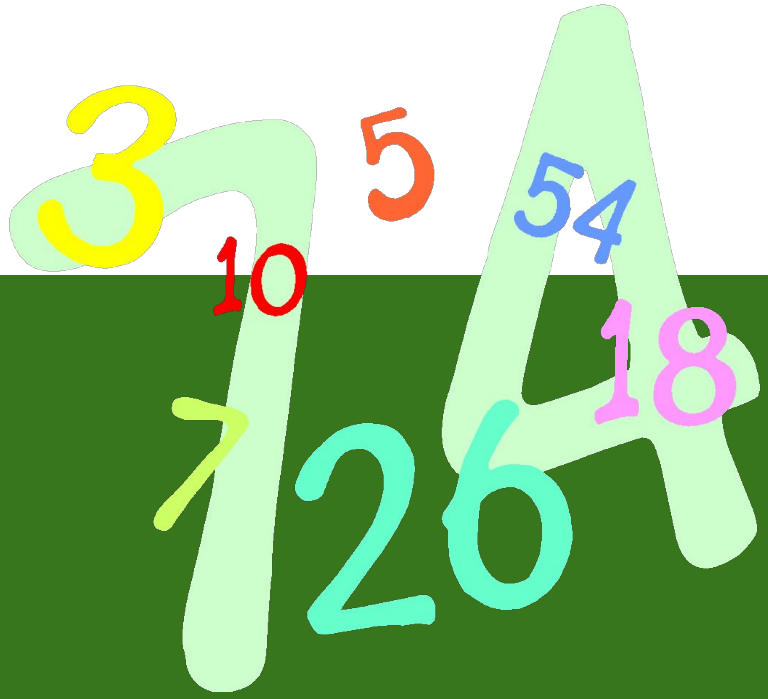
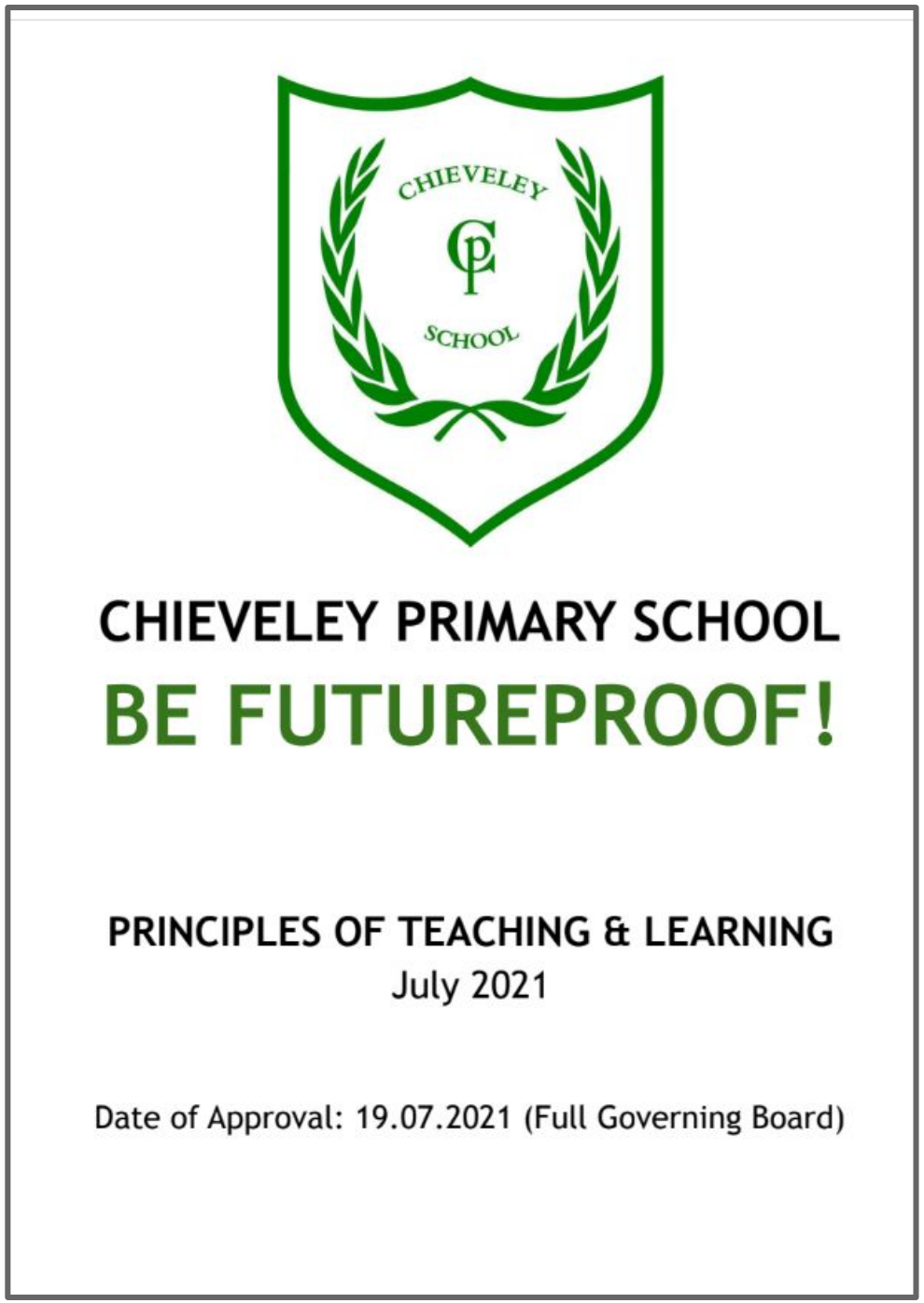
Maths Arithmetic: Addition and Subtraction



