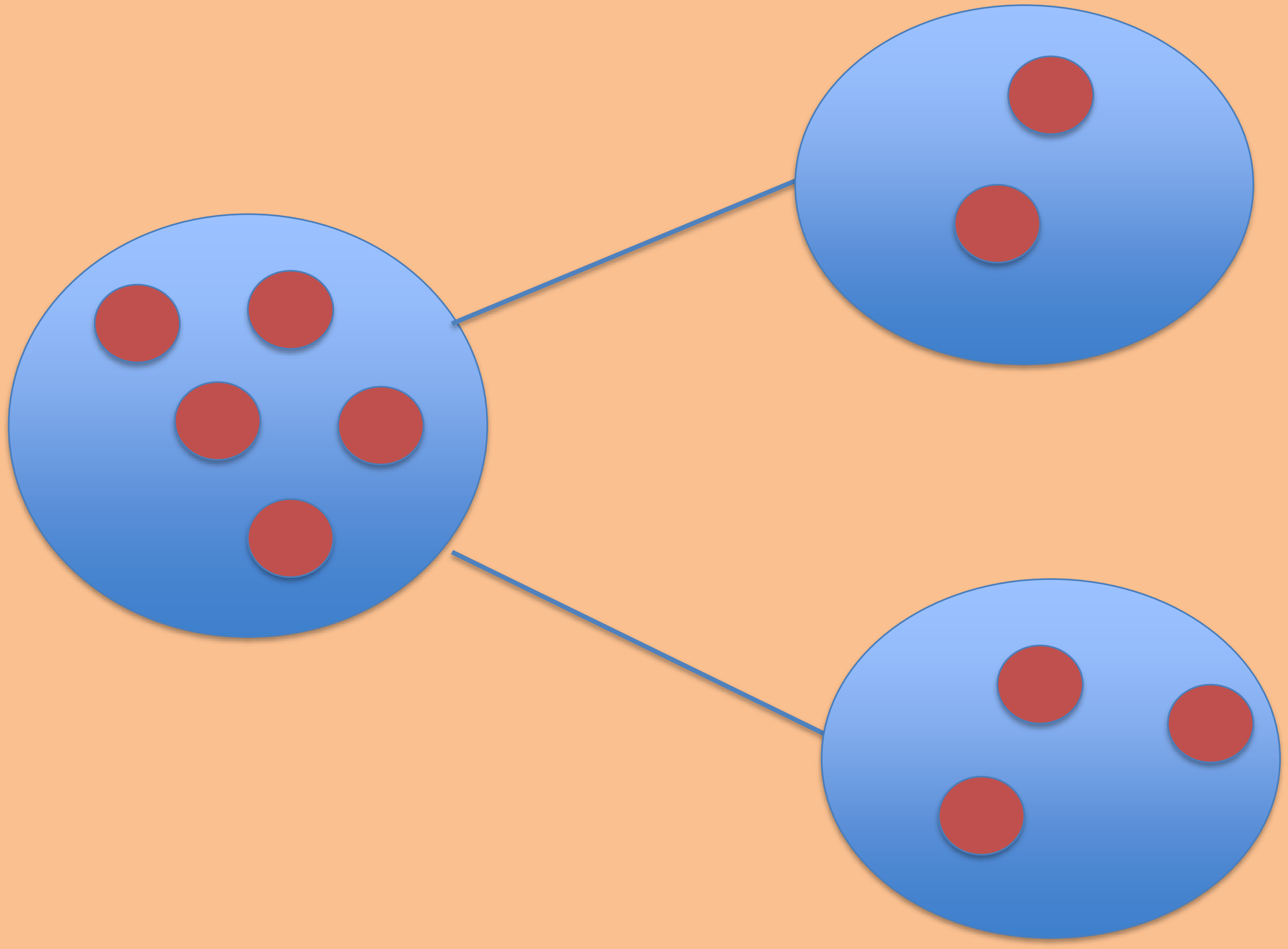
Concrete/ Pictorial/ Abstract

- Give the Concrete- objects, resources
- Pictorial – images/ diagrams/ pictures
- Abstract last- connecting to pictures

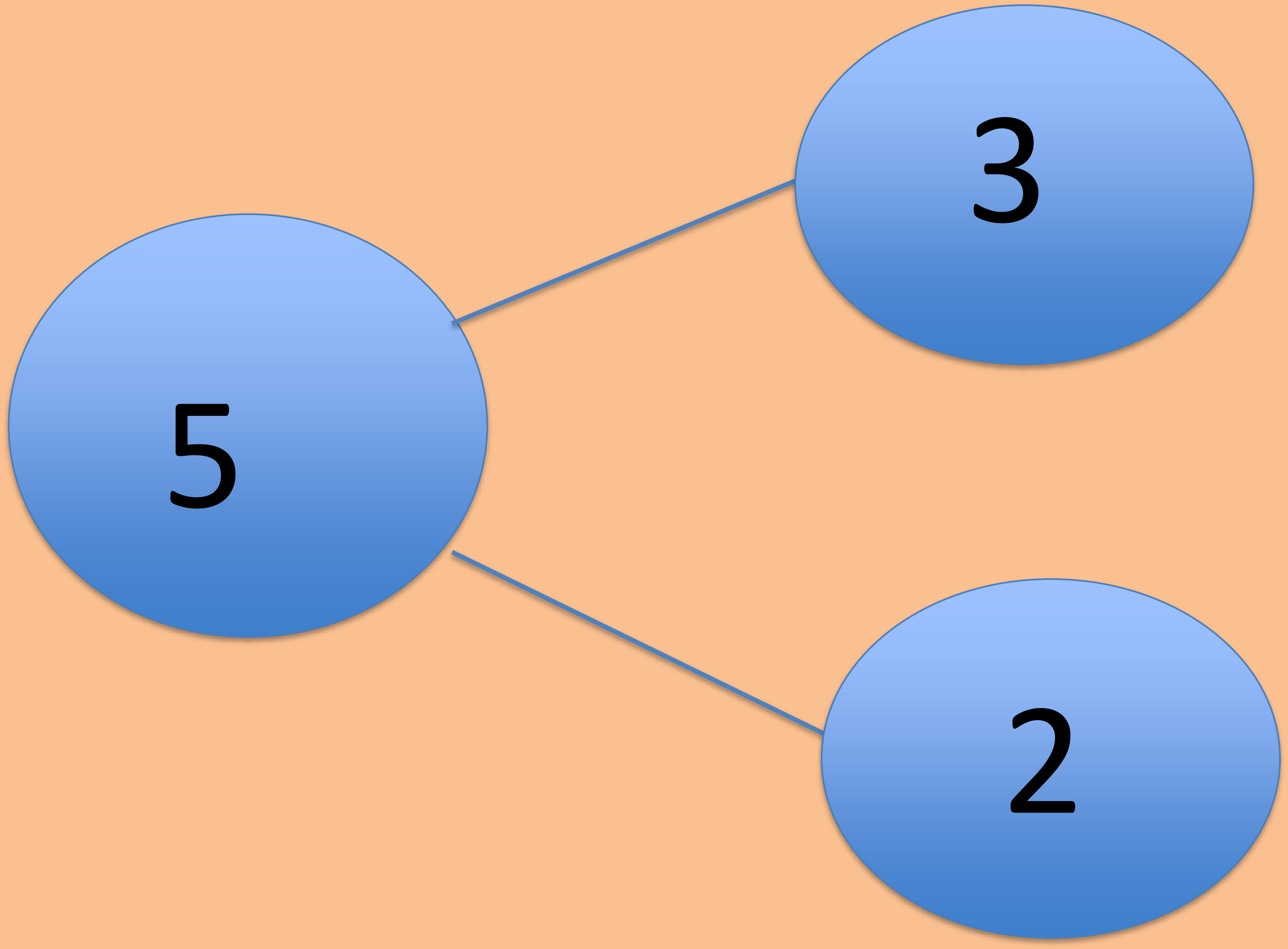
Part-Whole Model



Part-Whole Model



Part-Whole Model



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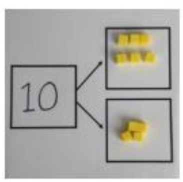
Part whole relationships

7 is the whole
3 is a part and 4 is a part

National Centre

Our calculation policy shows you how we use the part-whole model.

<table>
<tr><th>Objective and Strategies</th><th>Concrete</th><th>Pictorial</th><th>Abstract</th></tr>
<tr>
<td>Combining two parts to make a whole: part-whole model</td>
<td>

Use cubes to add two numbers together as a group or in a bar.

