Maths Mastery at St Peter's

Let's do some maths!

Solve the following:

□ + 17 = 15 + 24

99 – □ = 90 – 59

Consider the strategies you used.

Aims:

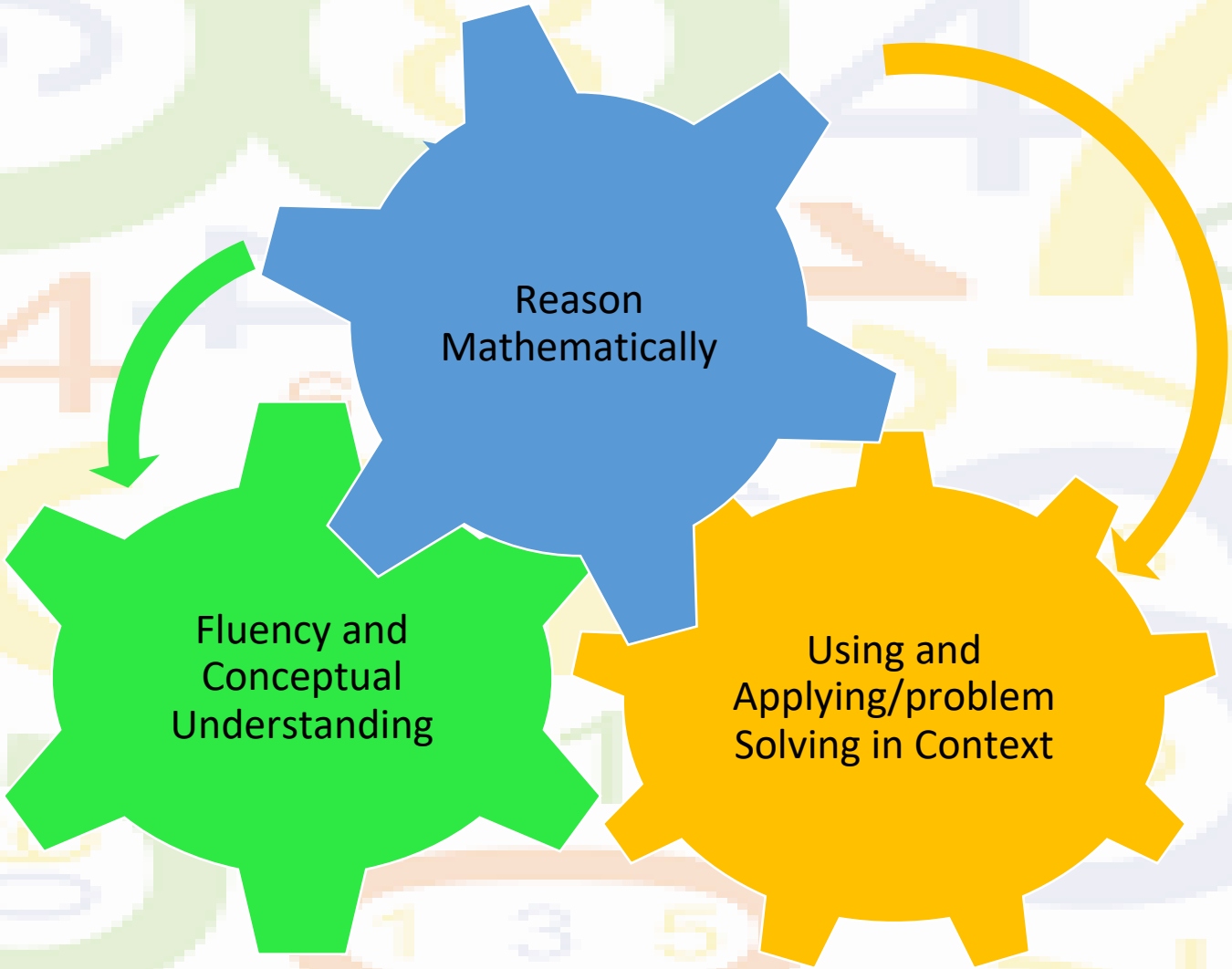
- To know what the Curriculum says about Maths
- To look at what Mastery means and what underpins it
- To know our approach to teaching maths
- To do some maths!

Manipulatives

What the curriculum says

- 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.

Aims of the National Curriculum



Why Mastery?

- Maths teaching for mastery rejects the idea that a large proportion of people ‘just can’t do maths’.
- All pupils are encouraged by the belief that by working hard at maths they can succeed.
- Pupils are taught through whole-class interactive teaching, where the focus is on **all** pupils working together on the same lesson content at the same time, as happens in Shanghai and several other regions that teach maths successfully. This ensures that all can master concepts before moving to the next part of the curriculum sequence, allowing no pupil to be left behind.
- Procedural fluency and conceptual understanding are developed in tandem because each supports the development of the other.