AIM OF THIS WORKSHOP

- Provide you with an understanding of the way we teach maths at Chieveley…

- so you can support your child at home.



CHIEVELEY PRIMARY SCHOOL

BE FUTUREPROOF!

PRINCIPLES OF TEACHING & LEARNING

July 2021

Date of Approval: 19.07.2021 (Full Governing Board)

Read the full document here!

What number is shown below?

SUBITIZING

Is the skill by which we easily recognise, for example, what number is represented by a dice.

This quick response, and having a strong, clear mental picture, underpins much of what we will talk about later!

AIMS OF THE NATIONAL CURRICULUM

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.

CURRICULUM COVERAGE

- FLUENCY – Being able to recall facts and solve calculations with speed. This also relates to solving simple word problems.

- REASONING – Being able to explain the steps in a process, how an answer was found, or explaining mistakes or misconceptions in a process.

- PROBLEM SOLVING – Children are able to solve complex problems that require recall of facts, reasoning, and logical thinking. Children are also required to think about representing questions in different ways to help solve a problem.

Our approach to maths uses the CPA method…

What is CPA ?

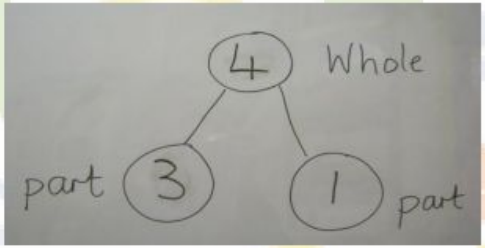
The CPA method involves using actual objects for children to add, subtract, multiply or divide. They then progress to using pictorial representations of the object, and ultimately, abstract symbols.

Children often find maths difficult because it is abstract. The CPA approach helps children learn new ideas and build on their existing knowledge by introducing abstract concepts in a more familiar and tangible way.

We believe that it gives children a deeper understanding of mathematics.

Concrete

Pictorial



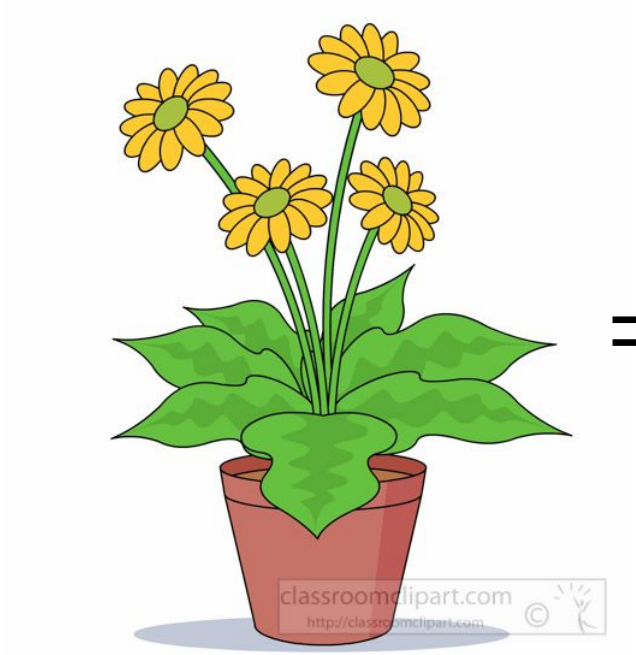
Abstract

3 + 1 = 4

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

BACK TO SUBITIZING…

=



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4

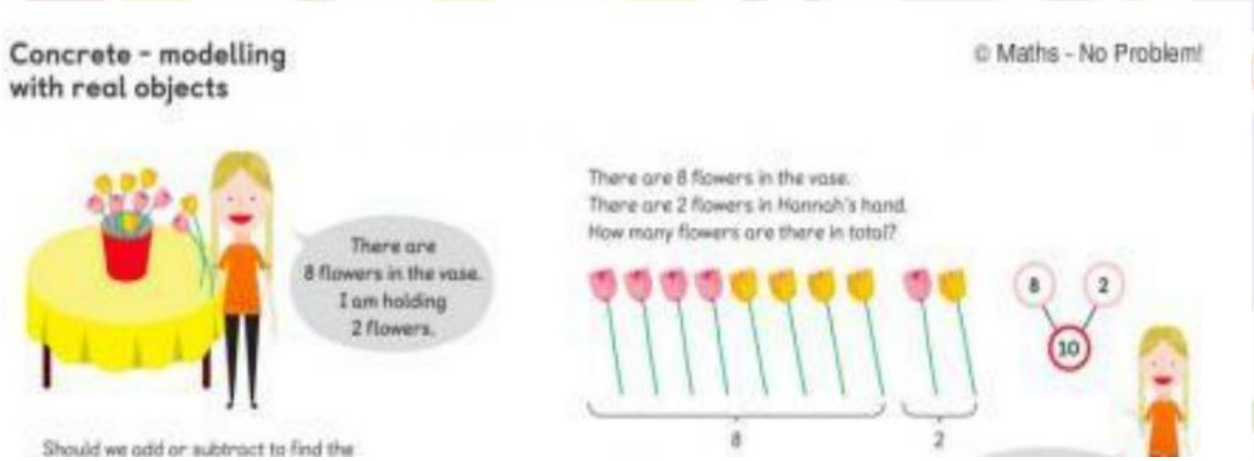
What is the CPA approach?