</td>
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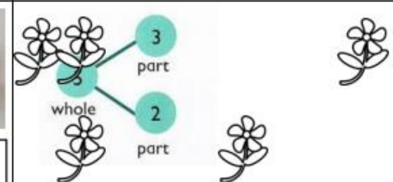
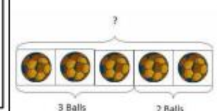
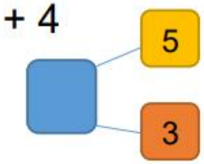




Use pictures to add two numbers together as a group or in a bar.


</td>
<td>
4 + 3 = 7

10= 6 + 4


Use the part-part whole diagram as shown above to move into the abstract.
</td>
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https://www.willowbrook.essex.sch.uk/page/?title=Maths&pid=24

Representing the Part - Part Whole Model

Attention to Structure

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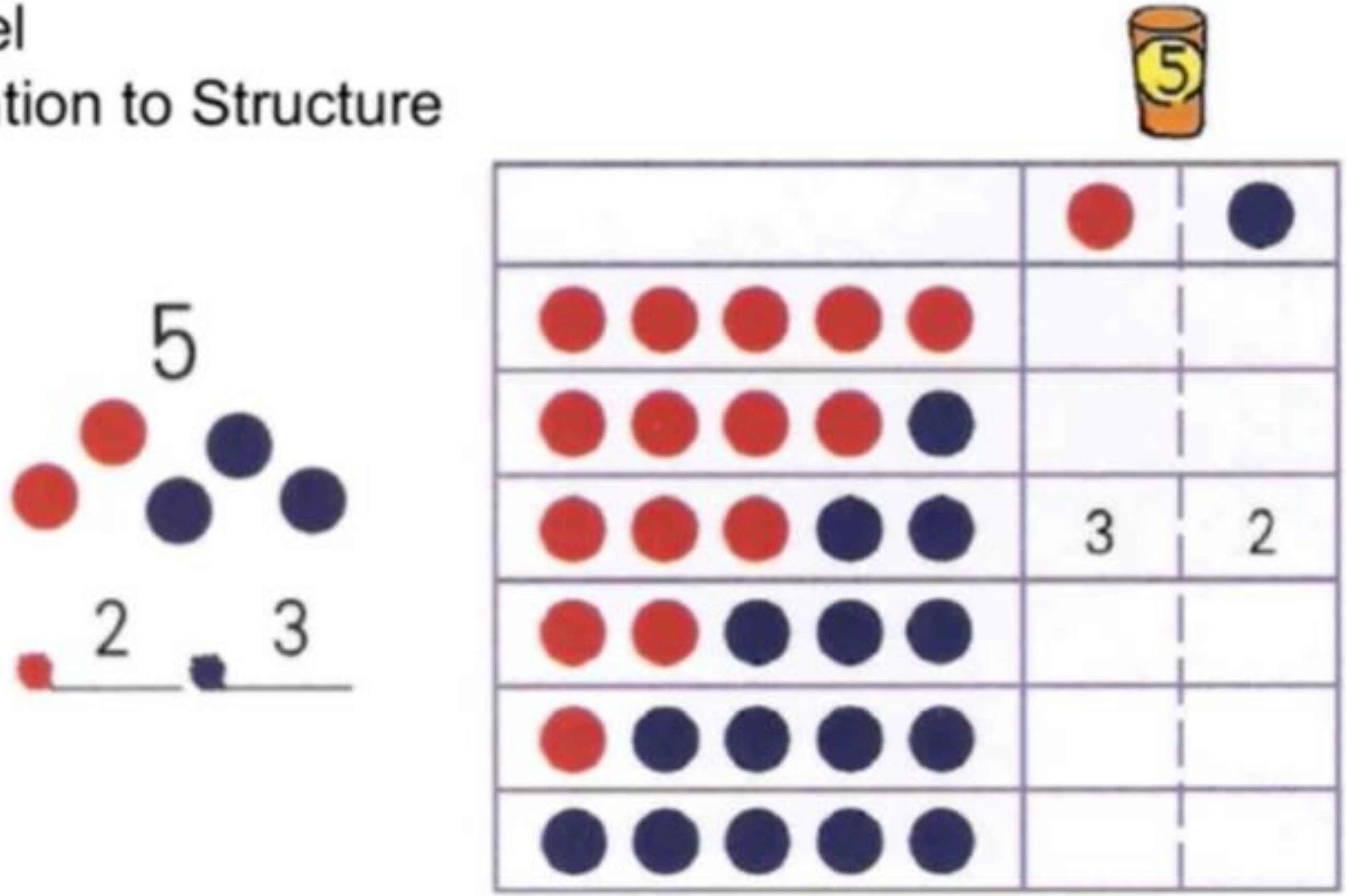
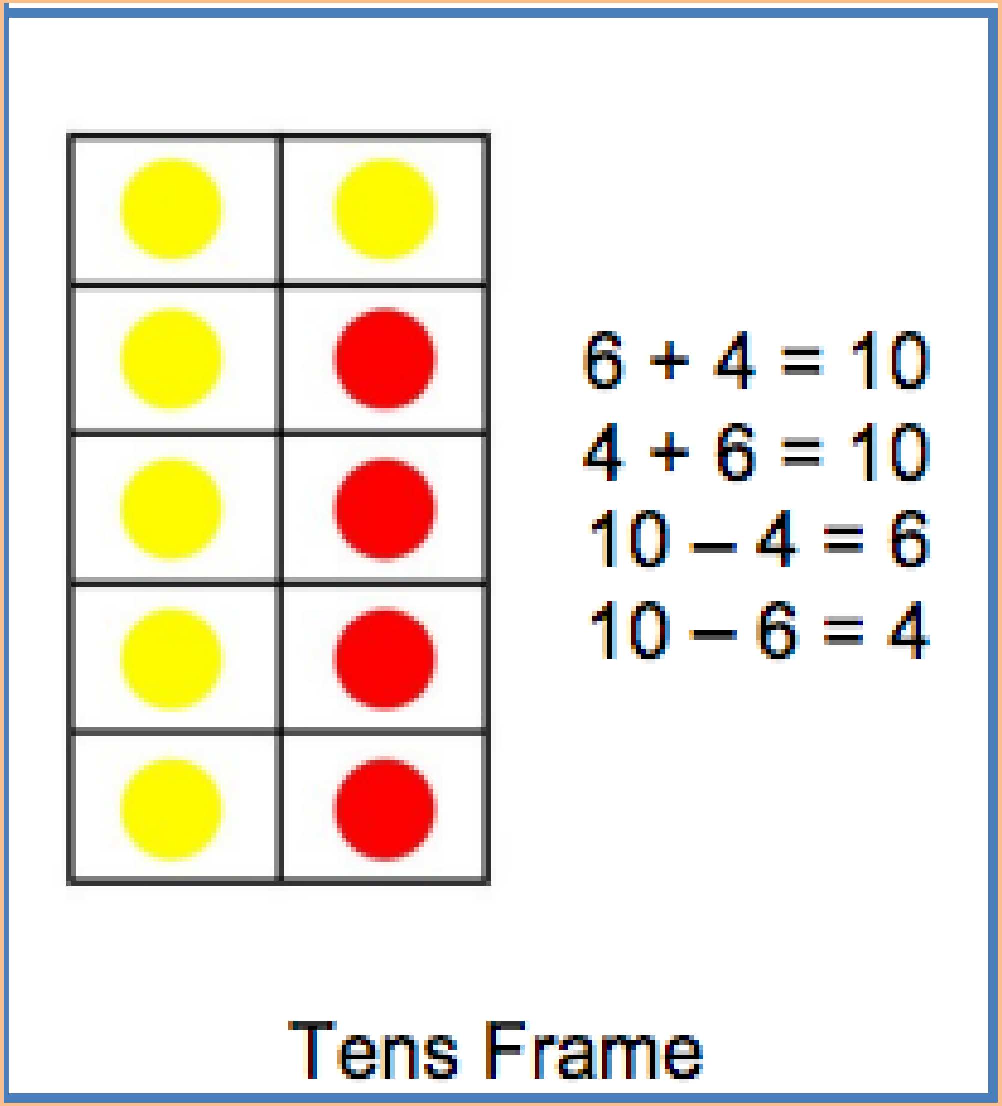
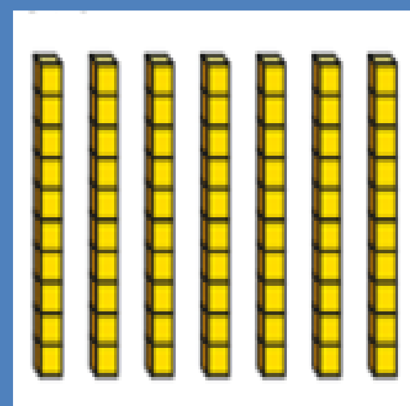
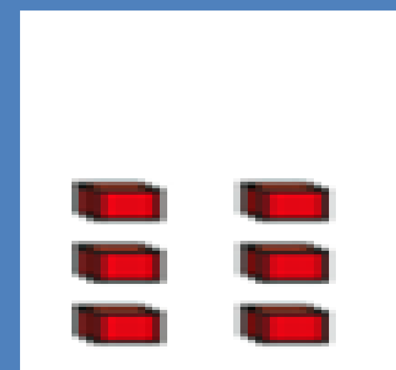


Tens frame- linked to part part whole model.

