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Compassion, Peace and Service

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Maths Curriculum Evening

Tuesday 1st February 2022

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- How do we teach Maths at CRS?
  - National Curriculum
  - Our Intent
  - Mastery Approach
  - Concrete, Pictorial, Abstract Approach
  - Use of variation
  - White Rose Scheme
  - Calculation Policy (key resources and representations and formal methods)
- What can you do to support your child at home?

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What does the National Curriculum say?

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The curriculum aims that all children:

- **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.
- can **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.

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Our Intent

At Christopher Rawlins we want children to be prepared for their future life. Our maths curriculum provides a foundation for understanding the world, the **ability to reason mathematically and a sense of curiosity about maths.** We use a Maths Mastery approach so that children are exposed to a **variety of concrete, pictorial and abstract representations** to help secure a **deep understanding** of new concepts, before they **apply their learning to varied fluency, problem solving and reasoning tasks. Rich mathematical talk** and reasoning provides children with the confidence to apply their learning to different contexts, and make cross-curricular links.

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What is mastery?

https://www.youtube.com/watch?v=Zv-uhCkLQ1Y ??

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

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The 5 Big Ideas

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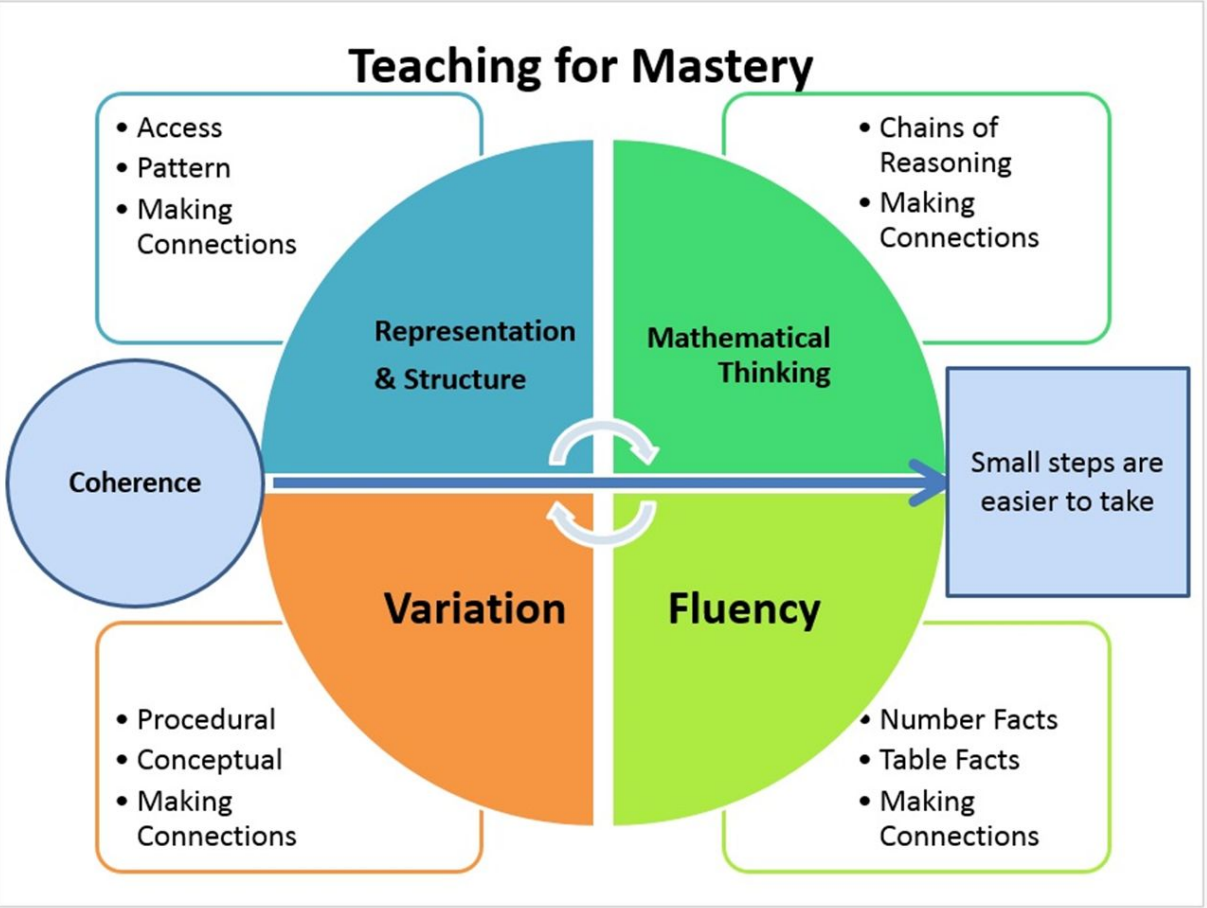

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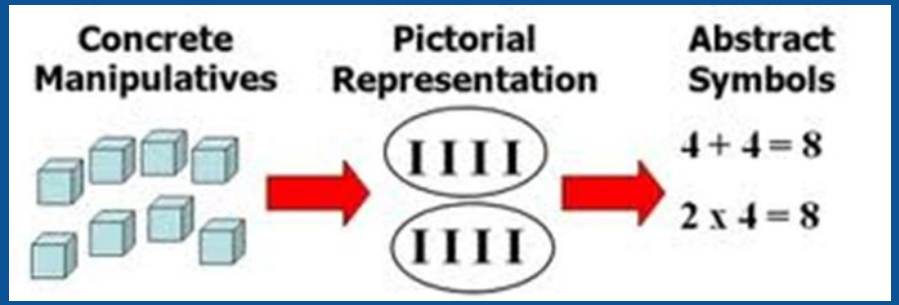
CPA approach

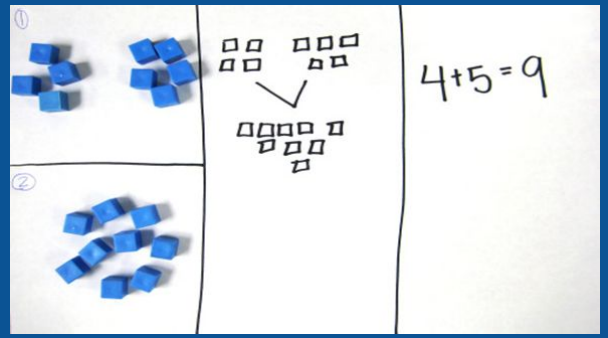
Concrete → Representational → Abstract

C
- Concrete = maths concept is modelled with concrete materials

P
- Pictorial representation = maths concept is modelled with representational examples

A
- Abstract = Maths concept is modelled with numbers and symbols.





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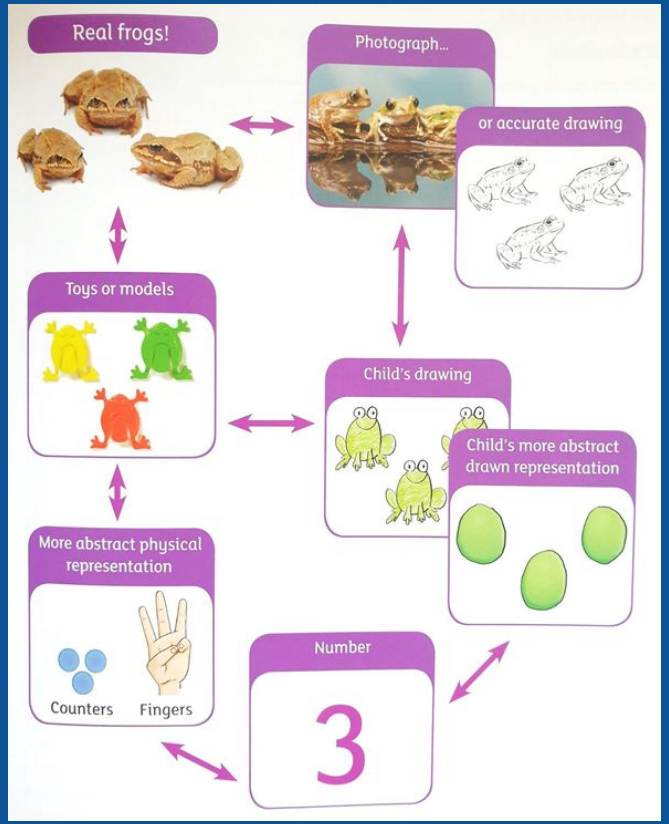
CPA doesn't have to be linear



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I hear and I forget. I see and I remember. I do and I understand.

"In order to develop every student's mathematical proficiency, leaders and teachers must systematically integrate the use of concrete and virtual manipulatives into classroom instruction at all grade levels."

- -National Council of Supervisors of Mathematics

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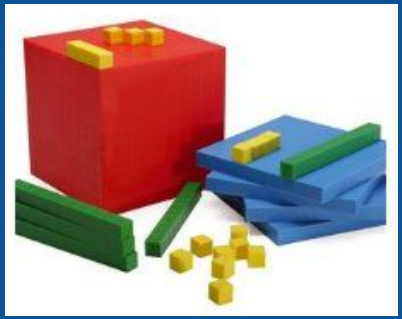
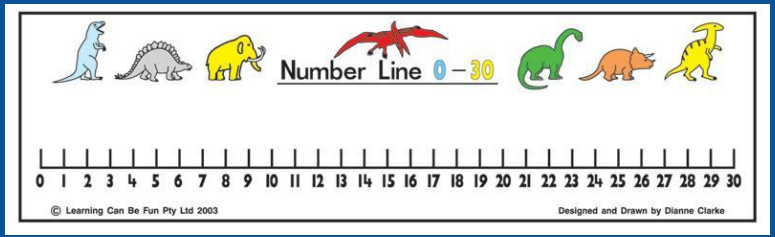
Manipulatives and representations

A manipulative is an object that children or practitioners can interact with and move to represent mathematical ideas. Manipulatives could include everyday objects such as pine cones, buttons, and small toys as well as resources like interlocking cubes, Cuisenaire® rods, Dienes blocks, and building blocks.