Concrete is the 'doing' stage, using concrete objects to solve problems. It brings concepts to life by allowing children to handle physical objects themselves. Every new abstract concept is learned first with a 'concrete' or physical experience.

For example:

There are 8 flowers in the vase. Hannah has 2 flowers in her hand. How many flowers are there altogether?

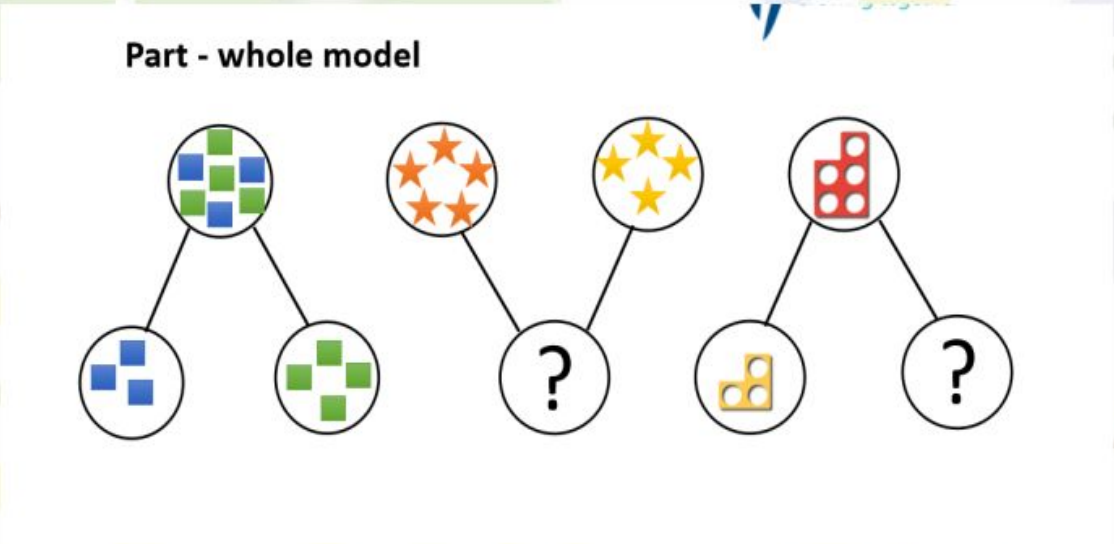
In this problem, the children might first handle actual flowers – the concrete stage – before progressing to handling counters or cubes (like Numicon) which are used to represent the flowers.



Concrete resources give time pupils to investigate a concept first - and then make connections when formal methods are introduced later on.
Teaching children to really think.

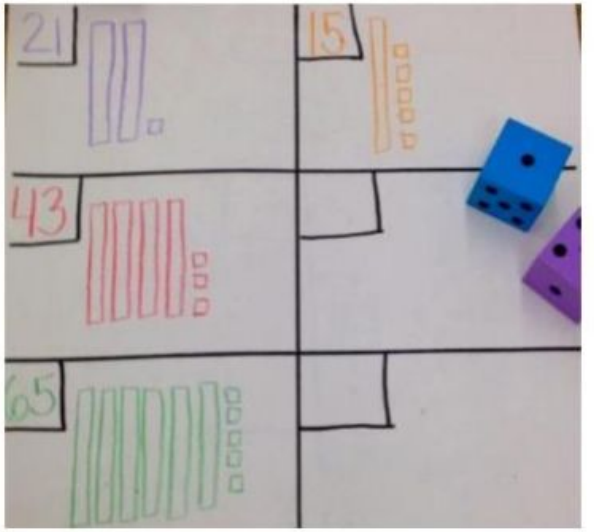
What is the CPA approach?

Pictorial is the 'seeing' stage, using representations of the objects involved in maths problems. This stage encourages children to make a mental connection between the physical object and abstract levels of understanding, by drawing or looking at pictures, circles, diagrams or models which represent the objects in the problem.