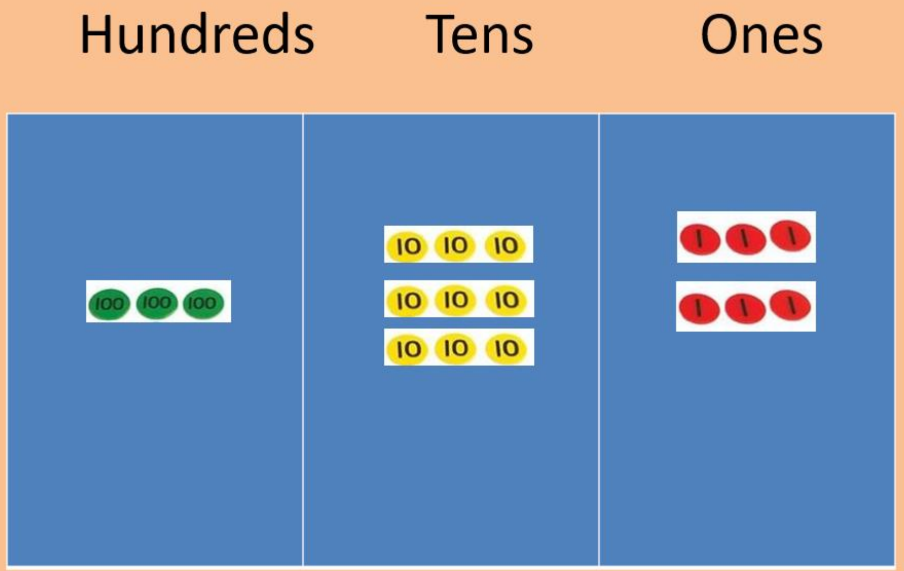


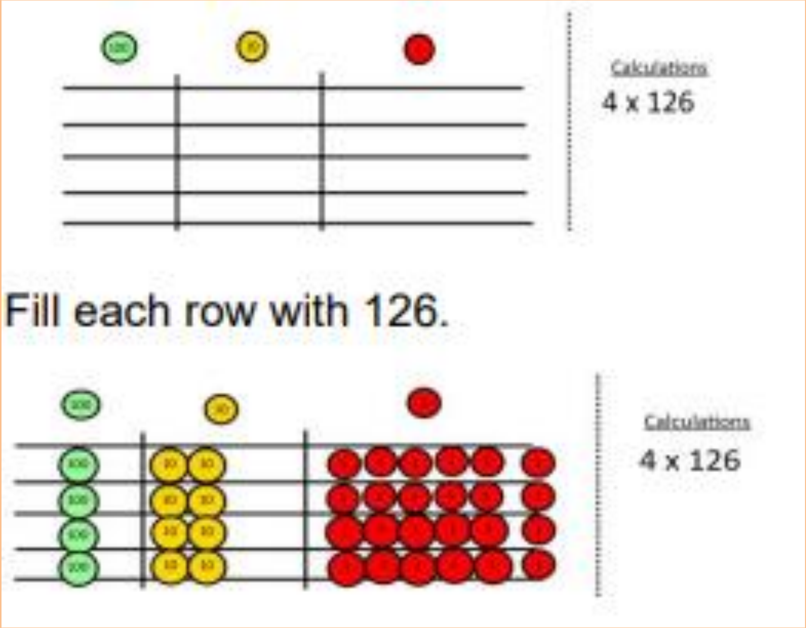
Double-sided counters and Tens Frames are great for supporting learning number bonds (year 1 & 2)

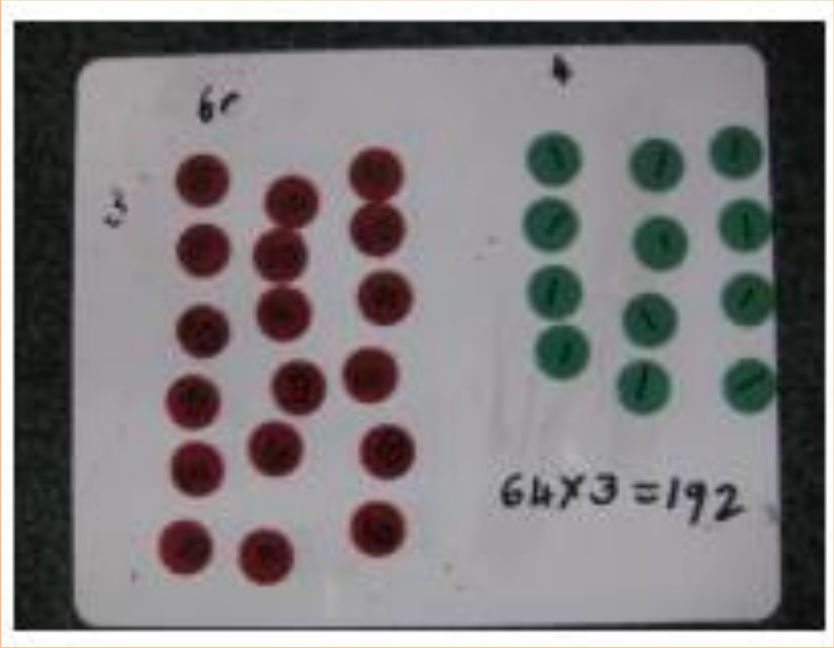
Base 10/ Diens

Tens	Ones
	

Place Value Counters







Why use the bar model?

- It helps children to represent problems in a way that the mathematical structure is exposed.
- It enables the pupils to 'see' the problem clearly and then recognise the strategy they need to solve the problem.

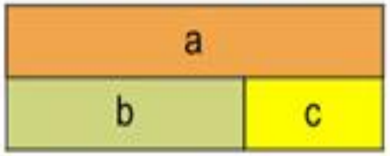
This model can be used for:

- Addition
- Subtraction
- To show the inverse between addition and subtraction.
- Division
- Ratio
- Algebra
- Multiplication
- Fractions

Bar model

Addition and Subtraction

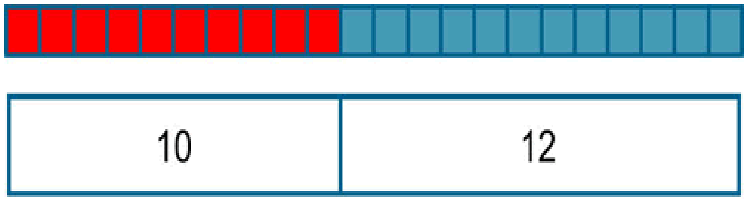
The bar model supports understanding of the relationship between addition and subtraction in that both can be seen within the one representation and viewed as different ways of looking at the same relationships.



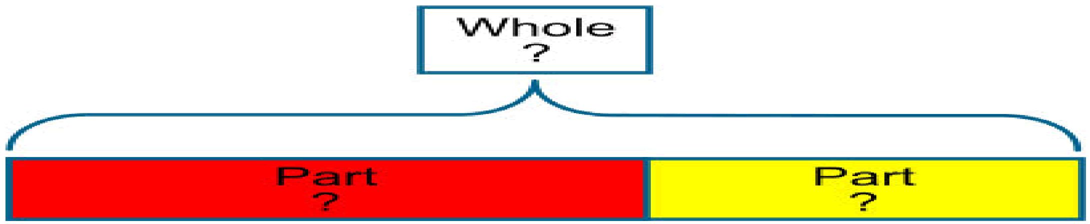
This diagram encapsulates all of the following relationships;

a = b + c ; a + c + b ; a − b = c ; a − c = b

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

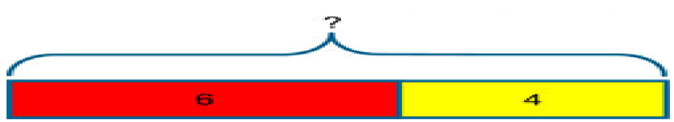


10 + 12 = 22



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.