A ‘representation’ refers to a particular form in which mathematics is presented. Representations include informal drawings, mathematical symbols, and more formal diagrams, such as a number line or graph.



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



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Why are manipulatives and representations important?

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Our aim is to ensure that we develop children's understanding of mathematical structures through careful use of representations.

Which means:

•consider their use carefully

•they are there to **see the structure of the mathematics not as a crutch to do the mathematics.**

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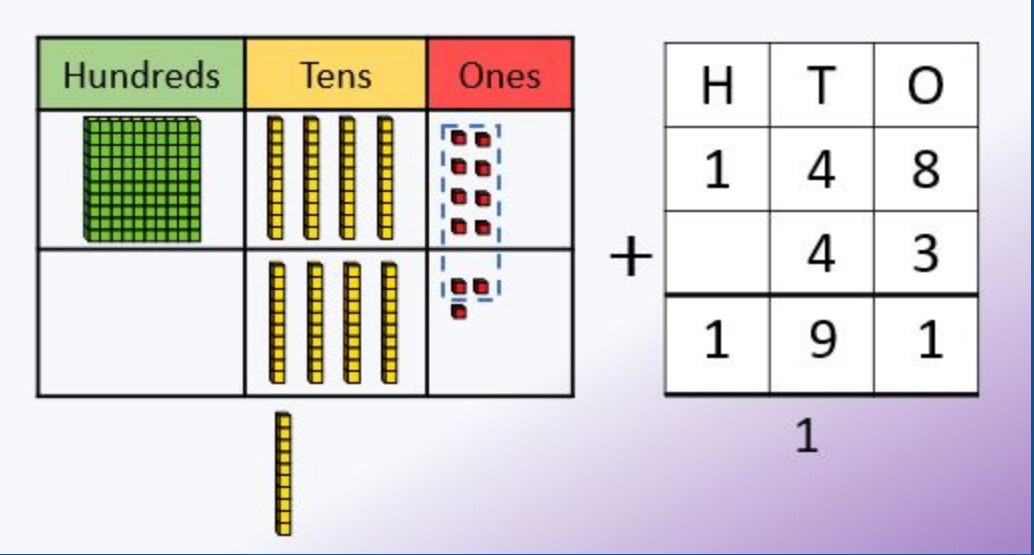
Example progression in manipulatives



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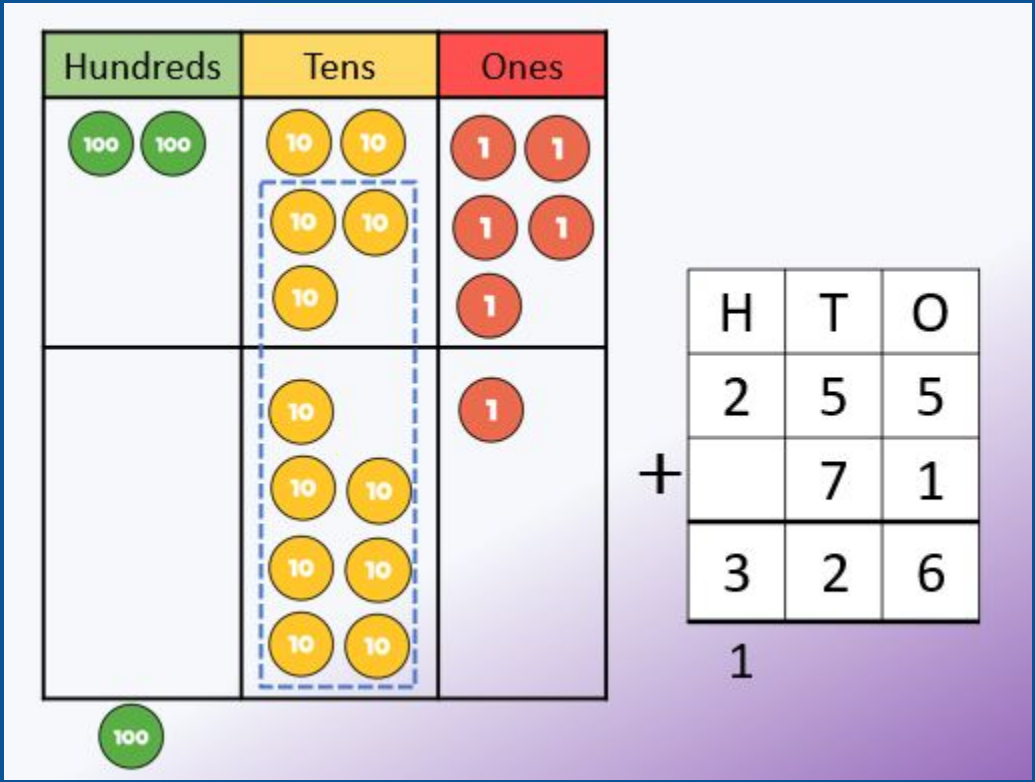
Example progression in manipulatives



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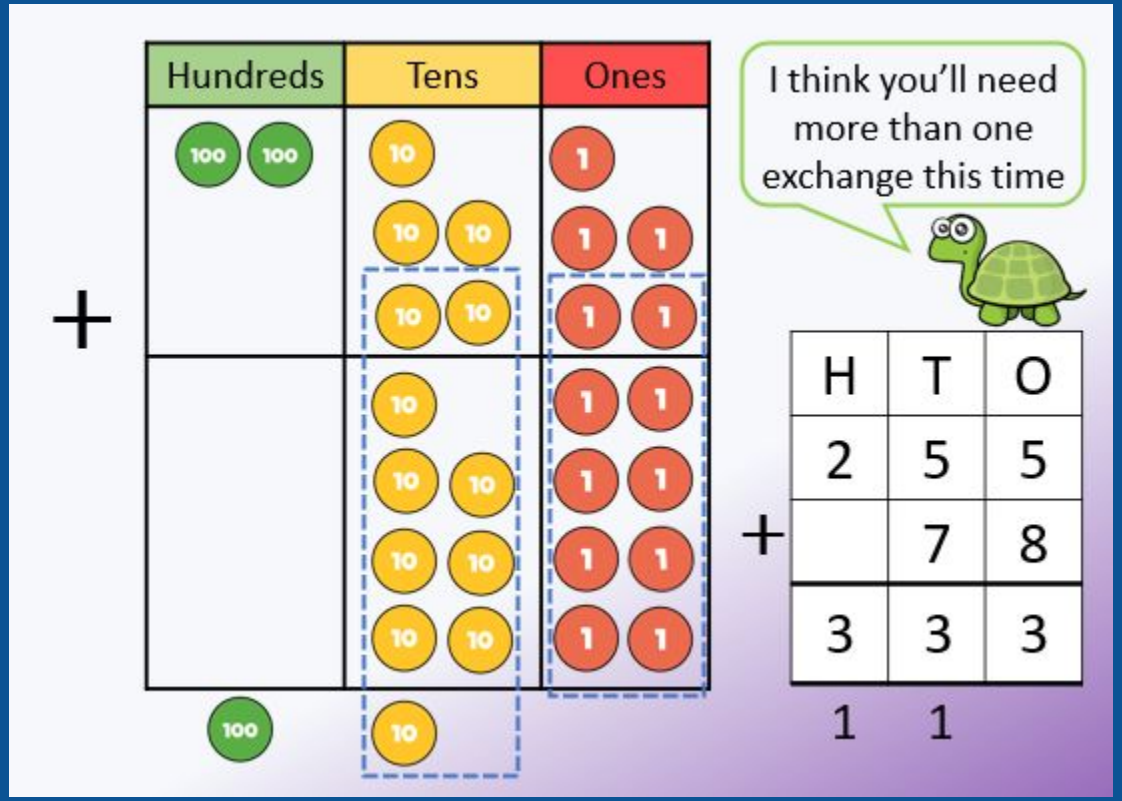
Example progression in manipulatives



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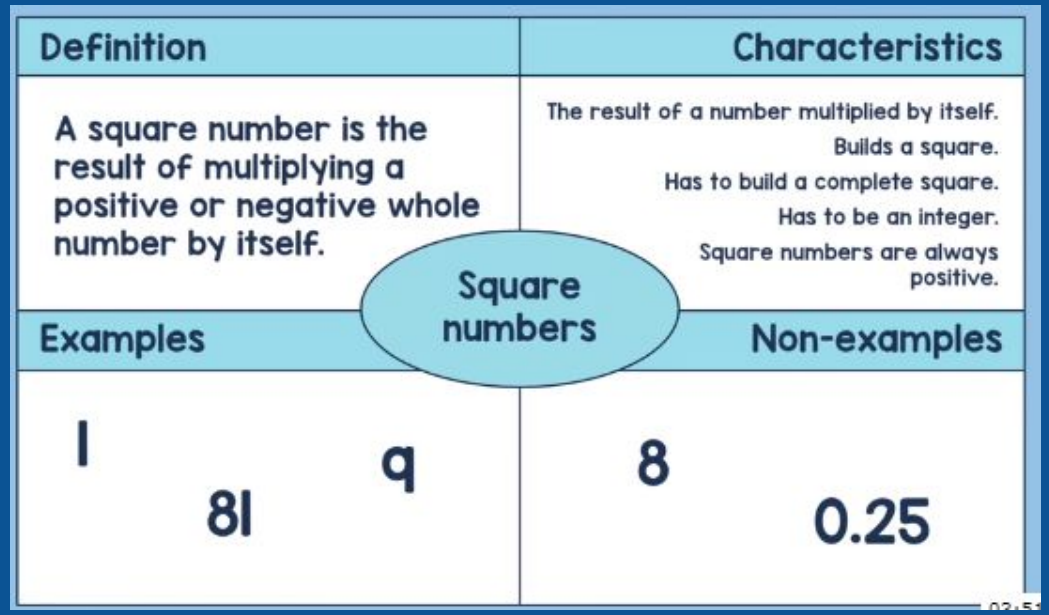
Conceptual Variation

- **Concept variation-** (standard and non-standard) what *it is*, what *it is also*
- **Non-concept variation** (giving counter-examples)- what *it is not*



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Procedural Variation

Sometimes referred to as 'intelligent practice'

It's about spotting patterns, making connections, generalisations

6 + 9 =
16 + 9 =
26 + 9 =
36 + 9 =
46 + 9 =
56 + 9 =

7 x 4 =
7 x 4 =
70 x 4 =
70 x 40 =
700 x 4 =
700 x 40 =

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YOUR TURN

What is a triangle?