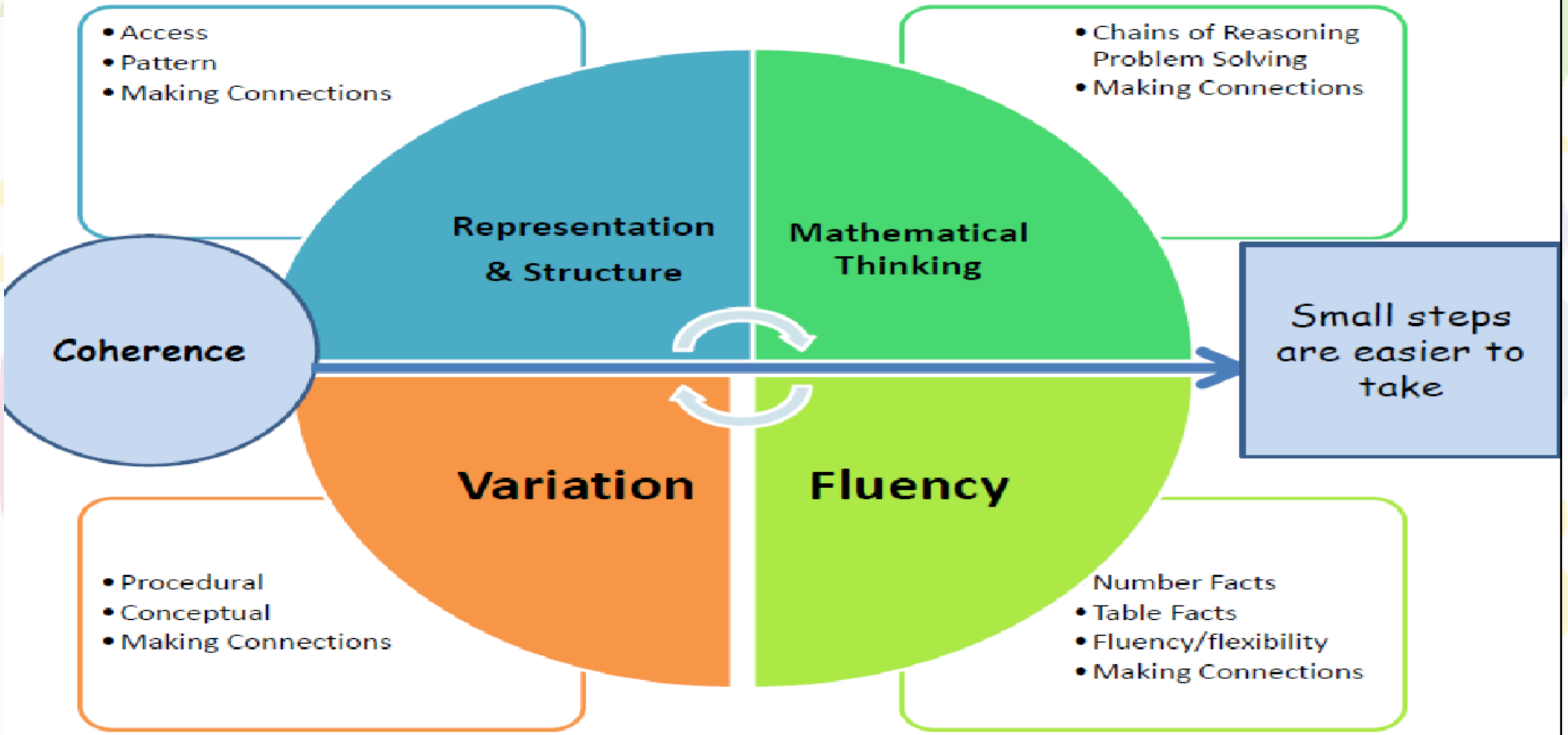
- It is recognised that practice is a vital part of learning, but the practice used is **intelligent practice** that both reinforces pupils' procedural fluency and develops their conceptual understanding.
- Significant time is spent developing deep knowledge of the key ideas that are needed to underpin future learning. The structure and connections within the mathematics are emphasised, so that pupils develop deep learning that can be sustained.

Compare the two sets of calculations

What's the same, what's different?

Set A	Set B
120 – 90	120 – 90
235 – 180	122 – 92
502 – 367	119 – 89
122 – 92	235 – 180
119 – 89	237 – 182
237 – 182	502 – 367

What is Mastery? 5 big ideas:



3. Some children, who feel confident, will be let loose. They'll be able to explore deeper into the woods, before returning to the group to continue on with the journey.