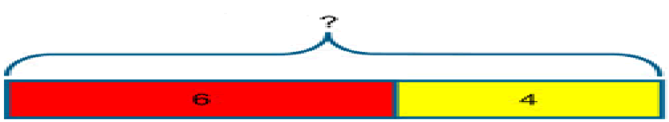
Addition
Aggregation
- two quantities combined



I have 6 red pencils and 4 yellow pencils. How many pencils do I have?

(I combine two quantities to form the whole)

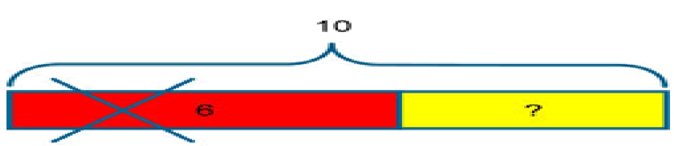
Addition
Augmentation
- a quantity is increased



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)

Subtraction
- Take Away



I had 10 pencils and I gave 6 away, how many do I have now?

Subtraction
- Comparison or Difference

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

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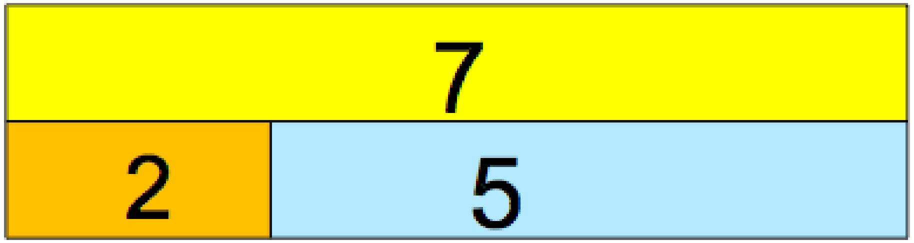
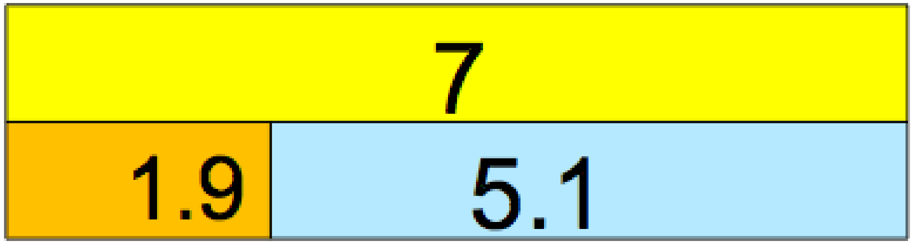
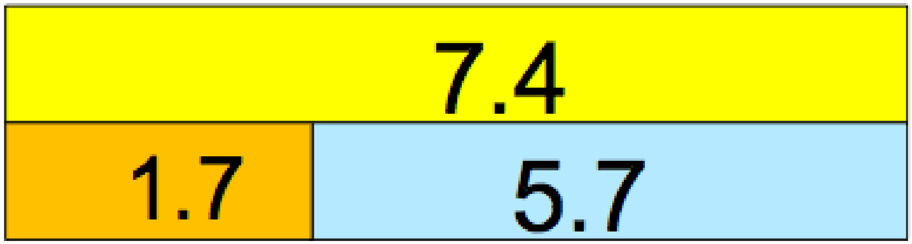
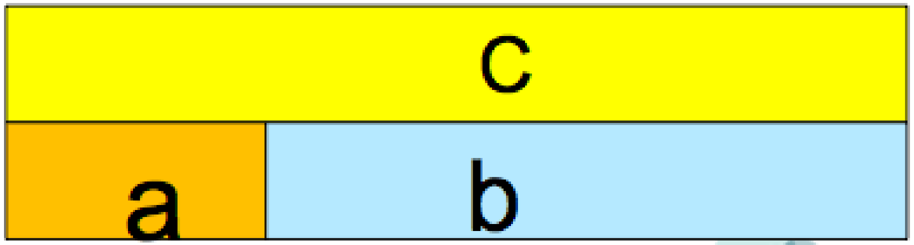
Developing Depth/Simplicity/Clarity







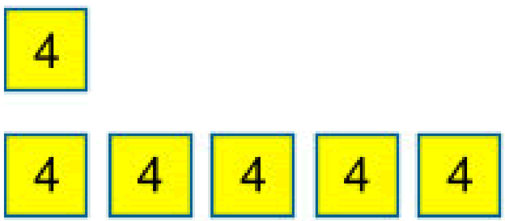


Have a go drawing a bar model to represent the problem:

- (Year 1) Ebony has 5p and Daniel has 8p. How much do they have altogether?
- (Year 2) Dylan has 37 coloured pencils and he buys 30 more. How many does he have now?
- (Year 3) There are 334 children at Springfield School and 75 at Holy Trinity Nursery. How many children are there altogether?

Multiplication & Division

Peter has 4 books
Harry has five times as many books as Peter.
How many books has Harry?



4 × 5 = 20
Harry has 20 books

Mr Smith had a piece of wood that measured 36 cm.
He cut it into 6 equal pieces.
How long was each piece?

36 ÷ 6 = 6
Each piece is 6 cm

Fractions

Find $\frac{1}{5}$ of 30

The same image can be used to find $\frac{2}{5}$ or $\frac{3}{5}$ of 30 etc.

Proportion

24 In a class, 18 of the children are girls.

A quarter of the children in the class are boys.

Altogether, how many children are there in the class?

Show your working

The Class

The bar represents the whole class

Boys			

Folding the bar into quarters allows us to represent the boys as a proportion of the whole class