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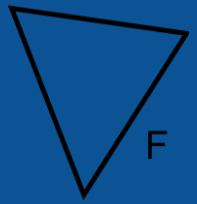
A

B

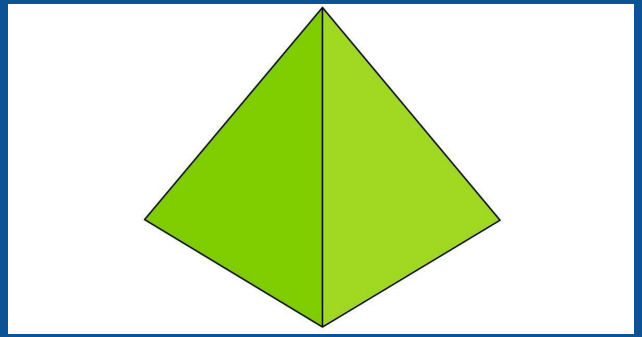
C

D

E



F



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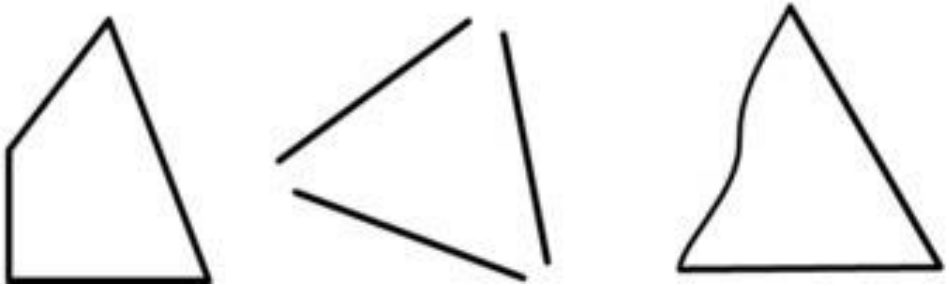
Now improve your definition!

These are triangles

These are not triangles



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What is a triangle?

A triangle is a 3-sided polygon, meaning it has three straight sides and three vertices.

A polygon is a 2D shape which has straight sides which do not cross

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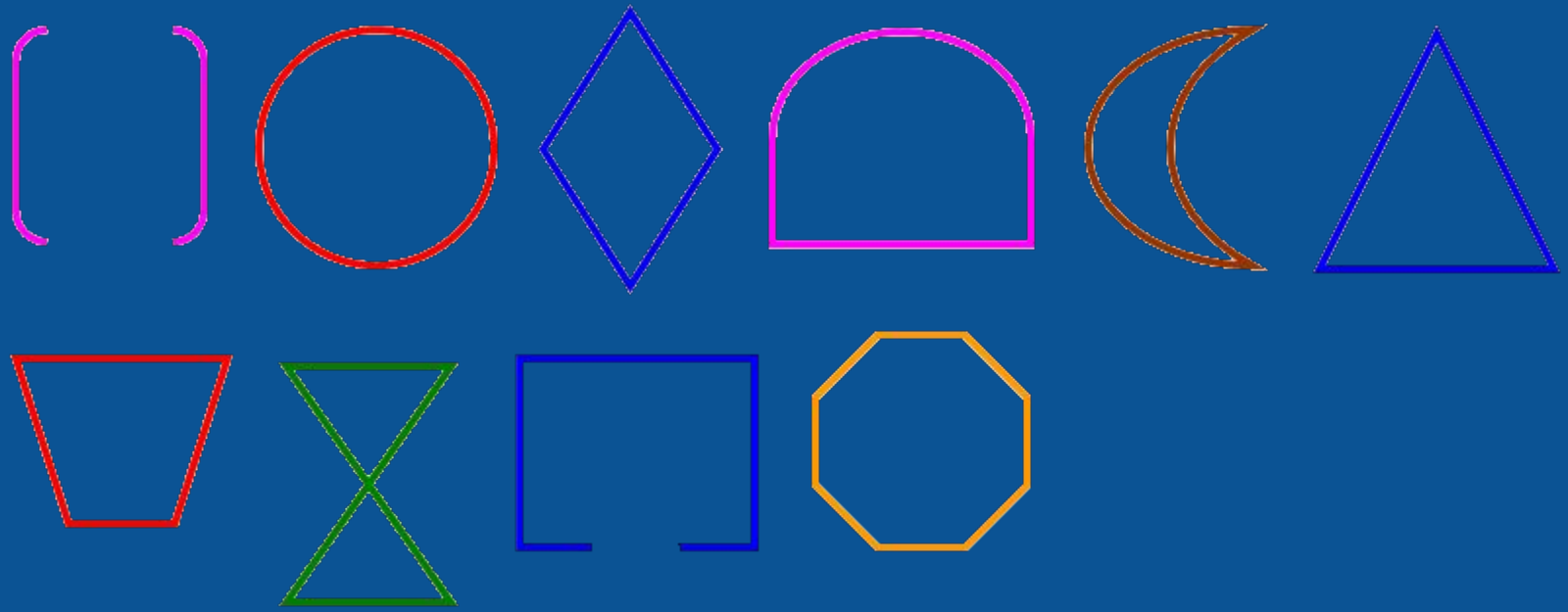
A triangle is an example of a polygon. **Tick the shapes below which are polygons. Explain why the rest aren't.**



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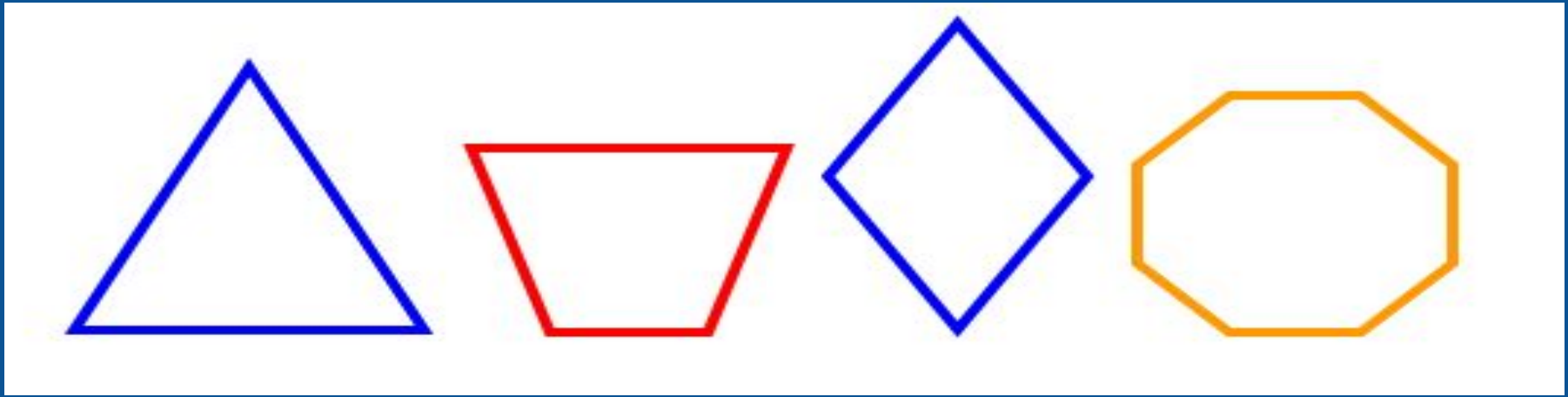
True



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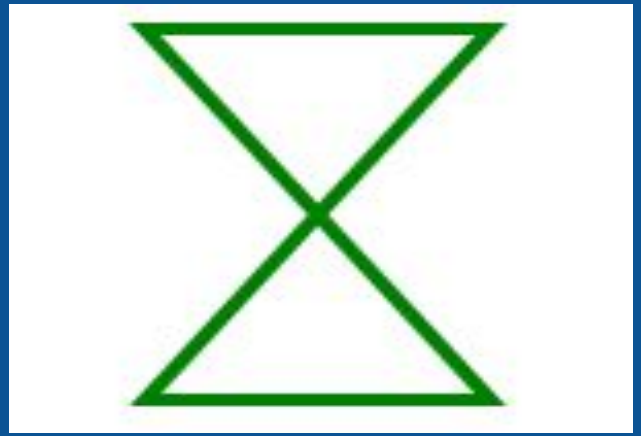
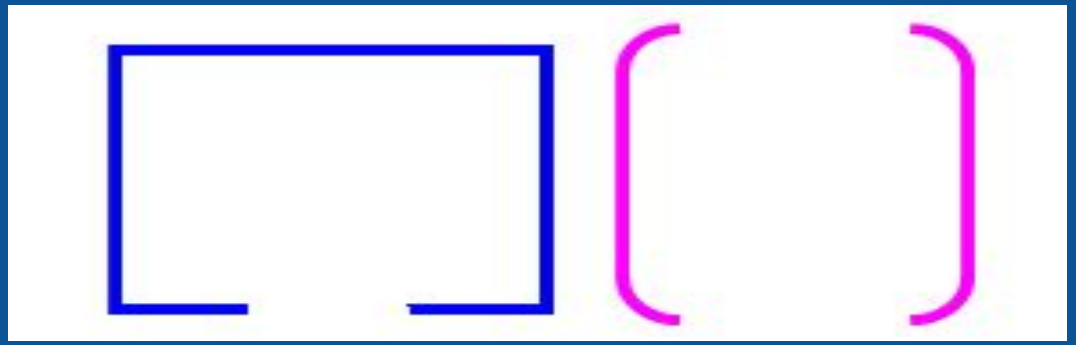
False





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Look at the triangles above. What's the same? What's different? Explain about their properties in your answer.