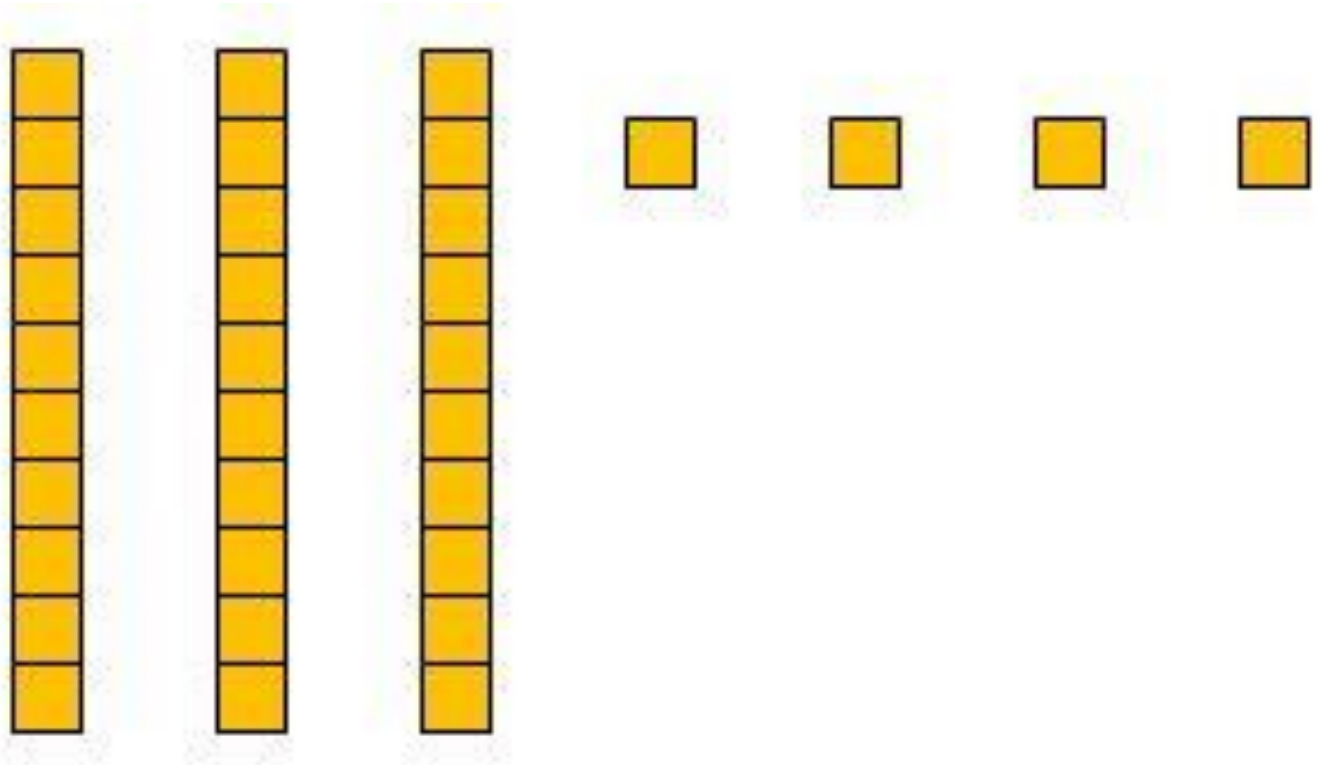


Building or drawing a model makes it easier for children to grasp concepts they traditionally find more difficult, such as fractions, as it helps them visualise the problem and make it more accessible.

The pictorial stage would involve using drawings of flowers, or pictures of objects such as multi-link blocks or counters, to represent the actual object.