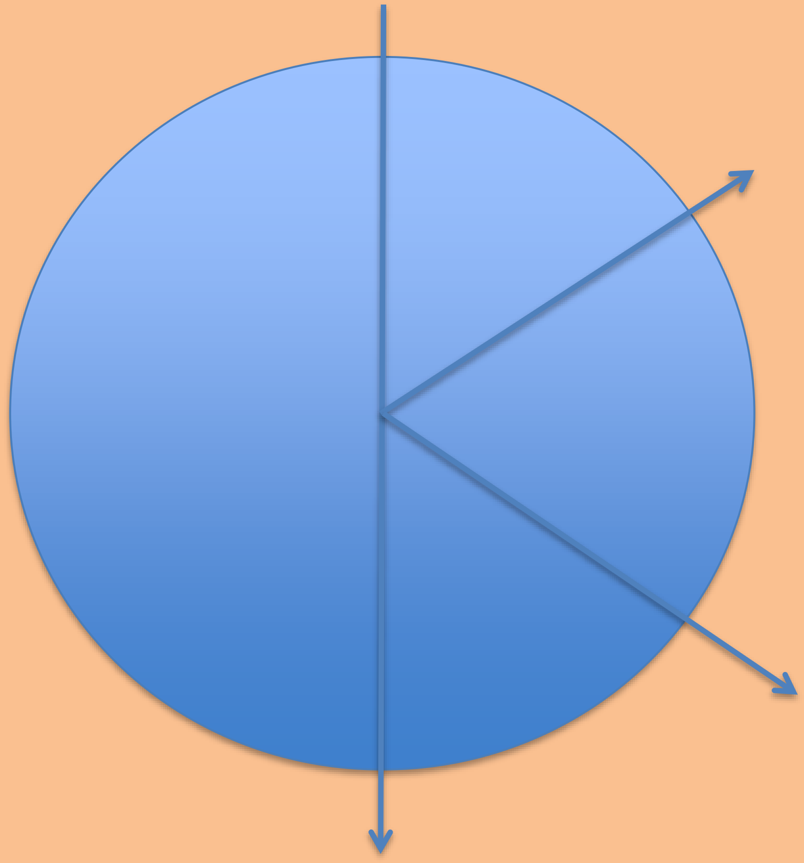
Boys	Girls	Girls	Girls

The rest of the class must be girls

Boys	Girls	Girls	Girls

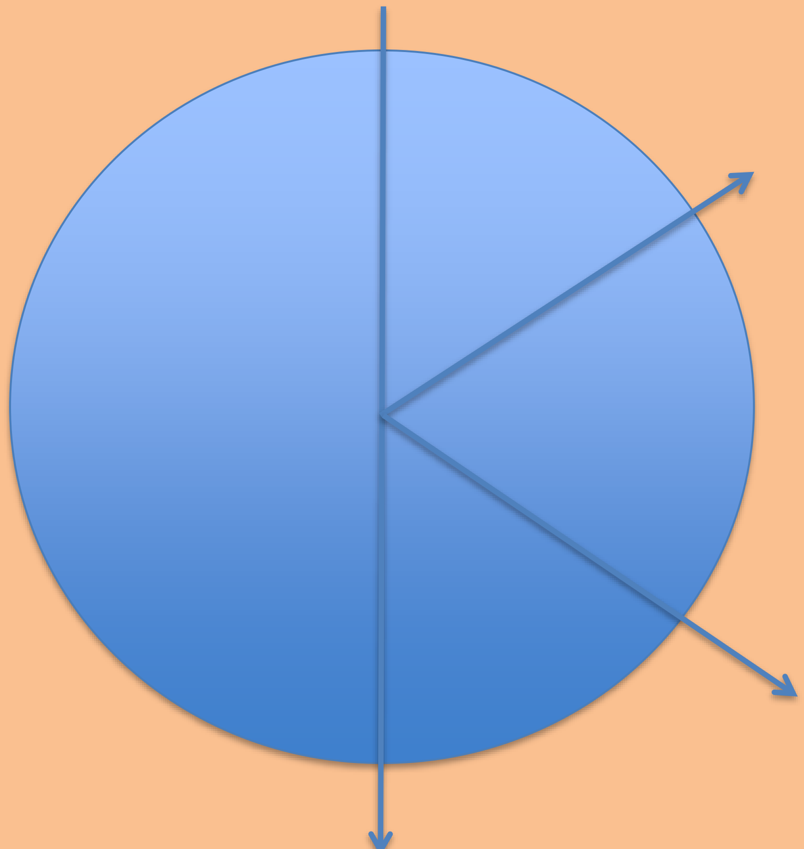
There are 18 girls so each of the three girl sections must equal 6 and so the boy section must also be 6. 6 × 4 = 24, there are 24 children in the class.

- ½ ÷ 3 = ?
- Too abstract for some



If I had a cake and shared half with two others how much would we get each?

If I had a cake and shared half with two others how much would we get each? PICTORIAL- Abstract

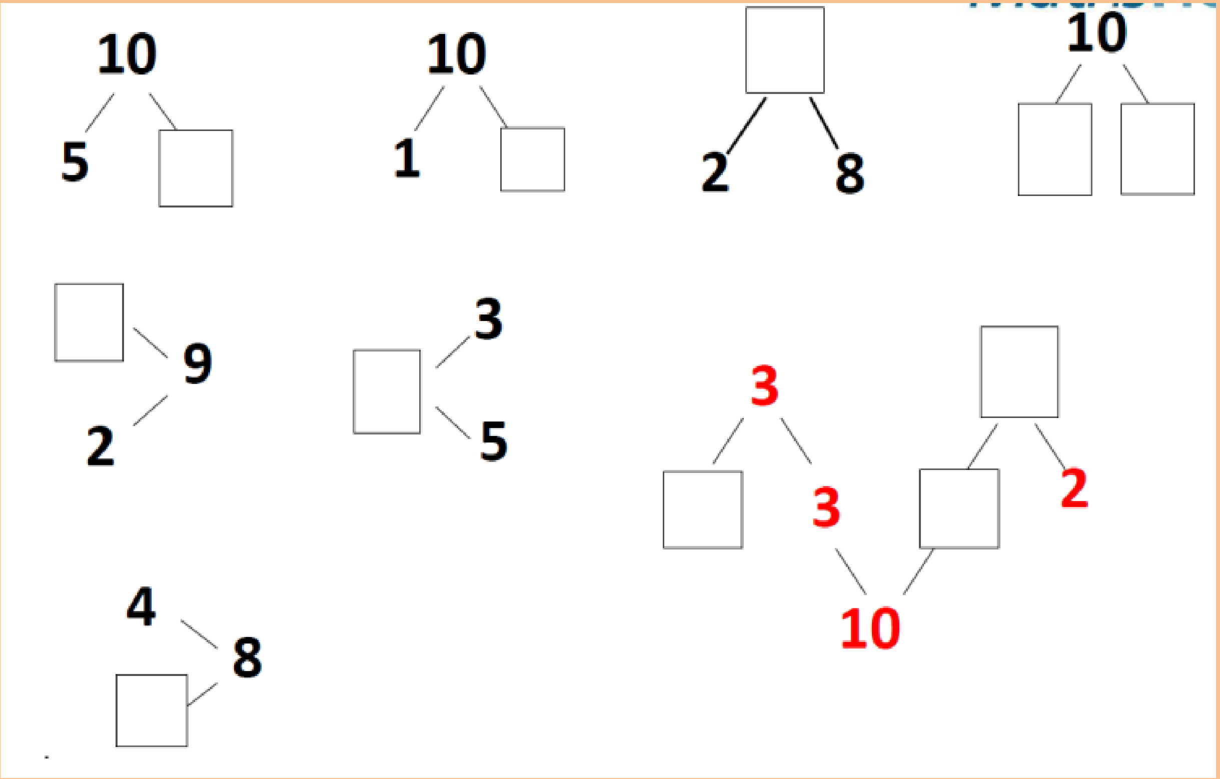


$\frac{1}{2} \div 3 = 1/6$

Variation- a brief overview

Variation

- This is not harder.
- It is the same learning intention that is represented in a different way.



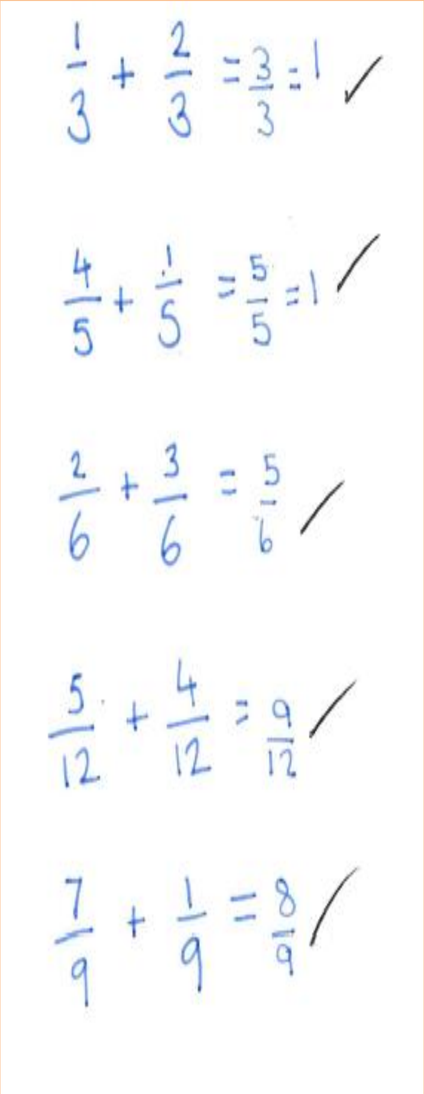
95% of the children answered 25 correctly.