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Odd one out- is there more than one answer?

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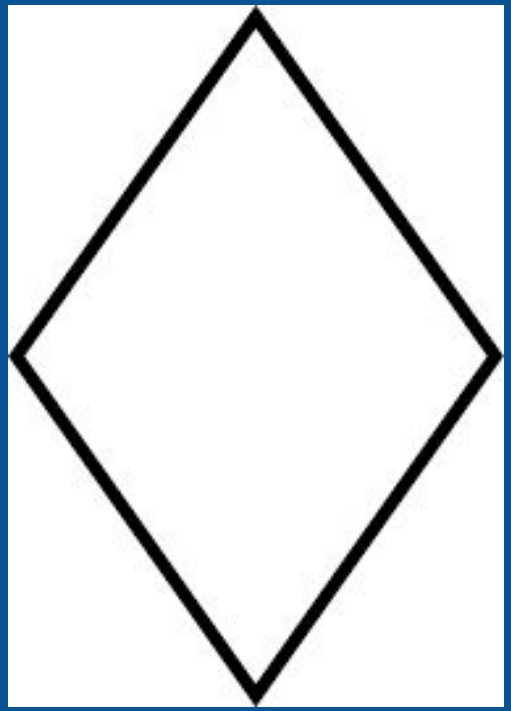

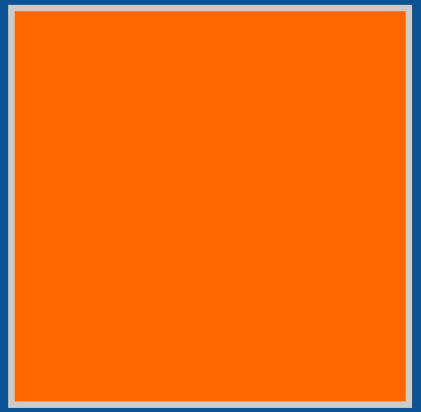

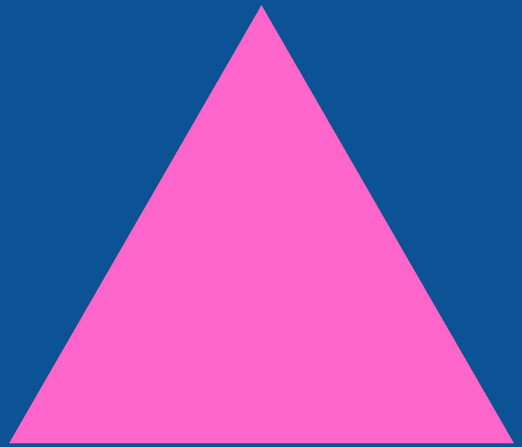

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Teach it - What it is

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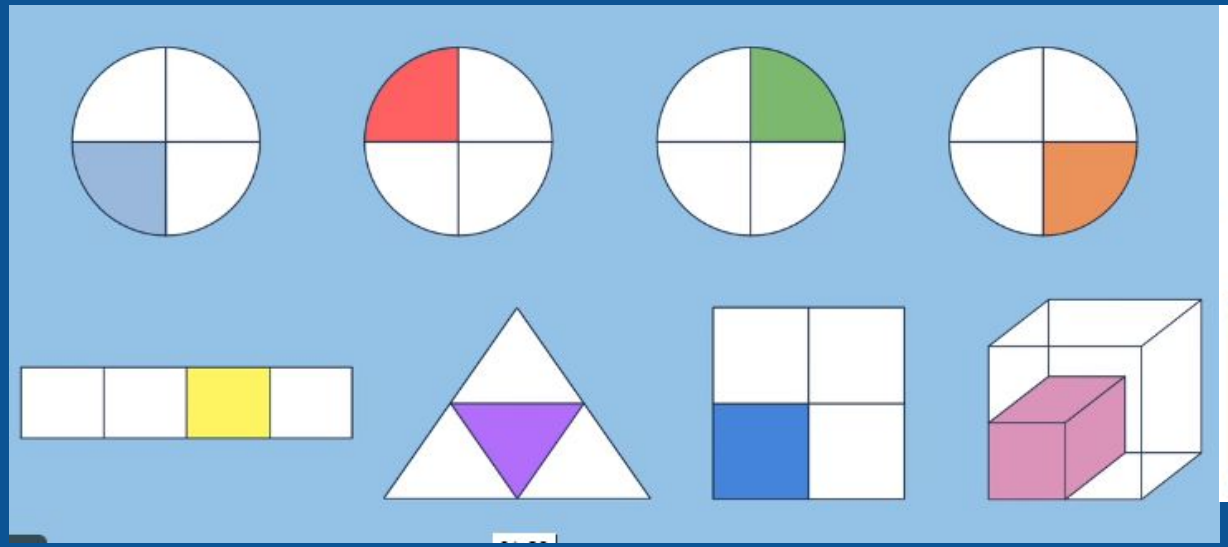
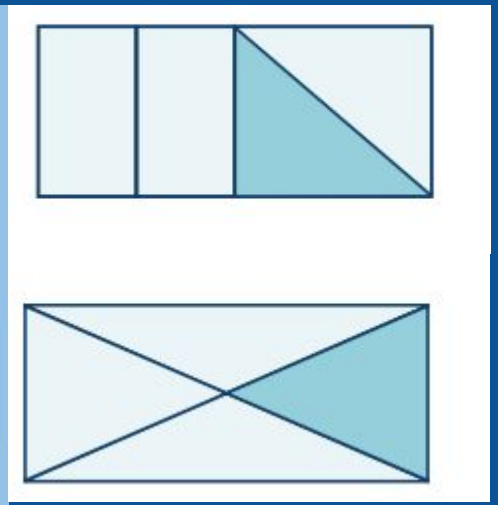
Which are standard examples? Which are non-standard? Why have they been chosen? Can you think of any other ways we could have represented ¼ ?





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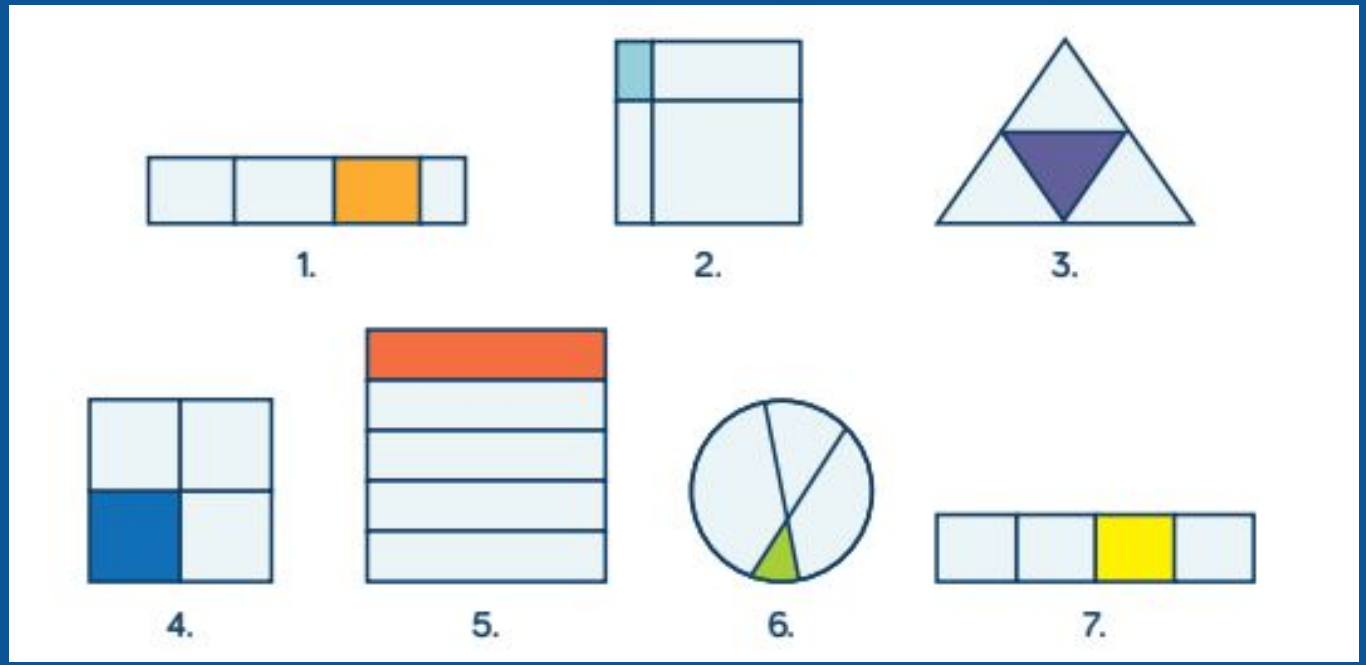
Teach it- What it is **not**

Which of these does NOT represent ¼ ? Why have these non-examples been chosen?