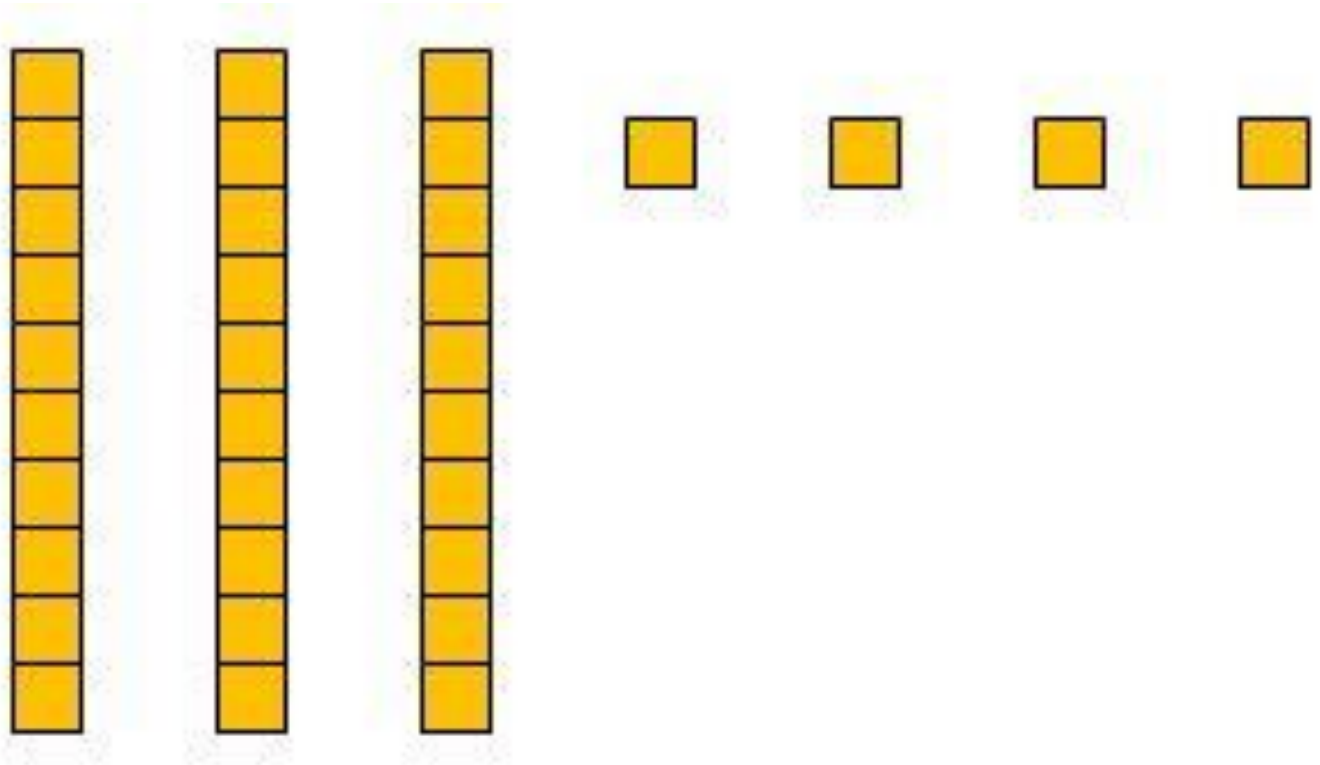


SO…WHAT NUMBER IS THIS?



Back to subitizing again – if we say ‘34’, this is what

BACK TO SUBITIZING (AGAIN)

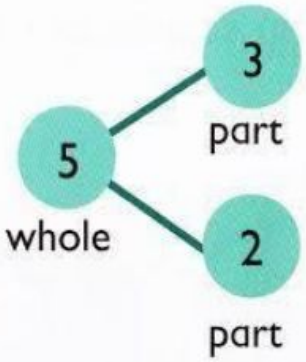


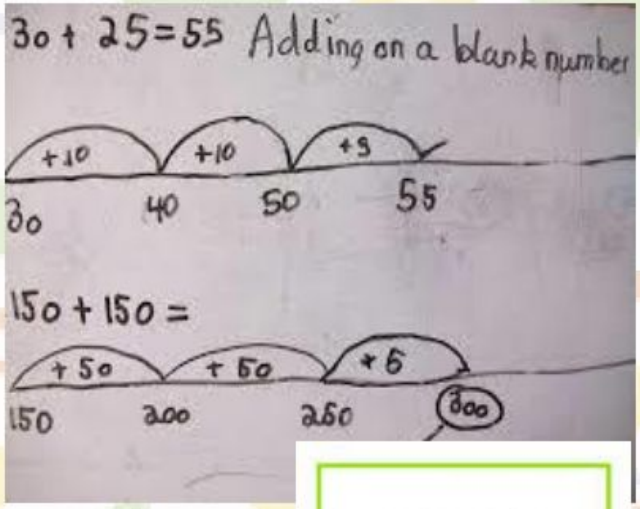
If we say ‘34’, this is what <u>we want children to visualise!</u>

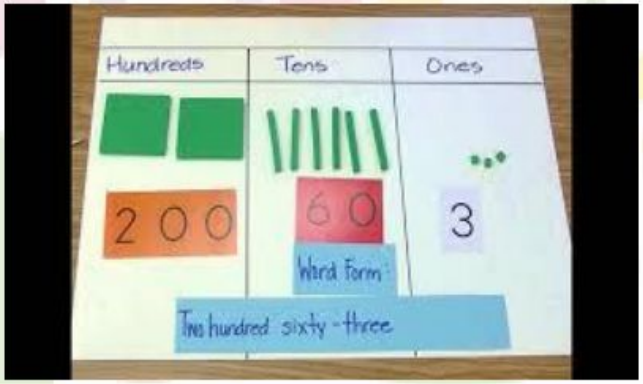
HOW DOES THIS FIT WITH ADDITION?

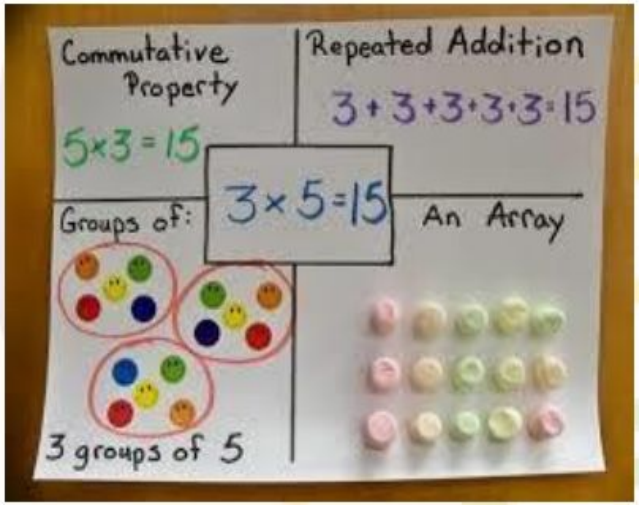
33 + 25 = ____

Further Pictorial Representations









WHAT IS THE A IN CPA?