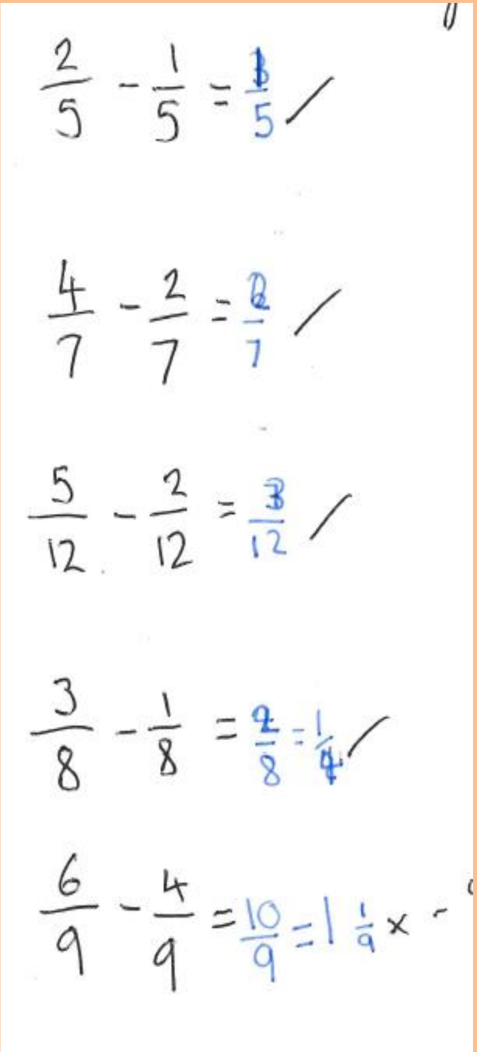
44% answered 29 correctly

25	20% of 1,800 =

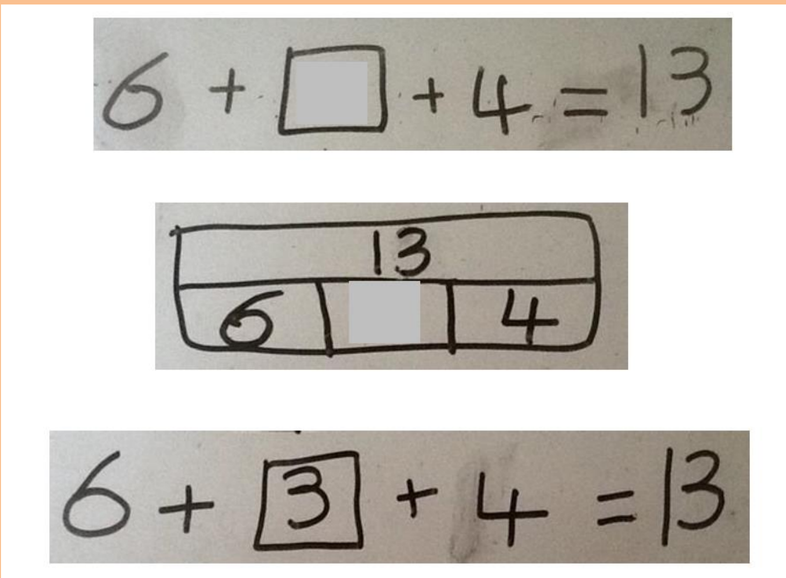
29	15% × 440 =

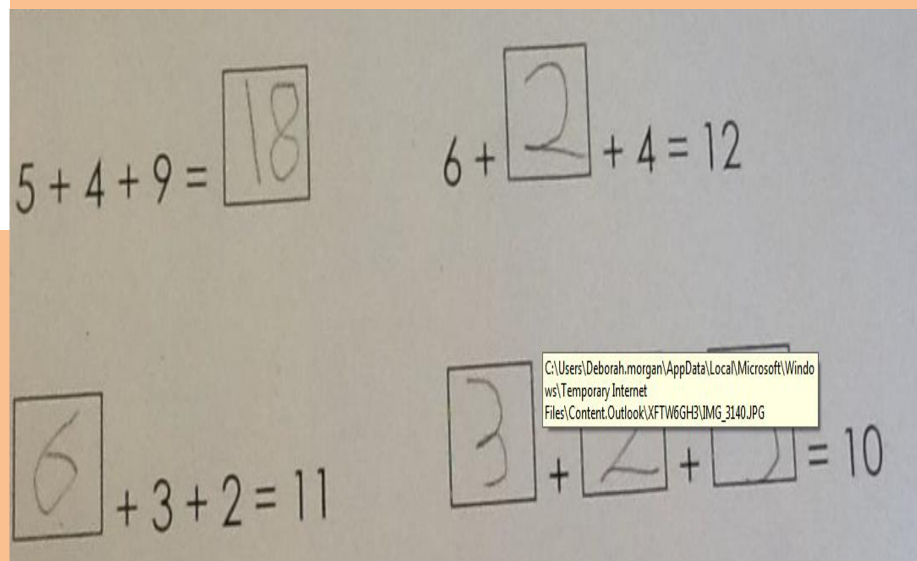
This does not show varied fluency:





Examples of variation





Can I x and ÷ by 10, 100 and 100?

a) When I x by 10 what happens?
b) When I divide by 10 what happens?
c) When I times by 100 what happens?
d) When I ÷ by 100 what happens?
e) When I share a number into 100 parts what happens?
f) What happens when I make a number 100 times bigger?

1. 1.2 x 10 =
2. 3.04 x 100 =
3. 5.8 ÷ 100 =
4. 0.4 ÷ 1000 =
5. 7.08 ÷ 1000=
6. 100 x 0.03 =

i. ☐ X 3.03 = 30.3

ii. 4.56 ÷ ☐ = 0.456

iii. ☐ X 1000 = 0.8

iv. 3.6 + ☐ x 100 = 500

v. 2.07 x ☐ = 2070 ÷ ☐

a. What number do I need to multiply 200 by in order make 100000?
b. What number do I need to multiply 50 by to make one million
c. How many times will 20 go into tem million?
d. Which other number when multiplied by 500 equals one hundred thousand?

What have I done wrong?

(Explain your answer)

1.) 2.03 X 10 = 2.3

2.) 0.02 x 1000 = 2

3.) 3.04 ÷ 100 = 3.04

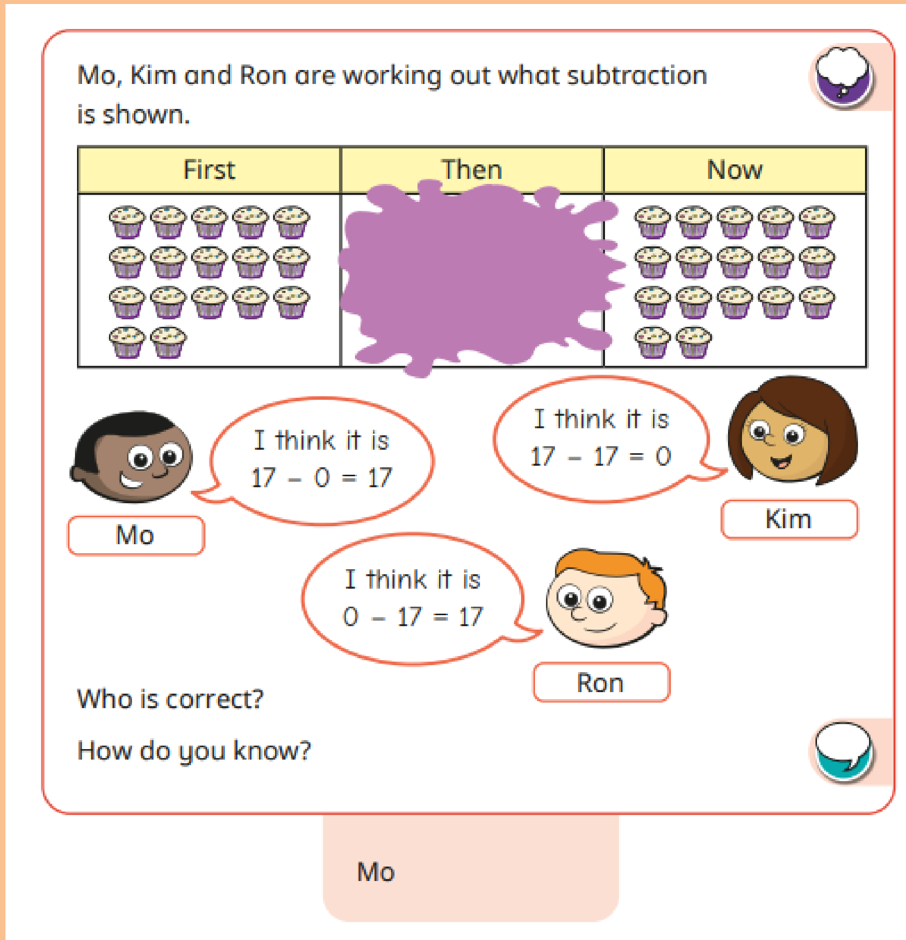
Make 1000000 -Match the statements together

50000		500000
1000		100
Ten million	X	One thousand
100 x 100		One tenth
2x10		200