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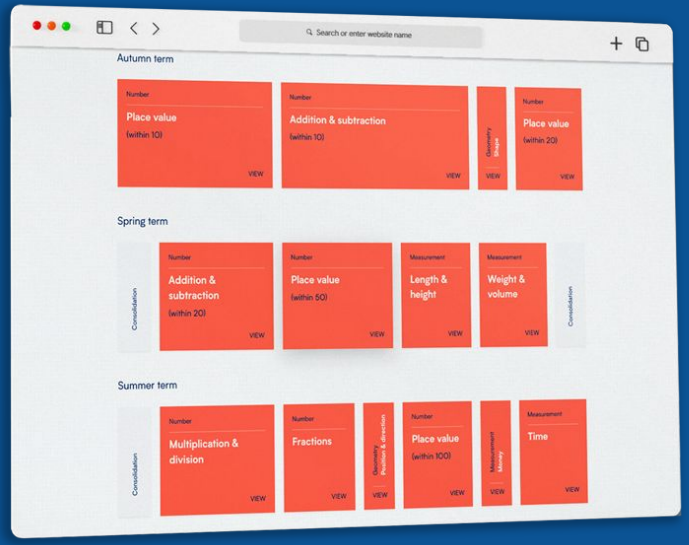
White Rose Scheme (Y1-6)

https://whiterosemaths.com/advice-and-guidance

- Blocks of learning divided into autumn, spring and summer terms.
- Knowledge divided into sequences of small steps
- Varied fluency, reasoning and problem solving tasks
- Premium resources including further practice and videos.
- End-of-block and termly assessments



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Example of White Rose scheme of learning

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Year 3 | Spring Term | Week 7 to 9 – Measurement: Length & Perimeter

Overview

Small Steps

- Measure length
- Measure length (m) R
- Equivalent lengths – m & cm
- Equivalent lengths – mm & cm
- Compare lengths R
- Compare lengths
- Add lengths
- Subtract lengths
- Measure perimeter
- Calculate perimeter

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Example of White Rose scheme of learning

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Mathematical Talk

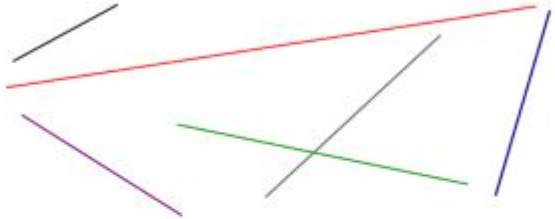
What would be the best equipment to measure ____ with? (e.g. tape measure, ruler, metre stick)

What do we have to remember when using a ruler to measure? Which unit of measurement are we going to use to measure? Centimetres or millimetres?

What unit of measure would be best to measure____ ?

Varied Fluency

Measure the lines to the nearest centimetre.
Can you measure the lines in millimetres?



What unit of measurement would you use to measure these real life objects? Millimetres, centimetres or metres?

Fingernail	Eraser	Pencil
Height of a house	Length of a playground	Length of a table

What is the length of each pencil?

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Example of White Rose scheme of learning

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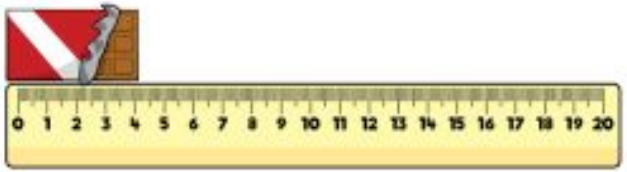
Whitney's ruler is broken.
How could she use it to still measure items?

Tommy thinks that this chocolate bar is 4 cm long.
Is he correct?



Convince me.

Three children measured the same toy car.

Eva says that the car is 6 cm and 5 mm

Dexter says the car is 5 cm

Annie says the car is 4 cm 5 mm

Who is correct?
Who is incorrect?
Explain why.

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Calculation Policies

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- Addition and subtraction
- Multiplication and division

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Calculation Policies- Addition

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Skill	Year	Representations and models	
Add two 1-digit numbers to 10	1	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
Add 1 and 2-digit numbers to 20	1	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead strings (20) Number tracks Number lines (labelled) Straws
Add three 1-digit numbers	2	Part-whole model Bar model	Ten frames (within 20) Number shapes
Add 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square

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Calculation Policies- Addition

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Skill	Year	Representations and models	
Add two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters Column addition
Add with up to 3-digits	3	Part-whole model Bar model	Base 10 Place value counters Column addition
Add with up to 4-digits	4	Part-whole model Bar model	Base 10 Place value counters Column addition
Add with more than 4 digits	5	Part-whole model Bar model	Place value counters Column addition
Add with up to 3 decimal places	5	Part-whole model Bar model	Place value counters Column addition

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Example of how the representations are used

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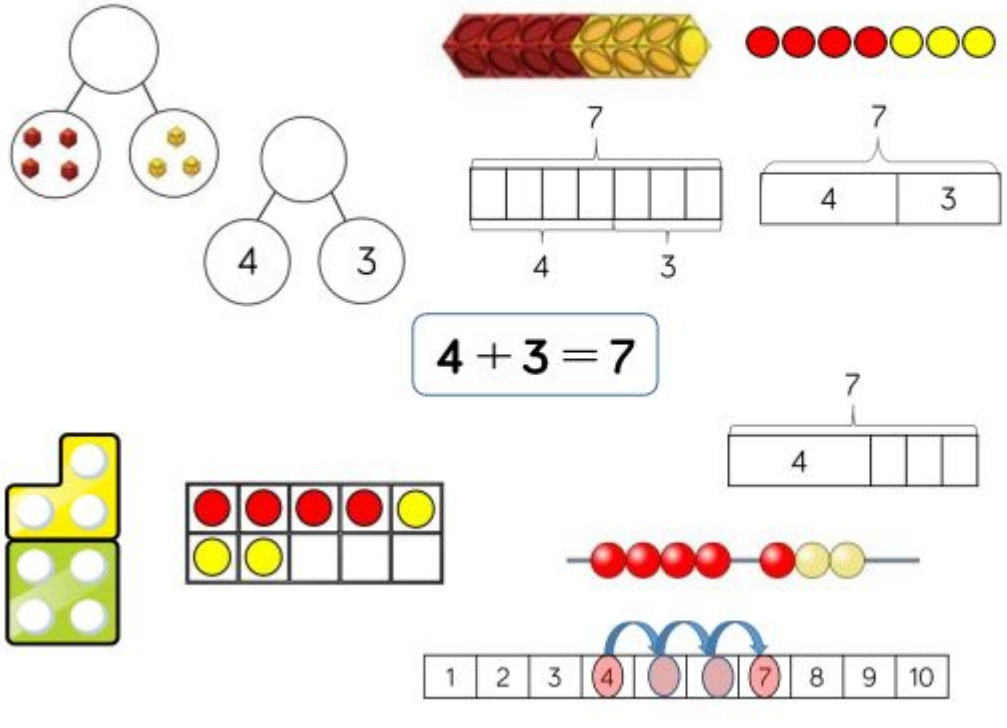
Skill: Add 1-digit numbers within 10	Year: 1
	When adding numbers to 10, children can explore both aggregation and augmentation. The part-whole model, discrete and continuous bar model, number shapes and ten frame support aggregation. The combination bar model, ten frame, bead string and number track all support augmentation.

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Calculation Policies- Subtraction

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Skill	Year	Representations and models	
Subtract two 1-digit numbers to 10	1	Part-whole model Bar model Number shapes	Ten frames (within 10) Bead strings (10) Number tracks
Subtract 1 and 2-digit numbers to 20	1	Part-whole model Bar model Number shapes Ten frames (within 20)	Bead string (20) Number tracks Number lines (labelled) Straws
Subtract 1 and 2-digit numbers to 100	2	Part-whole model Bar model Number lines (labelled)	Number lines (blank) Straws Hundred square
Subtract two 2-digit numbers	2	Part-whole model Bar model Number lines (blank) Straws	Base 10 Place value counters Column addition

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Calculation Policies- Subtraction

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Skill	Year	Representations and models	
Subtract with up to 3-digits	3	Part-whole model Bar model	Base 10 Place value counters Column addition
Subtract with up to 4-digits	4	Part-whole model Bar model	Base 10 Place value counters Column addition
Subtract with more than 4 digits	5	Part-whole model Bar model	Place value counters Column addition
Subtract with up to 3 decimal places	5	Part-whole model Bar model	Place value counters Column addition

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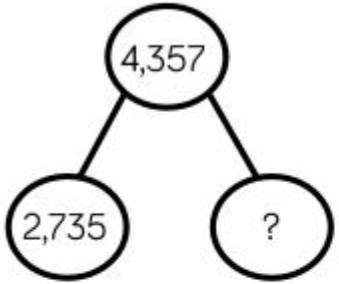
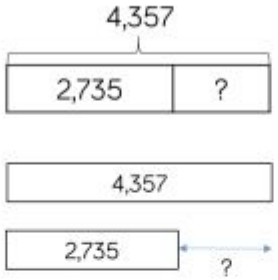
Example of how the representations are used

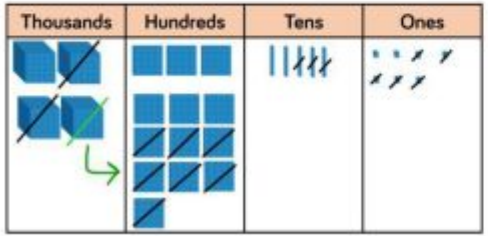
Skill: Subtract numbers with up to 4 digits	Year: 4

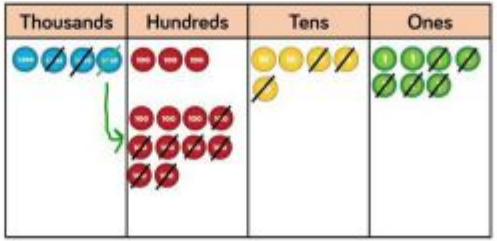




$$\begin{array}{r} {}^{3}\cancel{4}{}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$$

4,357 − 2,735 = 1,622





Base 10 and place value counters are the most effective manipulatives when subtracting numbers with up to 4 digits.

Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.

Plain counters on a place value grid can also be used to support learning.

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Glossary

Addend - A number to be added to another.

Aggregation - combining two or more quantities or measures to find a total.

Augmentation - increasing a quantity or measure by another quantity.

Commutative – numbers can be added in any order.

Complement – in addition, a number and its complement make a total e.g. 300 is the complement to 700 to make 1,000

Difference – the numerical difference between two numbers is found by comparing the quantity in each group.

Exchange – Change a number or expression for another of an equal value.

Minuend – A quantity or number from which another is subtracted.

Partitioning – Splitting a number into its component parts.

Reduction – Subtraction as take away.

Subitise – Instantly recognise the number of objects in a small group without needing to count.

Subtrahend - A number to be subtracted from another.

Sum - The result of an addition.

Total – The aggregate or the sum found by addition.

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Times Tables

Skill	Year	Representations and models	
Recall and use multiplication and division facts for the 2-times table	2	Bar model Number shapes Counters Money	Ten frames Bead strings Number lines Everyday objects
Recall and use multiplication and division facts for the 5-times table	2	Bar model Number shapes Counters Money	Ten frames Bead strings Number lines Everyday objects
Recall and use multiplication and division facts for the 10-times table	2	Hundred square Number shapes Counters Money	Ten frames Bead strings Number lines Base 10

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Times Tables

Skill	Year	Representations and models	
Recall and use multiplication and division facts for the 3-times table	3	Hundred square Number shapes Counters	Bead strings Number lines Everyday objects
Recall and use multiplication and division facts for the 4-times table	3	Hundred square Number shapes Counters	Bead strings Number lines Everyday objects
Recall and use multiplication and division facts for the 8-times table	3	Hundred square Number shapes	Bead strings Number tracks Everyday objects
Recall and use multiplication and division facts for the 6-times table	3	Hundred square Number shapes	Bead strings Number tracks Everyday objects

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Times Tables

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Skill	Year	Representations and models	
Recall and use multiplication and division facts for the 7-times table	4	Hundred square Number shapes	Bead strings Number lines
Recall and use multiplication and division facts for the 9-times table	4	Hundred square Number shapes	Bead strings Number lines
Recall and use multiplication and division facts for the 11-times table	4	Hundred square Base 10	Place value counters Number lines
Recall and use multiplication and division facts for the 12-times table	4	Hundred square Base 10	Place value counters Number lines

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Times Tables

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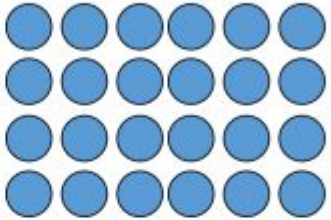
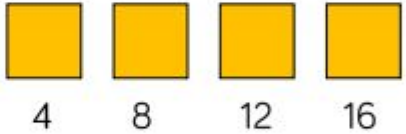
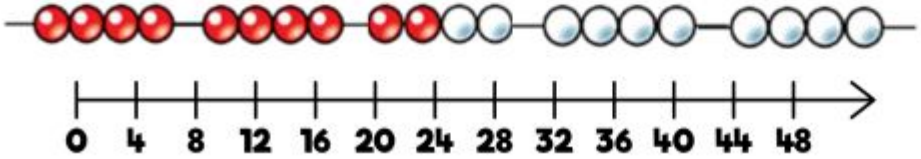
Skill: 4 times table	Year: 3



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50



4	8	12	16	20
24	28	32	36	40
44	48	52	56	60



Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the four times table, using manipulatives to support. Make links to the 2 times table, seeing how each multiple is double the twos. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

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Calculation Policy- Multiplication

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Skill	Year	Representations and models	
Solve one-step problems with multiplication	1/2	Bar model Number shapes Counters	Ten frames Bead strings Number lines
Multiply 2-digit by 1-digit numbers	3/4	Place value counters Base 10	Short written method Expanded written method
Multiply 3-digit by 1-digit numbers	4	Place value counters Base 10	Short written method
Multiply 4-digit by 1-digit numbers	5	Place value counters	Short written method

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Calculation Policy- Multiplication

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Skill	Year	Representations and models	
Multiply 2-digit by 2-digit numbers	5	Place value counters Base 10	Short written method Grid method
Multiply 2-digit by 3-digit numbers	5	Place value counters	Short written method Grid method
Multiply 2-digit by 4-digit numbers	5/6	Formal written method	

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Calculation Policy- Multiplication

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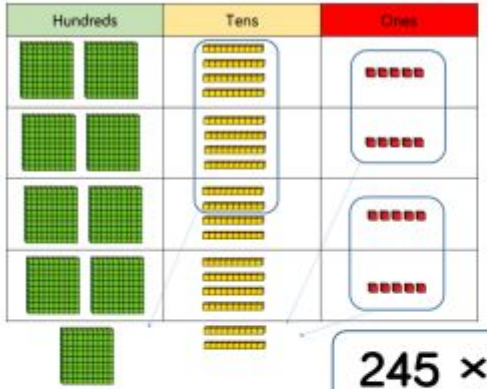
Skill: Multiply 3-digit numbers by 1-digit numbers	Year: 3/4



Year 4

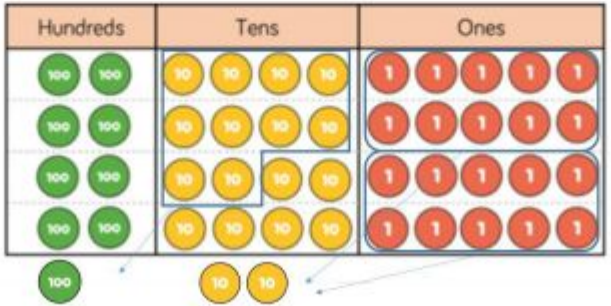
	H	T	O
	2	4	5
×			4
	9	8	0
	1	2	

$245 \times 4 = 980$

Year 3

x	200	40	5
4	800	160	20

800 + 160 + 20 = 980



When moving to 3-digit by 1-digit multiplication, encourage children to move towards the short, formal written method.
Base 10 and place value counters continue to support the understanding of the written method.
Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.

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Calculation Policy- Division

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Skill	Year	Representations and models	
Solve one-step problems with division (sharing)	1/2	Bar model Real life objects	Arrays Counters
Solve one-step problems with division (grouping)	1/2	Real life objects Number shapes Bead strings Ten frames	Number lines Arrays Counters
Divide 2-digits by 1-digit (no exchange sharing)	3	Straws Base 10 Bar model	Place value counters Part-whole model
Divide 2-digits by 1-digit (sharing with exchange)	3	Straws Base 10 Bar model	Place value counters Part-whole model

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Calculation Policy- Division

Skill	Year	Representations and models	
Divide 2-digits by 1-digit (sharing with remainders)	3/4	Straws Base 10 Bar model	Place value counters Part-whole model
Divide 2-digits by 1-digit (grouping)	4/5	Place value counters Counters	Place value grid Written short division
Divide 3-digits by 1-digit (sharing with exchange)	4	Base 10 Bar model	Place value counters Part-whole model
Divide 3-digits by 1-digit (grouping)	4/5	Place value counters Counters	Place value grid Written short division

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Calculation Policy- Division

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Skill	Year	Representations and models	
Divide 4-digits by 1-digit (grouping)	5	Place value counters Counters	Place value grid Written short division
Divide multi-digits by 2-digits (short division)	6	Written short division	List of multiples
Divide multi-digits by 2-digits (long division)	6	Written long division	List of multiples

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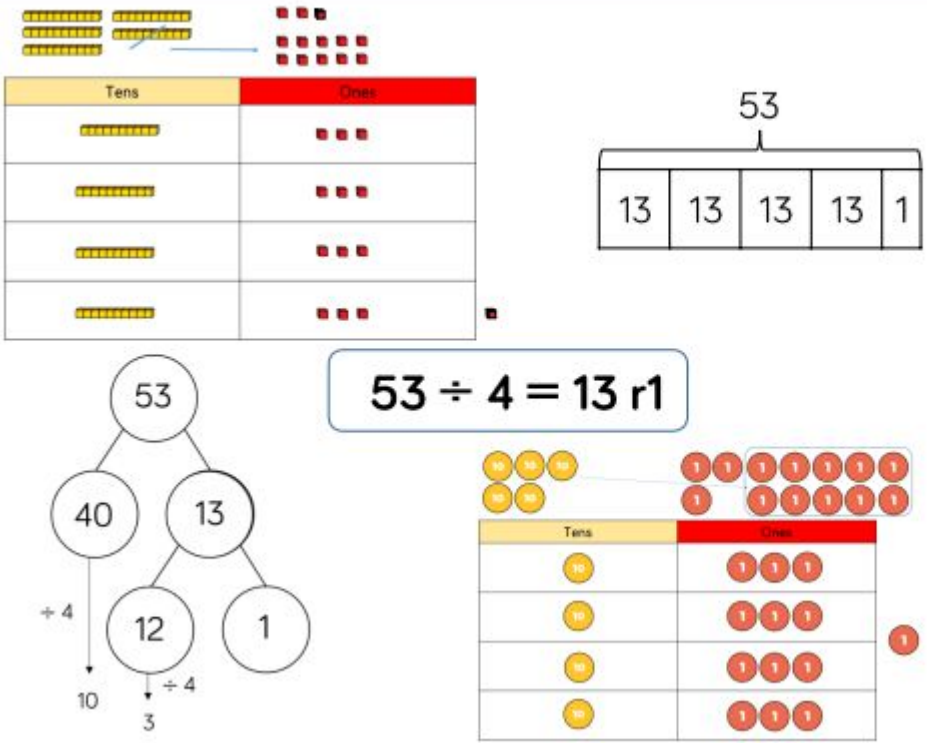
Skill: Divide 2-digits by 1-digit (sharing with remainders)	Year: 3/4
	When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones. Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made. Flexible partitioning in a part-whole model supports this method.