Abstract

The formal written method (what you would traditionally expect maths to look like).

This is the third stage of the process. The children can use the concrete and pictorial methods alongside the abstract to help them feel more confident.

Traditionally children would be taught to use abstract methods before having a solid foundation and therefore they didn't truly understand the maths - they just followed a process.

ABSTRACT IS THE 'SYMBOLIC' STAGE

Once a child has demonstrated that they have a solid understanding of the 'concrete' and 'pictorial' representations of the problem, the teacher can introduce the more 'abstract' concept, such as mathematical symbols, or even the written numerals.

Children are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols,

+ – x /

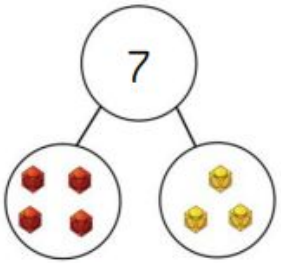
Jim has 12 cookies. Julie has 8 cookies. How many do they have altogether?
Children at the abstract stage would be able to solve the problem by writing it out as 12 + 8 = 20.

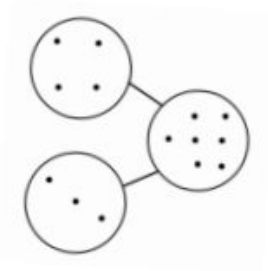
WHAT SYSTEMS AND RESOURCES DO WE USE?

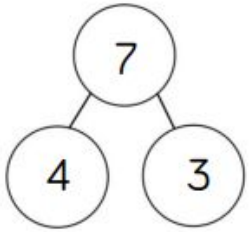
WRM forms the 'skeleton' of our curriculum, although we use MTC where we feel it better meets the needs of children. They both fully embed the CPA approach.

However, our teachers are expected not to 'blindly' follow a scheme of work and re-shape lessons and tasks to ensure challenge for all children in lessons. Therefore we also use resources from these sites in the classroom too, provided they meet the needs of your children and align with the CPA approach.

Part-Whole Model

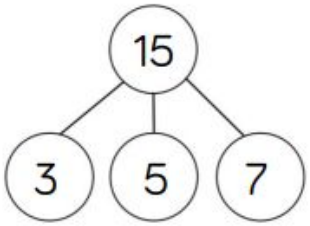


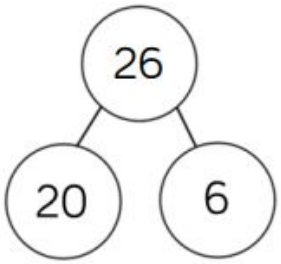


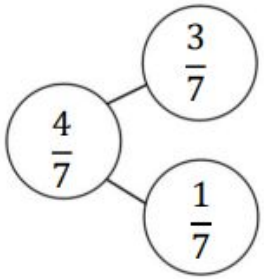


$7 = 4 + 3$ $\quad$ $7 - 3 = 4$

$7 = 3 + 4$ $\quad$ $7 - 4 = 3$



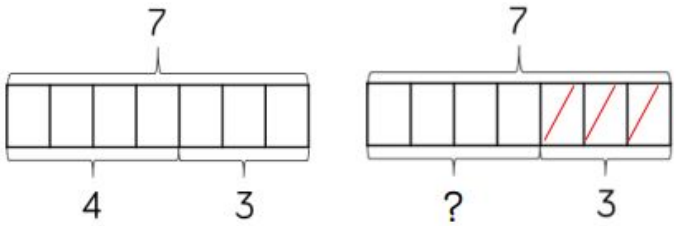




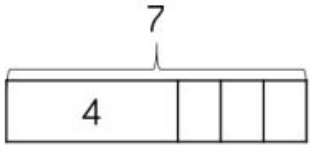
Bar Model (single)

Concrete

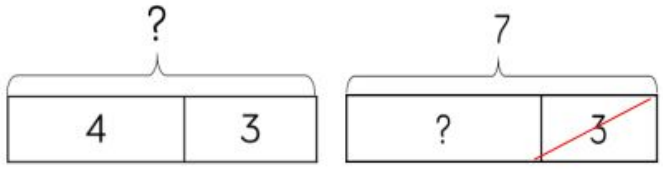
Discrete

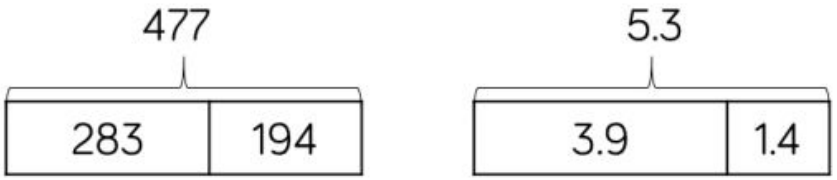


Combination



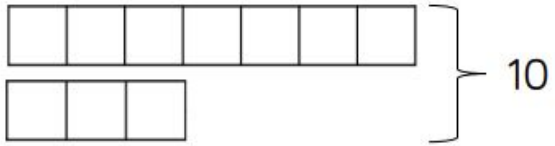
Continuous





Bar Model (multiple)