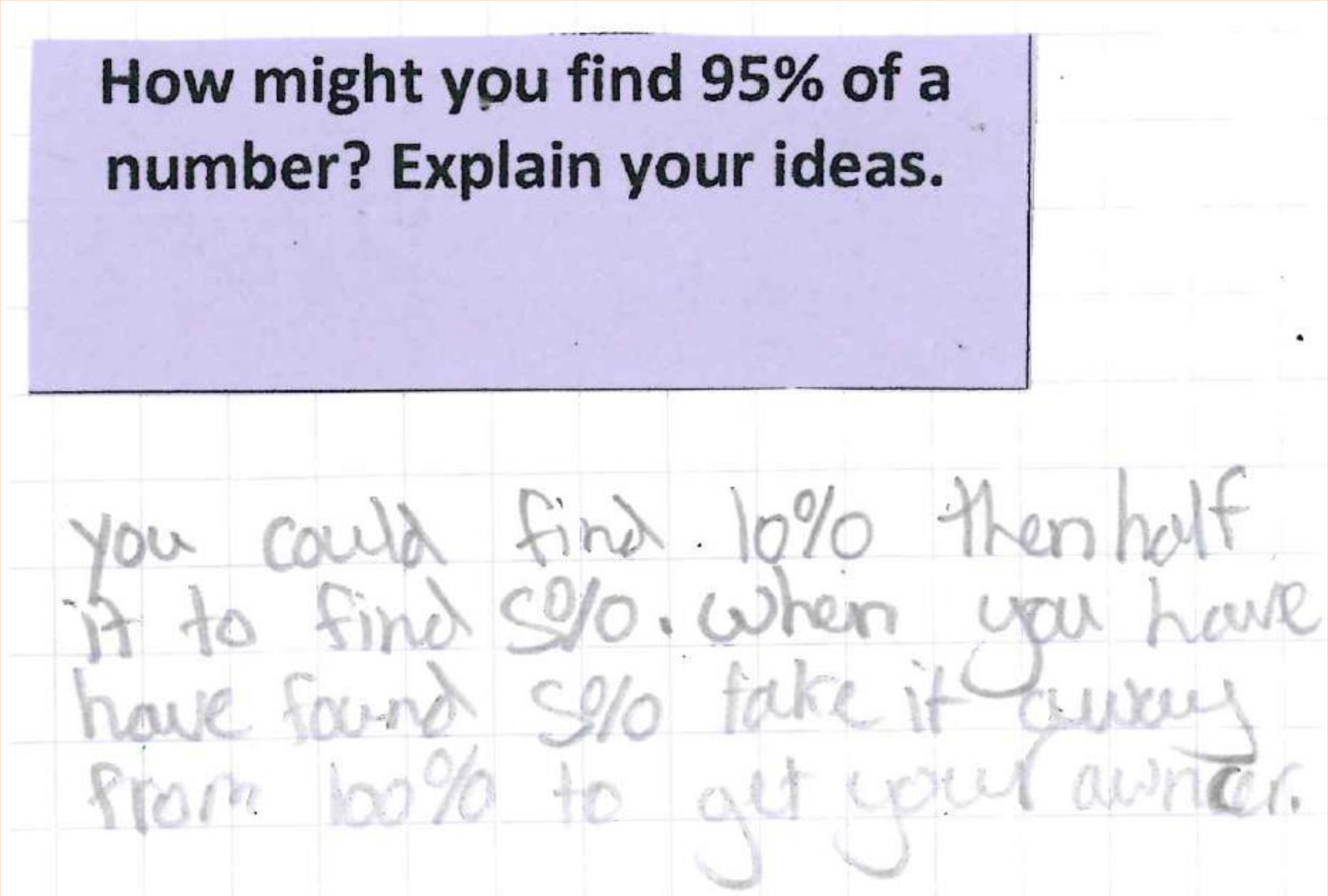
Depth

- Detail in exploring the concept:
  - Variation
  - Word Problems
  - Activities that develop reasoning

Example of a year 1 reasoning question



Example of a year 6 reasoning question



How might you find 95% of a number? Explain your ideas.

you could find 10% then half it to find 5%. when you have have found 5% take it away from 100% to get your awncer.

Example of a year 3 depth task

4a. Lily has written some number sentences about a fact family, but she's made a mistake.

3 x 6 = 18

30 x 6 = 180

180 ÷ 6 = 3

180 ÷ 3 = 60

Find and explain her mistake.

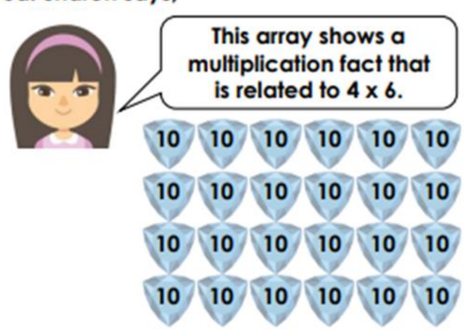
R

5a. Using the digit cards below, create five different multiplication or division sentences.

5	30	3
50	15	150

PS

6a. Sharon says,



Do you agree? Explain why.

Example of depth (Yr 6)

1) By rounding each number to the nearest thousand, estimate the answer to 8672 + 7239

2) Estimate the answer to 4243 + 1734 by rounding the numbers to:
a) the nearest 1000
b) the nearest 100
c) the nearest 50
d) the nearest 10.

3) Give an example of a six digit number which rounds to the same number when rounded to the nearest 10000 and 100000. **Explain why this has happened**.

4) **Spot the mistake!** Calvin rounded 215678 to the nearest ten thousand and wrote 220678. **Can you explain** to Calvin what mistake he has made and why he has done it?

5) Ed says, 'My number is 1,350 when rounded to the nearest 10.
Joe says, 'My number is 1,400 when rounded to the nearest 100.
Both numbers are whole numbers. What is the greatest possible difference between the two numbers?

6) Kiera rounded 2,215, 678 to the nearest million and wrote 2, 215, 000. **Can you explain** what mistake she has made and **why** she has done it?

8) Two numbers when added together make 100 but when rounded, one number rounds to 0 and the other rounds to 100. **How many different combinations of numbers can you find?**

Greater Depth

There is a difference between a Higher Attaining Child and a Greater Depth Child:

Higher Attaining Child

- Can follow a given procedure and the answer right.
- Might not necessarily want to think outside of the given procedure/ rule.
- Can sustain attention enough to get through the entire maths papers.
- Can deal with the range of responses, language and variation of presentation.

Greater Depth Child

- Thrives on thinking that little bit more.
- Can appreciate viewpoints.
- Has multiple strategies to solve the same problem in different ways.
- They are prepared and able to convince and prove using different resources and representations.
- Can deal with complex renditions of maths they are learning.

Maths national curriculum aims:

The national curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils 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 of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

This describes maths mastery. Children working at greater depth *will* be fluent; *will* solve problems; and *will* reason mathematically.

Programme of study:

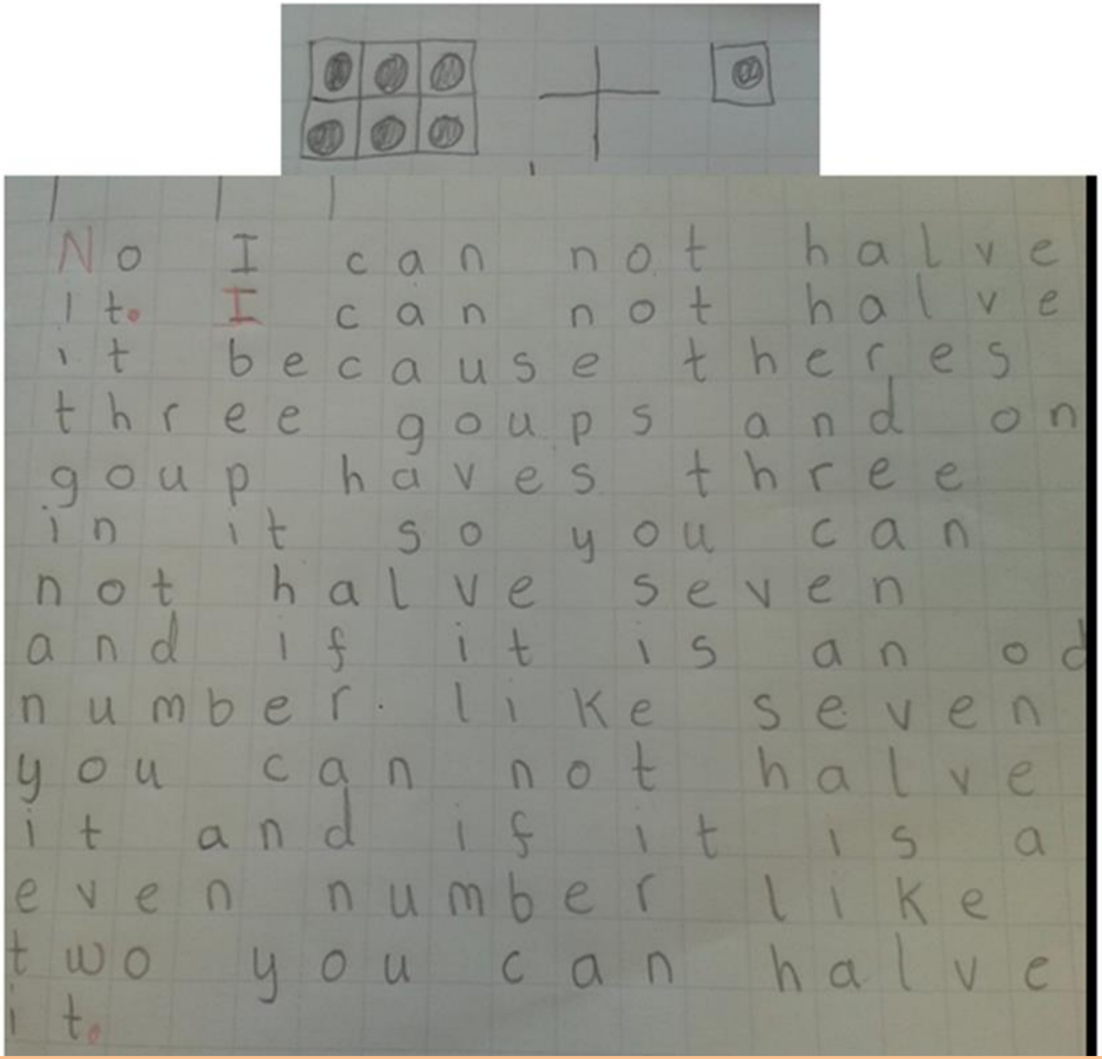
The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

Those working at greater depth should be offered 'rich and sophisticated problems'. It is not about moving onto the next year group's work.