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Calculation Policy- Division

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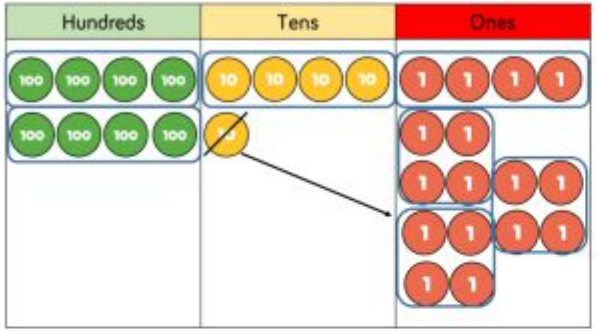
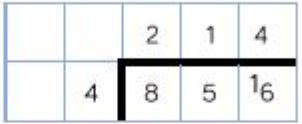
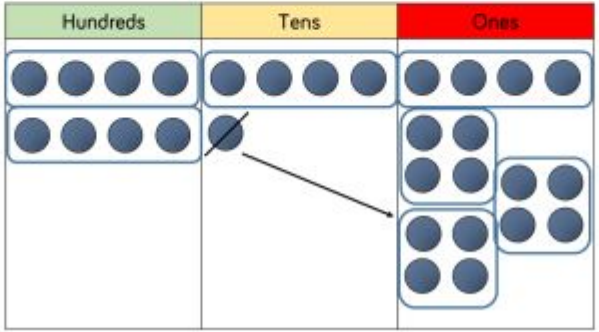
Skill: Divide 3-digits by 1-digit (grouping)	Year: 5
   856 ÷ 4 = 214	Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number. Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

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Glossary

Array – An ordered collection of counters, cubes or other item in rows and columns.

Commutative – Numbers can be multiplied in any order.

Dividend – In division, the number that is divided.

Divisor – In division, the number by which another is divided.

Exchange – Change a number or expression for another of an equal value.

Factor – A number that multiplies with another to make a product.

Multiplicand – In multiplication, a number to be multiplied by another.

Partitioning – Splitting a number into its component parts.

Product – The result of multiplying one number by another.

Quotient – The result of a division

Remainder – The amount left over after a division when the divisor is not a factor of the dividend.

Scaling – Enlarging or reducing a number by a given amount, called the scale factor

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What does daily maths look like?

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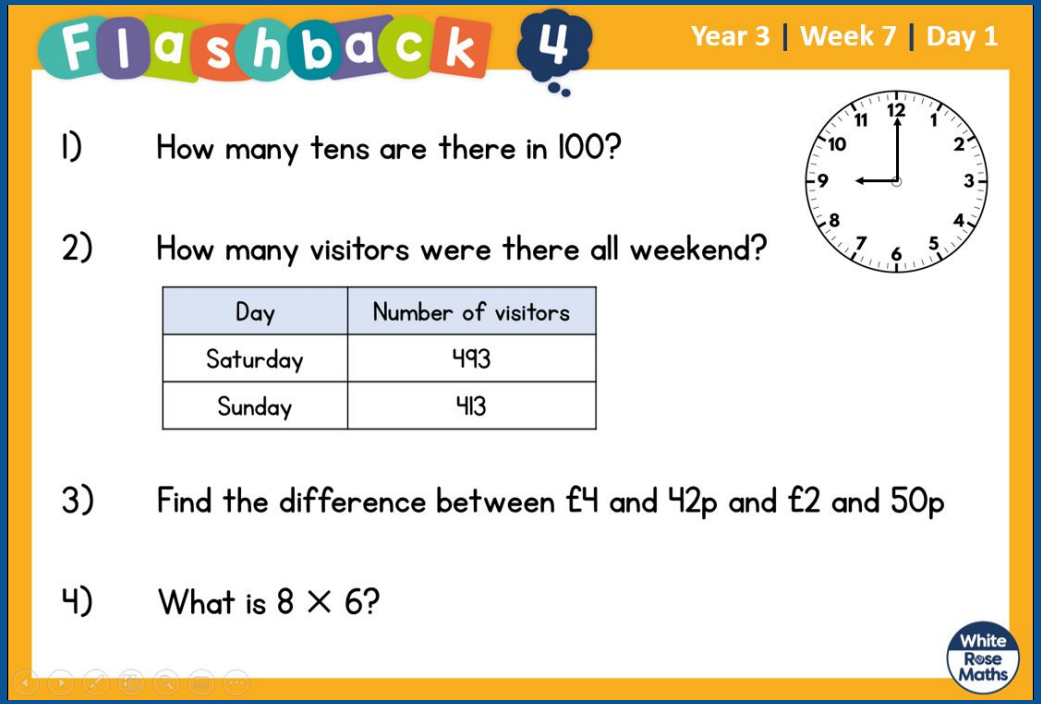
- Daily retrieval/prior learning practice
- Arithmetic practice (Year 2-6) /Mastering Number Programme (EYFS-Year 1)
- Maths lesson taught following small-step approach and a mixture of varied fluency, reasoning and problem solving.
- Targeted support/interventions e.g. pre-teach/post-teach as necessary



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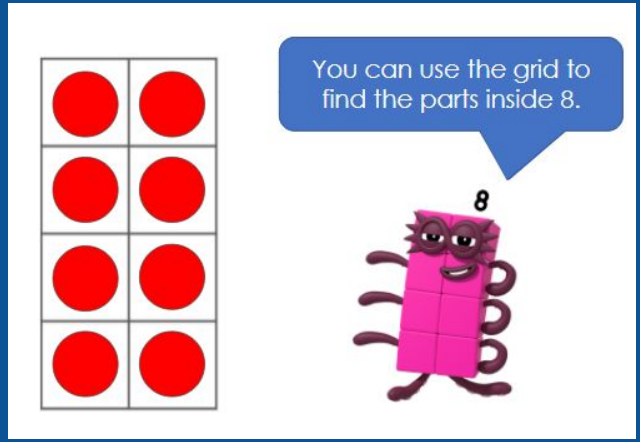
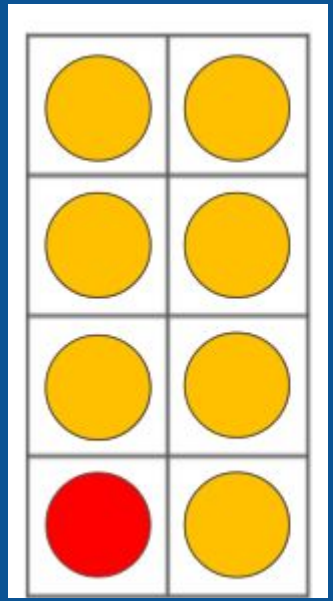
Mastering Number Programme

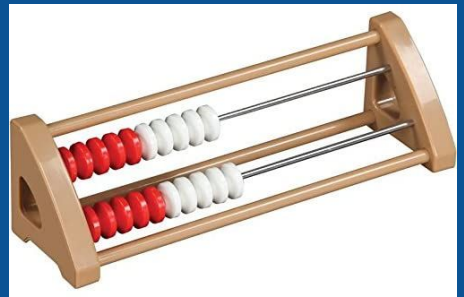
This project aims to secure firm foundations in the development of good number sense for all children from Reception through to Year 1 and Year 2.

Daily 10-15 minute session separate from normal maths lesson.

https://www.ncetm.org.uk/maths-hubs-projects/mastering-number/







8 is made of _____ and _____ ;
_____ and _____ make 8.

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Mixed-age classes

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Fractions	
Year 1	**Year 2**
• recognise, find and name a half as 1 of 2 equal parts of an object or shape	• recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a length, shape or set of objects
• recognise, find and name a quarter as 1 of 4 equal parts of an object or shape	
• recognise, find and name a half as 1 of 2 equal parts of a quantity	• recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a quantity
• recognise, find and name a quarter as 1 of 4 equal parts of a quantity	
	• write simple fractions, for example $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$

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Differentiation

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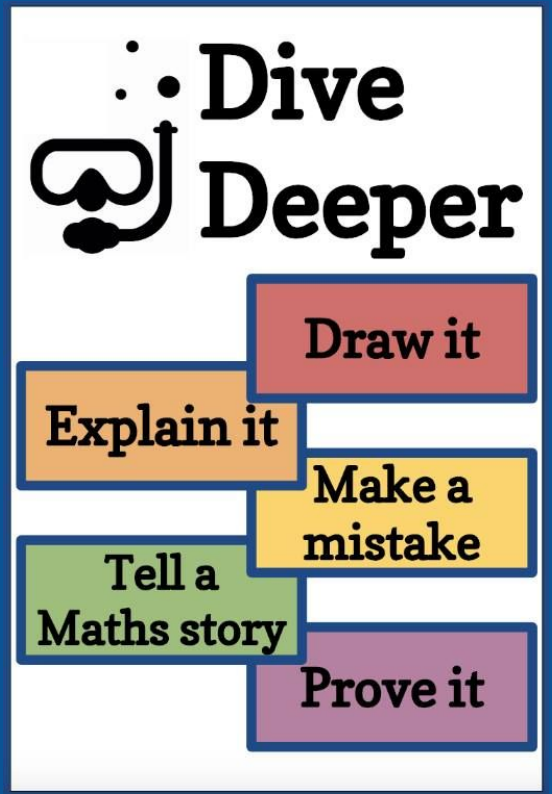
- Differing levels of scaffolding- modelled examples, adult supported, use of manipulatives, pre-teaching, post-teaching, mixed ability pairs etc.