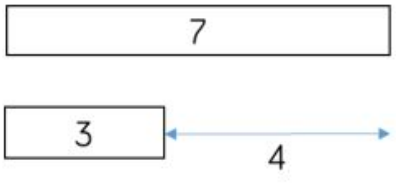
Discrete



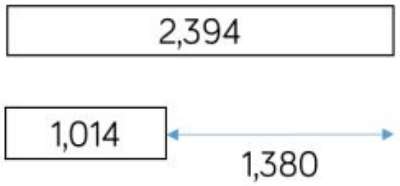
$7 + 3 = 10$

$7 - 3 = 4$

Continuous



$7 - 3 = 4$

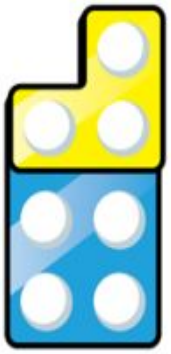


$2{,}394 - 1{,}014 = 1{,}380$

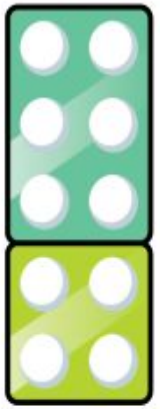
Number Shapes

$7 = 4 + 3$

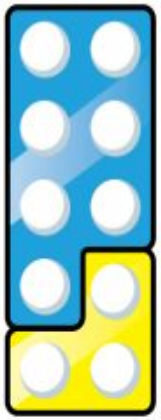
$7 = 3 + 4$



$7 - 3 = 4$



6+4

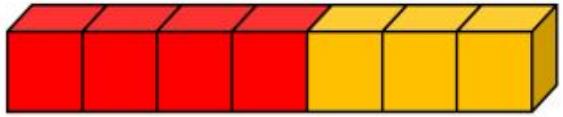


7+3

8+2

9+1

Cubes



$7 = 4 + 3$

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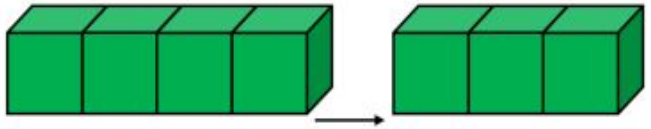
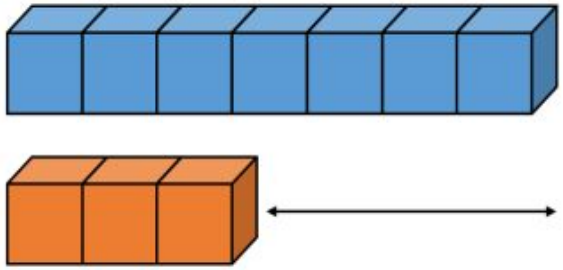
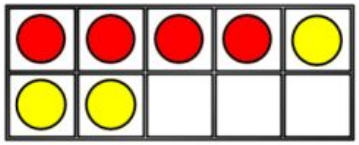


$7 - 3 = 4$



$7 - 3 = 4$

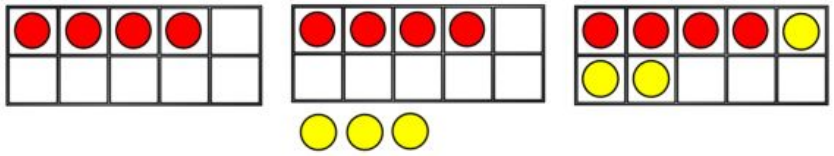
Ten Frames (within 10)



$4 + 3 = 7$
$3 + 4 = 7$
$7 - 3 = 4$
$7 - 4 = 3$

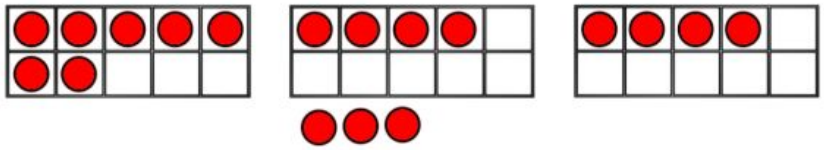
4 is a part.
3 is a part.
7 is the whole.