Children are challenged by:

- Word problems that are more complex by involving deduction skills.
- Word problems that are more complex by touching on other content domains.
- Questions involving reasoning.
- Open-ended investigations

Have a look at the work of this Year 1 pupil who during her reasoning demonstrates that she is able to deduce a simple generalisation from patterns she was working with – she made the leap independently where other pupils didn't. Now you might say, 'but you can halve 7.' – you can't halve seven counters which is what she was working with and is yet to experience halving 7 apples with her teacher. So we can only perhaps expect deductions with the patterns and clues that we have.

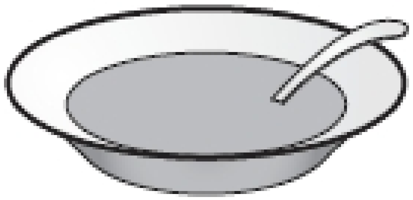


Yr 6 SATS Greater Depth question

Alfie did a survey to find which soup was most popular.

The choices were:

- tomato
- chicken
- mushroom



A quarter of the children chose chicken soup.

Four times as many children chose tomato soup as chose mushroom soup.

Alfie makes a pie chart to show this information.

What **angle** should he use for the children who chose tomato soup?

Content domains:
Ratio
Percentages
Angles
Solving problems

¼ is the same as 25%. So Chicken = 25%
75% = tomato and mushroom.
T:M
Ratio 4:1= 5 parts in total.
Divide 75% (T&M) by 5 so that each part equals 15%.
Therefore tomato = 15% x 4 = 60%
100% = 360 degrees
So 10% = 36 degrees
60% = 36 x 6 = 216 degrees.

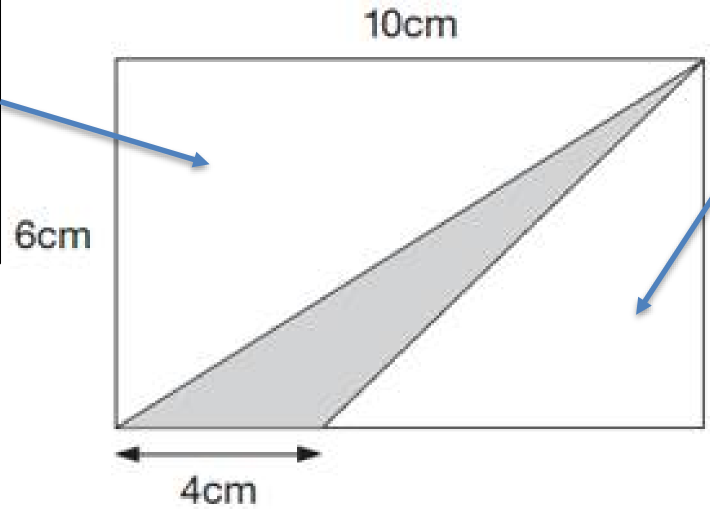
Yr 6 SATS Greater Depth question

The diagram shows a shaded triangle inside a rectangle.

STEP 1) Area of this triangle

10 x 6 = 60

60 divided by 2 = **30 cm²**



Step 2) Area of this triangle

Base is 6 because 10-4 = 6.

So area = (6x6= 36) divided by 2 = **18cm²**.

Not actual size

Step 3) Subtract the areas of the triangle from the area of the rectangle.

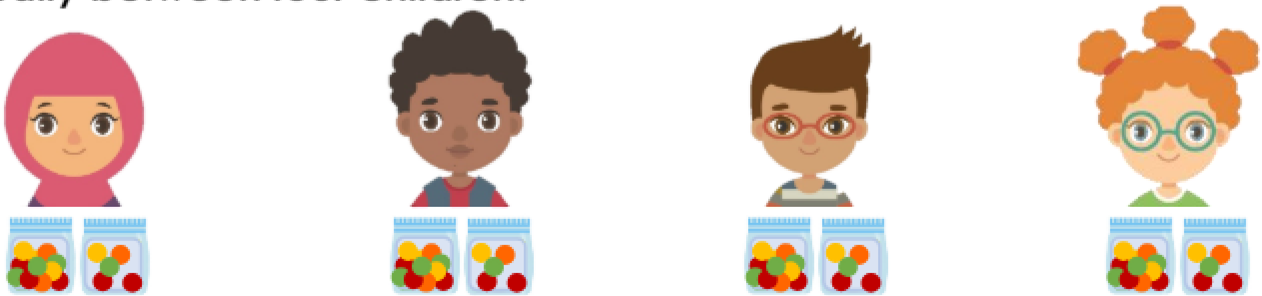
So 60 – 30 = 30

30 – 18 = **12cm²**

What is the area of the shaded triangle?

‘Working at’ children will know that Area of a triangle = ½ (b x h) but they will struggle to use their deduction skills to find the clues from the diagram to work out how to solve this.

2. In a factory there are bags of chocolates and bags of jellies. The chocolates and jellies are combined into equal proportions in pick 'n' mix bags of sweets. These are shared equally between four children.



$1\frac{2}{3}$	$1\frac{2}{3}$	$1\frac{2}{3}$	$1\frac{2}{3}$

Each child receives a full bag of sweets and two thirds of a bag of sweets.
Calculate what fraction of the sweets used in the factory were chocolates and what fraction were jellies.
Represent your working as a written calculation using at least two operations.

$(1\frac{2}{3} \times 4) \div 2 = \frac{20}{6}$

3 and $\frac{1}{3}$ of the sweets were jellies and 3 and $\frac{1}{3}$ of the sweets were chocolates.

What would the fractions be if there were more chocolates than jellies? Explore various possibilities.

Various answers, for example 1 bag of the sweets were jellies and 5 and $\frac{2}{3}$ of the sweets were chocolates.

DP

What can I do at home?

- The priority at home would be number fluency:
  - Number bonds
  - Times Table and Division facts.
- DO encourage your child to go onto Times Table RockStars (yr 3 upwards. Yr 2 after it is taught).
- DO complete the maths homework which is set (it links to classroom learning).
- You can also access the learning library on db primary which has additional online games/ activities linked to maths.

What does a lesson look like?

- Mental oral starter
- One clear objective eg Can I use column addition?
- Clear modelling of one focus ‘My turn- Our turn- Your turn’
- Visual models that link to our calculation policy.
- Success criteria- they are just smaller steps based around what has been taught and what they need to do in order to reach the learning objective.
- The children must show fluency in a variety of ways- **Varied Fluency**
- The children must show depth in a **variety of ways- Depth**
- Some children will complete **greater depth** challenges.

Objectives being covered today:

Class	Objective
Elm	Can I add and subtract within 20?
Beech	Can I make equal groups? (Second lesson on multiplication and division block)
Whitebeam	Can I find equivalent lengths (metres and centimetres)
Chestnut	Can I calculate the perimeter of rectilinear shapes?
Pine	Can I find the whole? Where they will need to find the fraction of an amount to allow them to find the whole.
Oak	Can I find a percentage of an amount?

Classroom visit

- You will now have an opportunity to visit the classrooms to see and take part in activities with your child.
- What to expect:
  - There may be different activities for groups of children depending on the teacher’s assessment for learning.
  - Some children may be working with adults.
  - All lessons will be showing the maths mastery approach.

Please remember:

- This is your child's learning time.
- You can approach your child, take part in the activities with them and ask him/her questions on their learning, but please do not give them the answer!
- Please speak quietly to each other/ your child.
- Please do not visit foundation stage.

Feedback

- On your way out:
  - On your post-it note, please could you record a WWW (What Went Well) and EBI (Even Better If).
  - Also if there are any particular areas of maths you feel you would like a workshop on, please also note it on a post-it note and add it to the EBI poster.