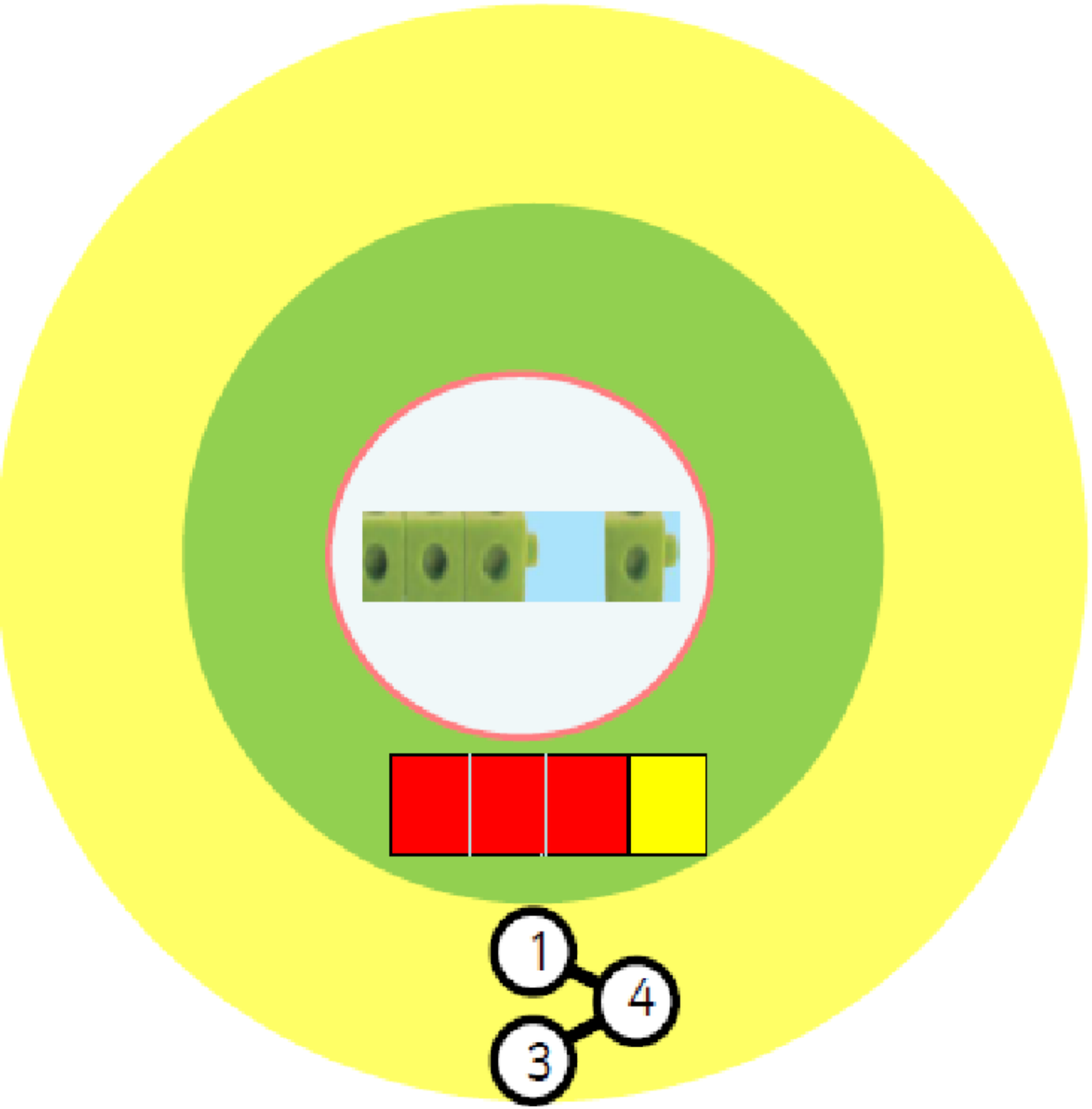
2. Some children will need a little additional support along the way

4. Children will not be racing off ahead on a different journey.

1. We ALL start the journey TOGETHER

5. Children will not be left behind alone and isolated.

We're Going on a Maths Hunt



Concrete:

Resources such as cubes, counters and shapes

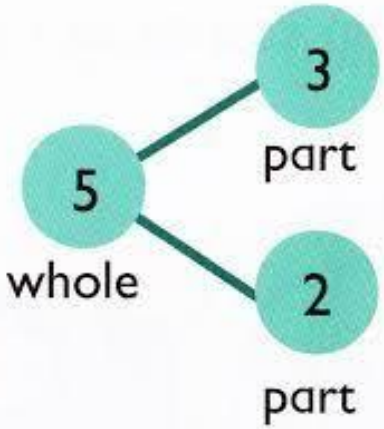
Pictorial:

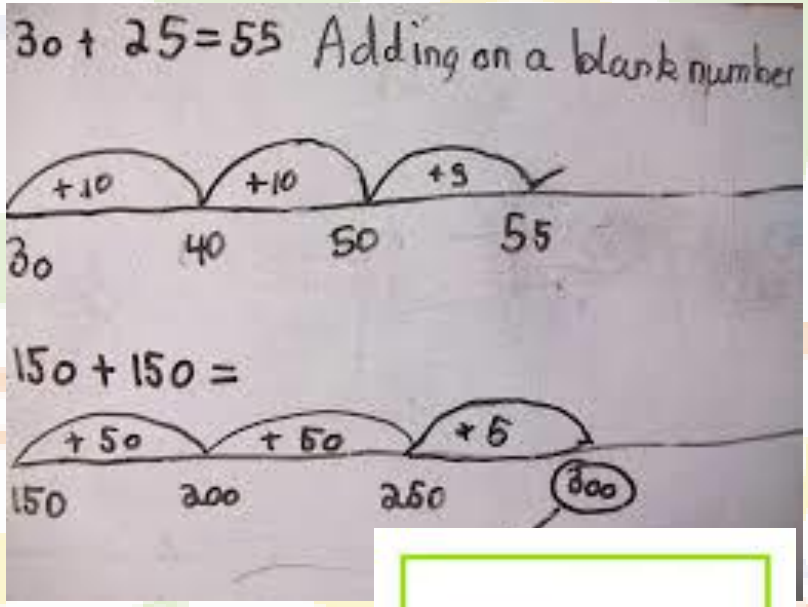
Pictures, drawings

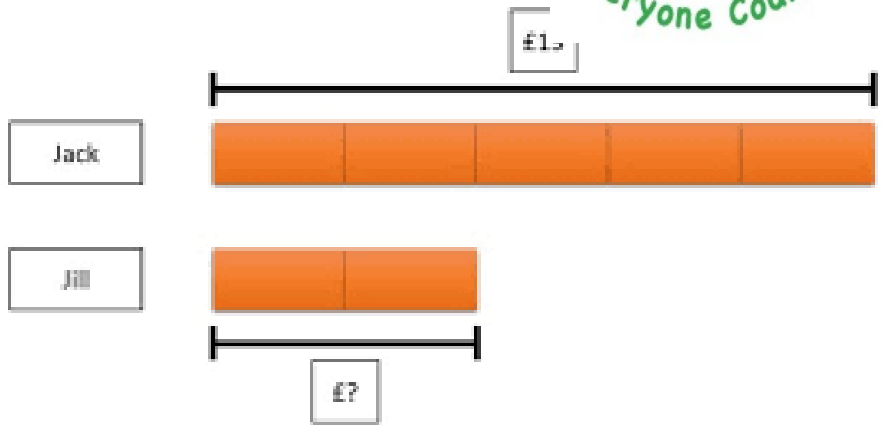
Abstract:

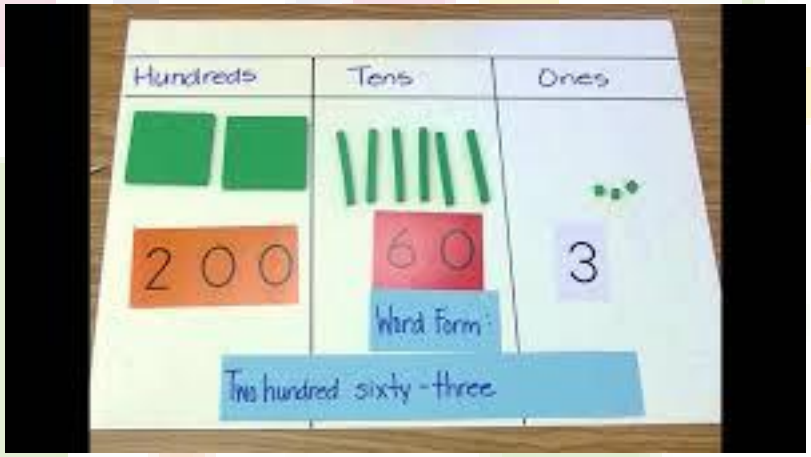
Numbers and symbols

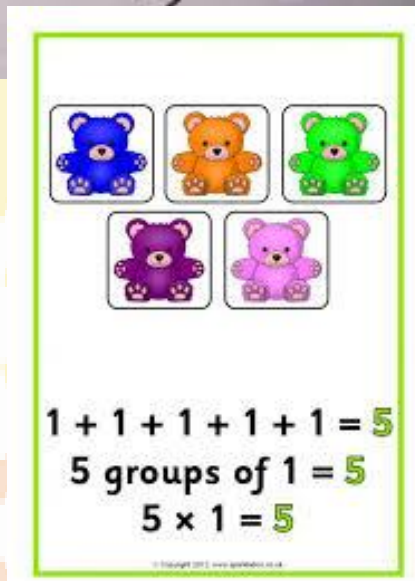
Pictorial Representations

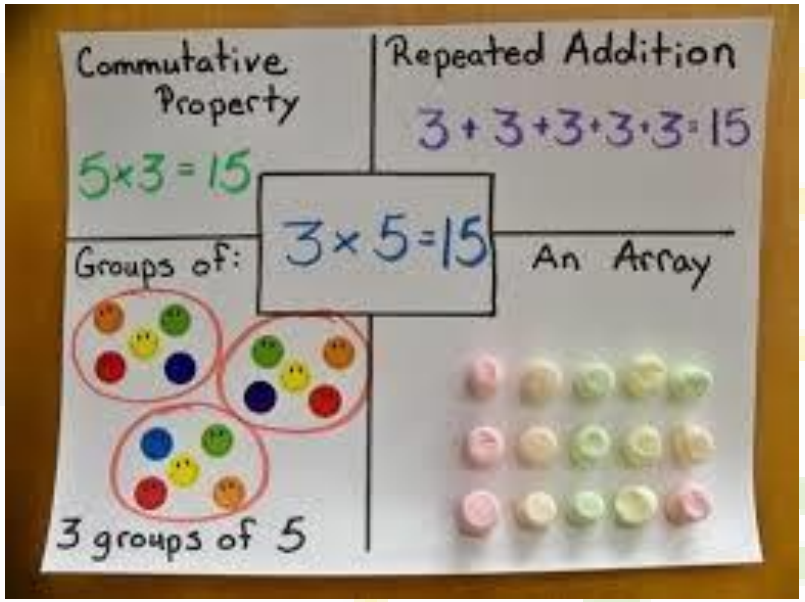




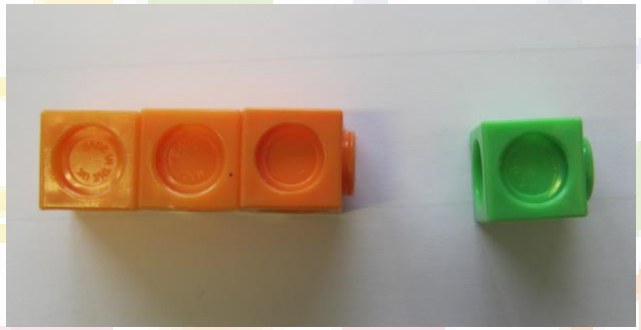




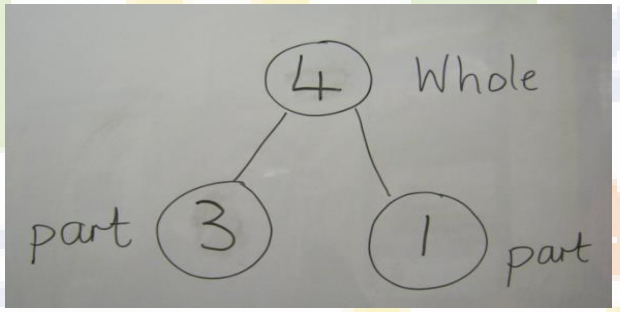




Concrete



Pictorial



Abstract

$3 + 1 = 4$

Concrete or pictorial representations support children to understand abstract concepts and deepen understanding.