- Challenge: higher order thinking questions e.g. prove it, justify, explain, represent question



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Differentiation

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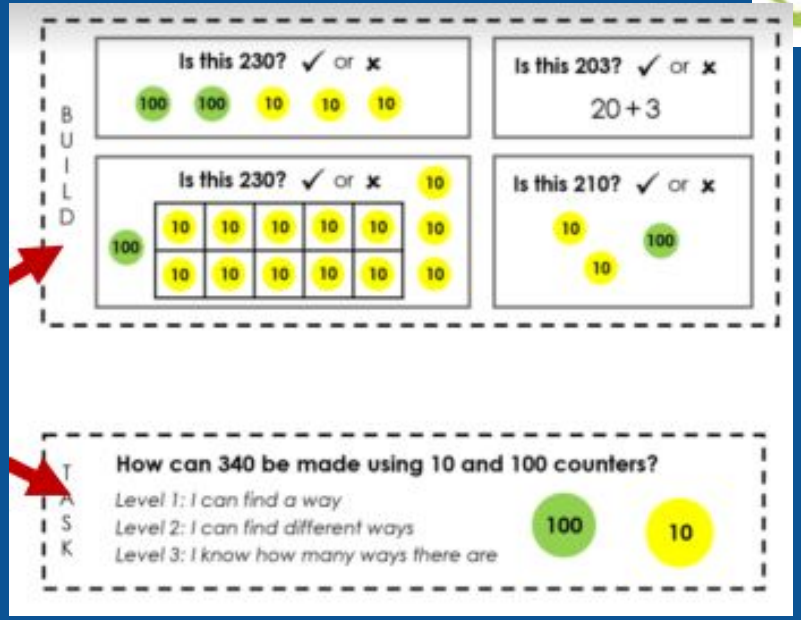
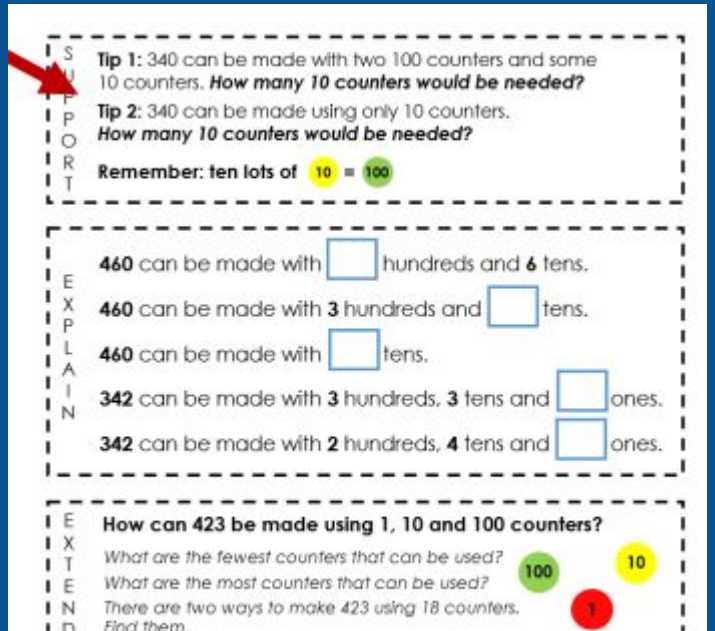
Tasks start with a Build prompt, which leads into the main Task question.





There are also Support, Explain and Extend prompts for most tasks – these provide additional support for the main task or extra challenge to take the learning deeper!

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To Summarise...

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MathsHUBS

Key Features of a mastery lesson

- Simple but deep
- Small focus
- Common misconceptions identified
- Conceptual variation – moving from one representation of the concept to another
- Procedural variation – how it can be tackled and represented
- Discussion – the answer is only the beginning
- Whole class teaching.
- Ping-Pong style – providing sufficient scaffold for all pupils to access
- Repetition and chorusing
- Precision in the use of mathematical language
- Carefully chosen examples and representations to draw out the essence of the concept (conceptual variation)
- Intelligent practice

National Centre for Excellence in the Teaching of Mathematics

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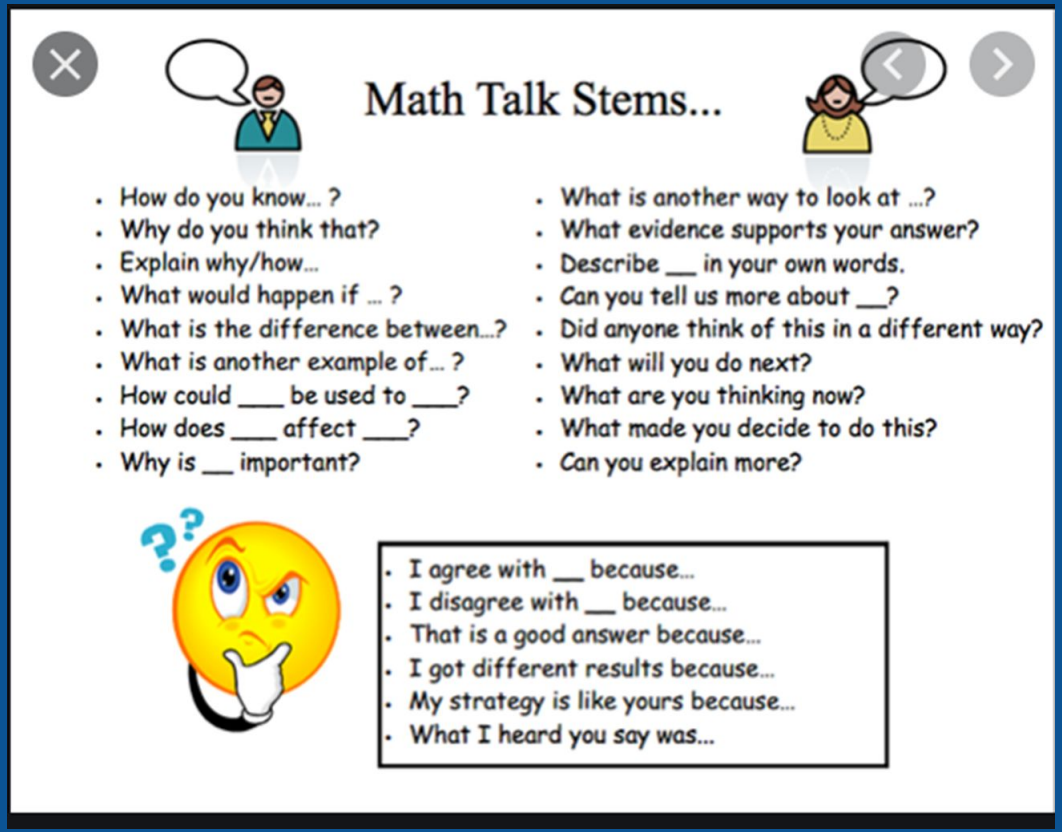
How can you help your child at home?

- Help with learning key number facts (number bonds, times tables etc.)
- Encourage daily practice of fluency/number facts
- Questioning rather than telling the answer- use talk stems to help discussion



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"When you are working with a child on maths it is important to be as enthusiastic as possible about maths. This is hard if you have had bad mathematical experiences, but it is very important. Parents, especially mothers of girls, should never, ever say I was useless at maths! Research tells us that this is a very damaging message, especially for young girls."

Jo Boaler

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Useful documents/resources:

- Our calculation policies
- -List of key resources
- -Mathsbot website- interactive manipulatives https://mathsbot.com/manipulativeMenu
- -White Rose maths app
- Hit the Button https://www.topmarks.co.uk/maths-games/hit-the-button
- Maths Shed https://www.mathshed.com/en-gb/
- White Rose Parent Support https://whiterosemaths.com/advice-and-guidance

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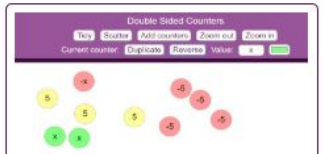
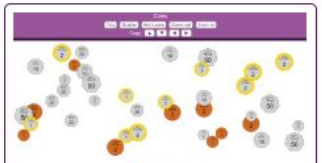
https://mathsbot.com/

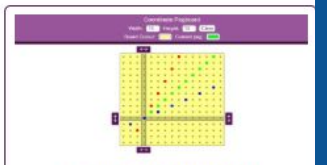
Manipulatives

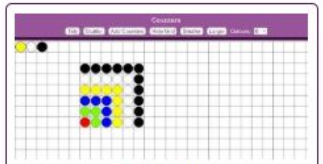

Algebra Discs

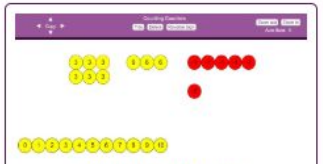

Algebra Tiles

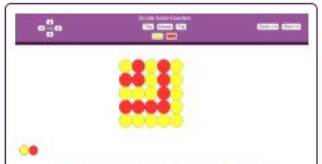

Bar Modelling

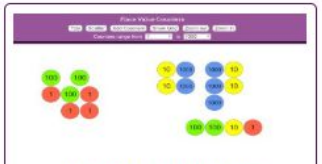

Coins


Coordinate Pegboard


Counters

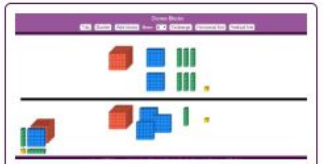

Counters - Directed

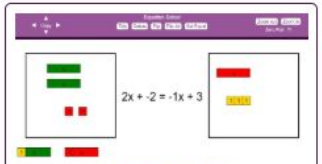

Counters - Double Sided


Counters - Place Value

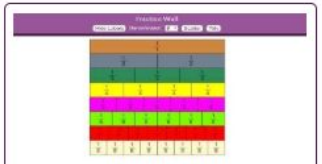

Counting Stick

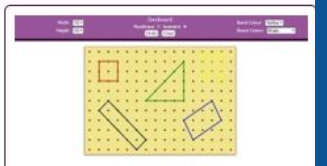

Cuisenaire Rods


Dienes Blocks



Equation Solver


Fraction Wall


Geoboard