Abstract

5 + 12 = 17

Place the larger number in your head and count on the smaller number to find your answer.

$$4 + 7 + 6 = \boxed{10} + \boxed{7}$$

10

$$= \boxed{17}$$

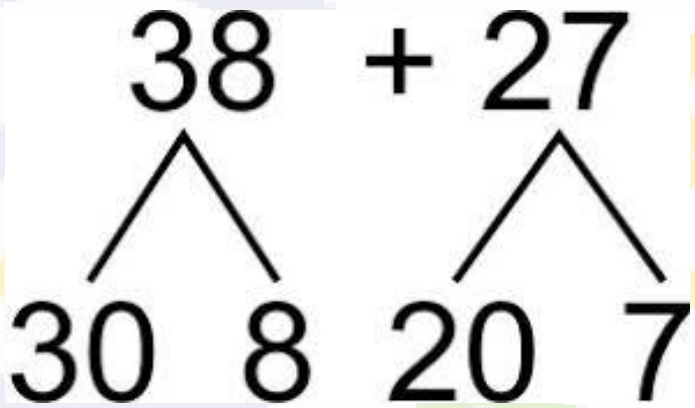
$$10 = 6 + 4$$

$$10 - 6 = 4$$

$$10 - 4 = 6$$

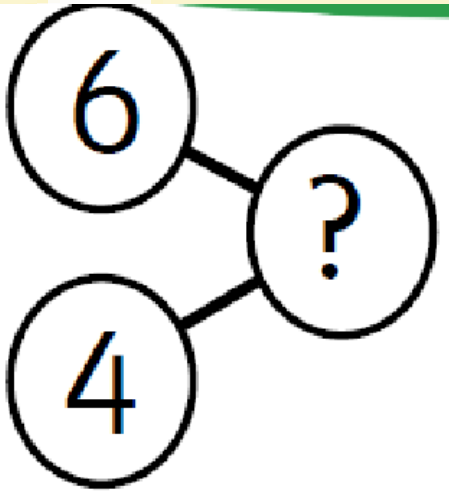
$$10 = 4 + 6$$

Divide 28 into 7 groups. How many are in each group?



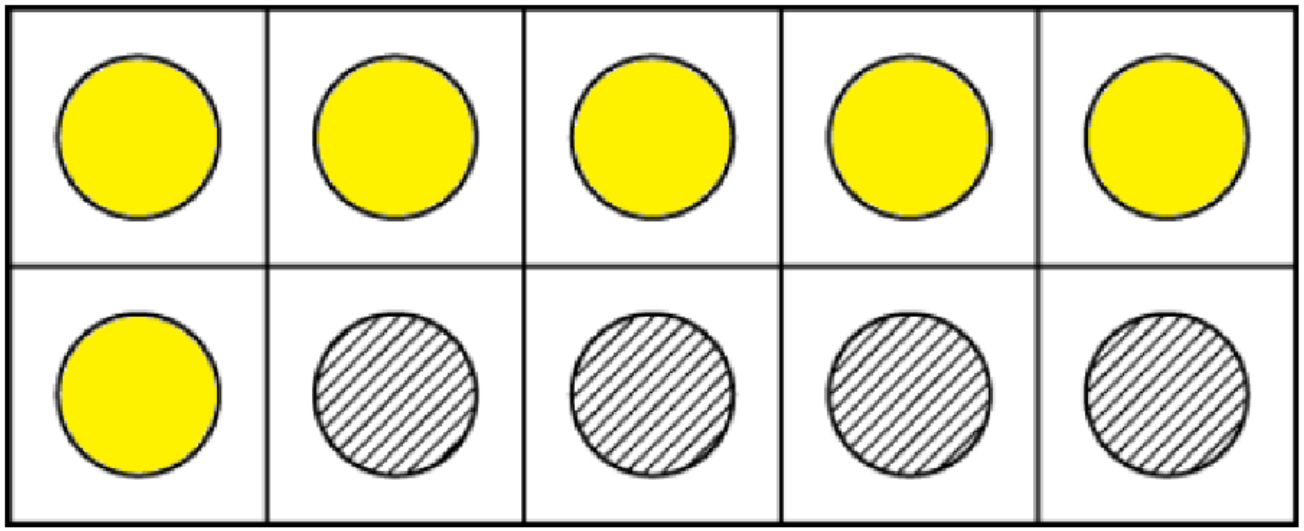
Fluency

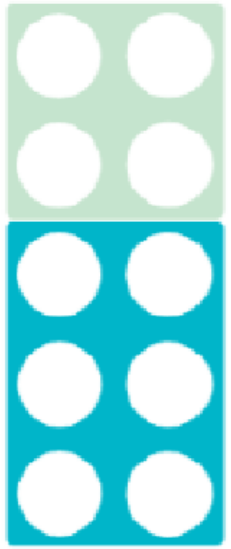
- I know how to do it (operations and their relationships)
- It becomes automatic and I don't need to think about it – e.g. driving a car (mental arithmetic)
- I'm really good at doing it (speed)
- I can show someone else how to do it (understanding)



1 part is 6, the other part is 4

The whole is .....

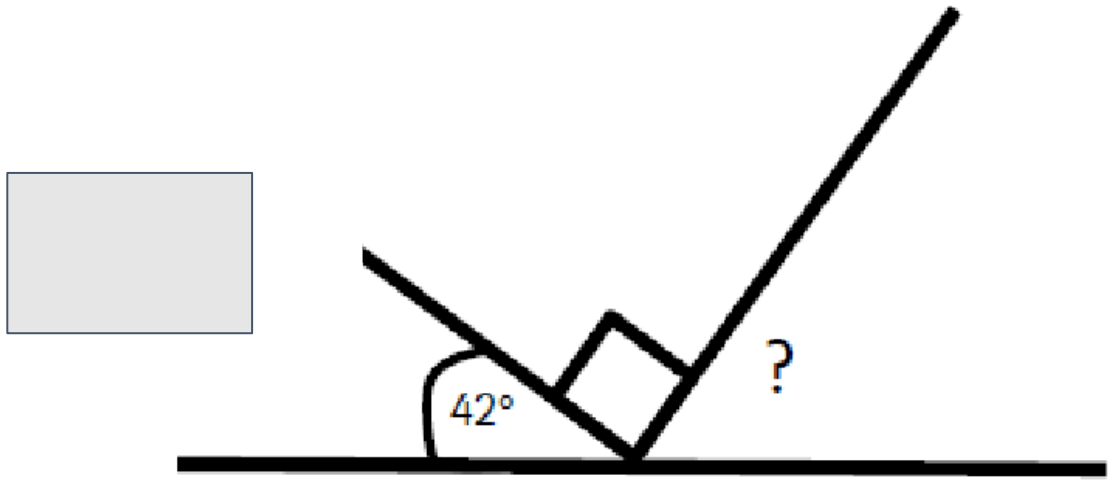


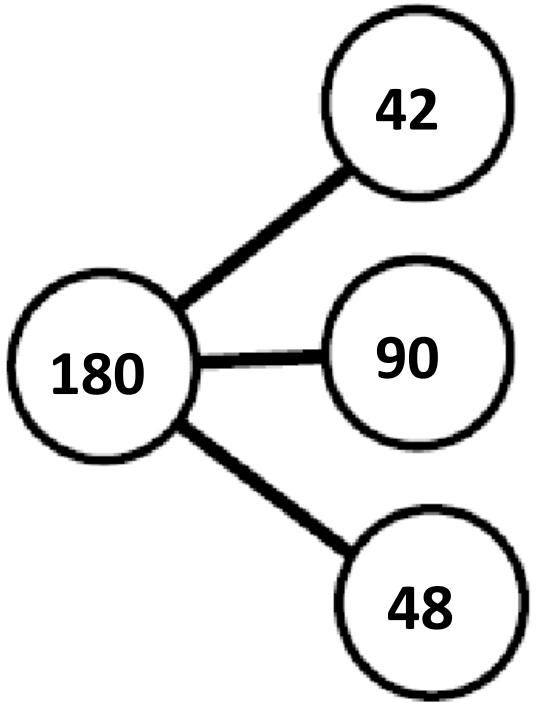


6+4

Consistency of models throughout the school

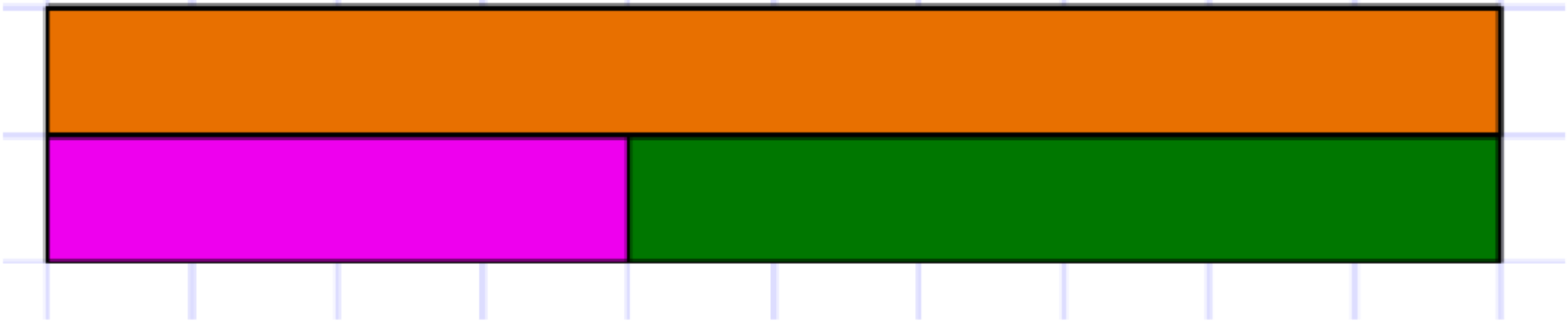
180 - 42 - 90 = 48 degrees





It can also be more than two parts.

Here is an example from a Year 6 geometry lesson.



10	
4	6

234	
103	?

Variation in Fluency

- 5 + 1 =
- 15 + 2 =
- 22 + 63 =

- 5 + ? = 6
- ? + 2 = 17
- ? = 22 + 63
- 20 ÷ ? = 5

Technical Challenge - Reasoning

- 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 understanding (comprehension of mathematical concepts, operations and relations) and procedural fluency (ability to formulate, represent and solve mathematical problems.

*"Reasoning is the "**glue**" that helps mathematics make sense."*

Teachers will secure fluency and then go deeper by using reasoning and problem solving

For example, if the learning intention was to multiply and divide whole numbers and those involving decimals by 10, 100 and 1000 (Year 5) a series of questions may be …

Fluency

- Complete the grid:

	×100	÷1000	×10
365			
2669			
12			

- Fill in the boxes:

□ × 100 = 38

56 □ = 5.6

0.8 x 1000 = □

- Some facts have been cut up. Work with a partner to put them back together.
e.g. 74 ÷ 10 = 7.4

100 **31** **×100** **÷1000** **3100** **=0.031** **÷100**

Reasoning

- **True or false?**
When you multiply whole and decimal numbers by 10, 100 or 1000, you just add noughts on to the end.

- If 5 x 4 = 20

Explain why these facts are true without working them out:

0.5 × 4 = 2
200 ÷ 4 = 50
0.4 × 0.5 = 0.2

Problem Solving

- Put these calculations in order from smallest to biggest:

100 x 540

5.4 x 1000

5400 ÷ 10

5400 ÷ 1000

540 ÷ 10

- Using a number from column A, an operation from B and a number from C, how many ways can you find to make 70? (There are more than 4 ways!)

A	B	C
7	X	1
70		10
700	÷	100
7000		1000

A glimpse of a year 5 and year 1 lesson

Th	H	T	O
		7	8

Have a think

Th	H	T	O
	7	8	0

$78 \times 10 = 780$

Th	H	T	O
7	8	0	0

$78 \times 100 = 7{,}800$

TTh	Th	H	T	O
7	8	0	0	0

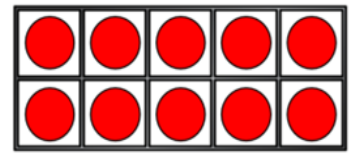
$78 \times 1{,}000 = 78{,}000$

What stays the same? What changes?

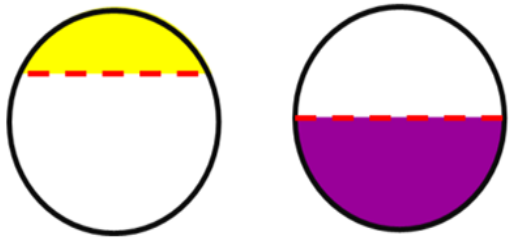
1) What number is missing?
5, 10, 15, ___

2) What is one less than 30?

3) Half of 10 is ___



4) Which shape has one half coloured in?



How do we help children to communicate their reasoning?

I am going to count to 20.

I start at 8.
Will I say 11?
Convince me.

Spot the mistake:

19, 18, 16, 15, 14
What is wrong with this sequence of numbers?

I count backwards from 20
How many steps does it take me to get to 7?

- I think this because
- If this is true then
- I know that the next one is….. because
- This can't work because
- When I tried….I noticed that
- The pattern looks like
- All the numbers begin with

Show Stopper – Problem Solving

- Sophie went to the shop and brought 5 bananas and 6 apples. How many pieces of fruit did she buy altogether?

$5 + 6 = ?$

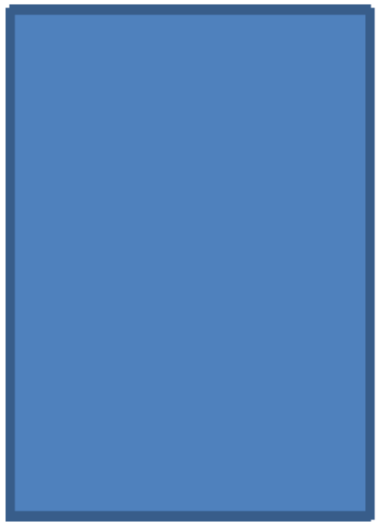
- Altogether Sophie and Ethan have 13 apples. Sophie has 6 apples. How many has Ethan got?

$6 + ? = 13$

- Sophie and Ethan have 20 apples. They both have an even amount each? How many could they have?

$? + ? = 20$

Which is the odd one out? Why?



81

18

45

28 There are **55** cakes.

20 boys and **19** girls each take a cake.

How many cakes are **left**?

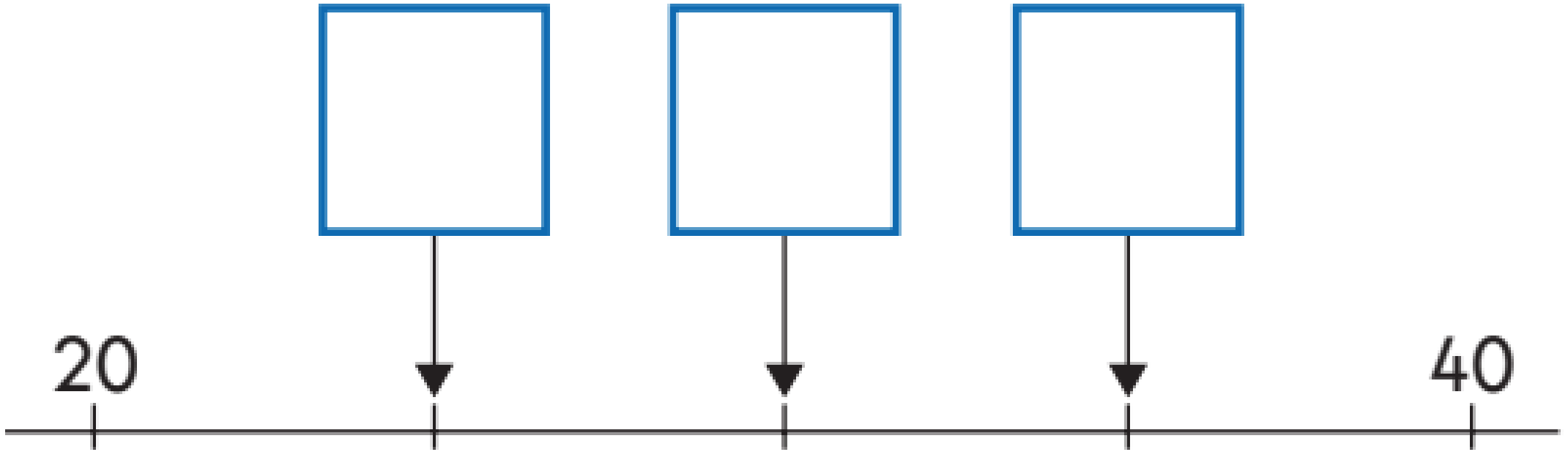
Show your working

cakes

Everyone Counts

20 The numbers on this number line go up by the **same amount** each time.

Write the missing numbers in the boxes.



Thinking about relationships

21 $5{,}542 \div 17 = 326$

Explain how you can use this fact to find the answer to **18 × 326**

$17 \times 326 = 5{,}542$

$18 \times 326 = 5{,}542 + 326$

How might children respond to this question?
What is the best response?

Mastery

- Involves the development of three forms of knowledge:
  - Factual - I know that
  - Procedural - I know how
  - **Conceptual - I know why**

Sally knows all her tables up to 12 x 12

When asked what is 13 x 12 is she looks blank.

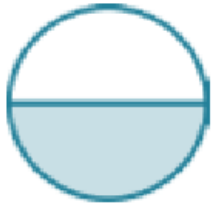
Does she have fluency and conceptual understanding?

Why is depth important?

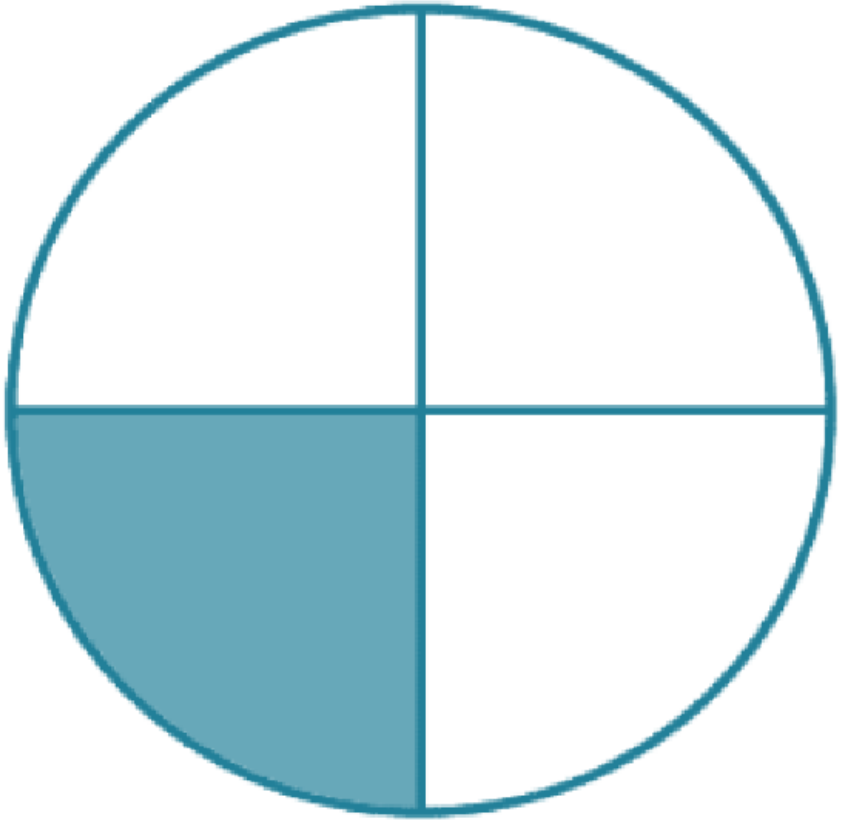
Compare

Which one is bigger?

$$\frac{1}{2} \quad \text{or} \quad \frac{1}{4}$$



$\frac{1}{2}$



$\frac{1}{4}$

How can you support at home?

Maths learning can happen anywhere. Maths is all around us and problem solving is at the heart of the mastery approach. Look for maths problems you can solve together, making connections between what your child has been learning at school and the world around them.

- **Follow a recipe:** work together to find out the quantities needed, ask your child to weigh the ingredients, discuss how you'd halve or double the recipe and discuss the ratio of ingredients.
- **Talk about the weather forecast:** is today's temperature higher or lower than yesterday's? What do the numbers mean?
- **Going shopping:** talk about the cost of items and how the cost changes if you buy two items instead of one. Let your child count out the coins when paying and discuss the change you get back. Use coins to explore addition, subtraction, multiplication and division.
- **Planning an outing:** discuss how long it takes to get to the park, and so work out what time you need to leave the house. Encourage your child to work out the best solution based on the time and distances. Discuss what shapes you

Think and talk like a mathematician

Mathematics language often uses common words in a new way. For example, 'difference', 'right', 'product', 'table'.

- Always encourage your child to *explain* how they have gone about solving a problem, and work with them to test, prove, explain, reflect and spot patterns. Questioning and prompts can be powerful tools to boost your child's mathematical thinking: 'What do you think…?' 'Why …?' 'What will happen if…?' 'What do you notice about…?' 'Can you see a pattern between…?' 'What if we try…?'
- Communicating and discussing maths problems (in a way that others can understand) demonstrates depth of understanding – another fundamental aspect of mastering mathematics.

Learn multiplication tables

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

Everyone Counts

Useful websites

- TT tockstars
- Mathletics
- Busy things
- Corbett Maths
- White Rose
- NCETM
- Top Marks