First Then Now



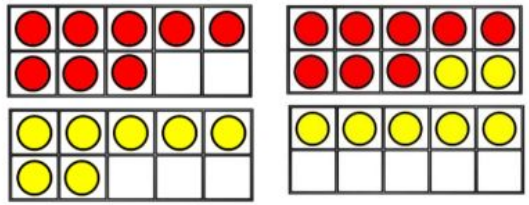
$4 + 3 = 7$

First Then Now



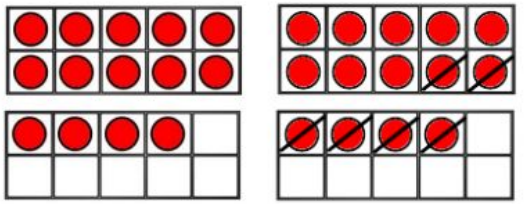
$7 - 3 = 4$

Ten Frames (within 20)



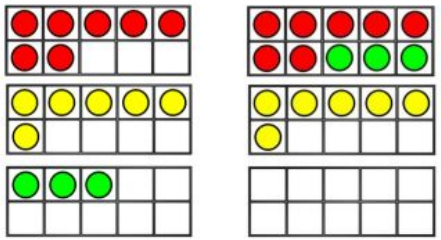
$8 + 7 = 15$

2 5



$14 - 6 = 8$

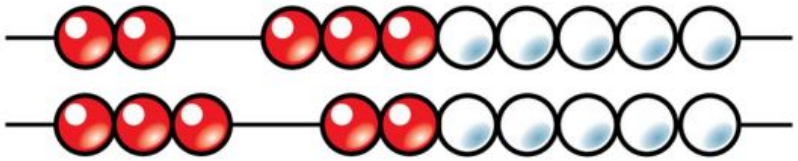
4 2

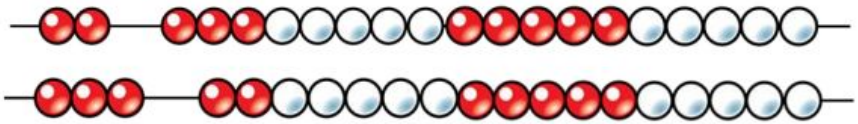


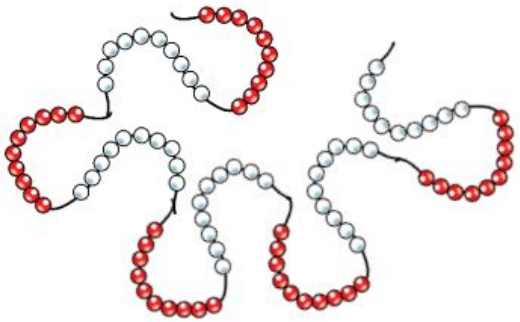
$7 + 6 + 3 = 16$

10

Bead Strings

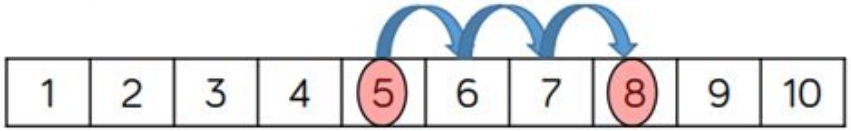




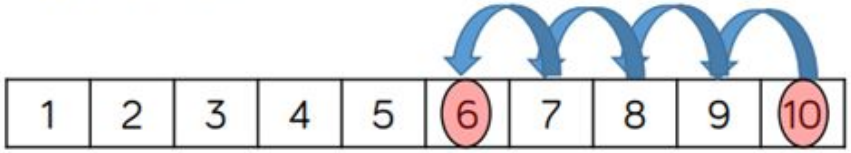


Number Tracks

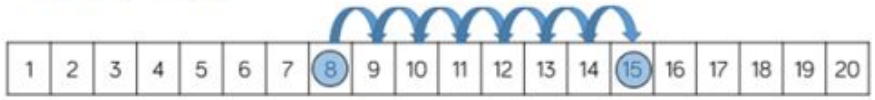
5 + 3 = 8



10 − 4 = 6

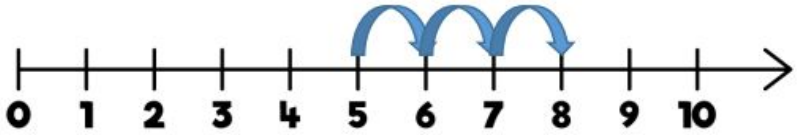


8 + 7 = 15



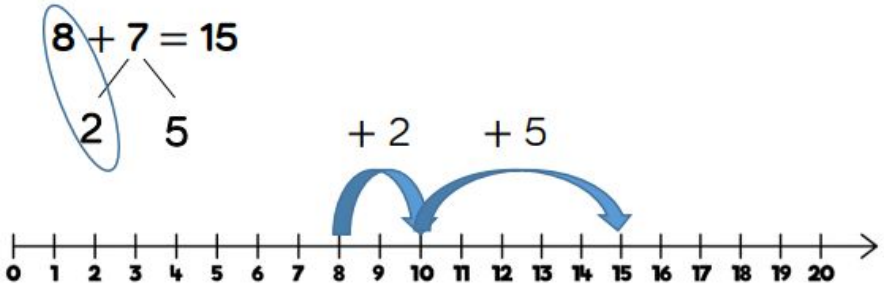
Number Lines (labelled)

$5 + 3 = 8$



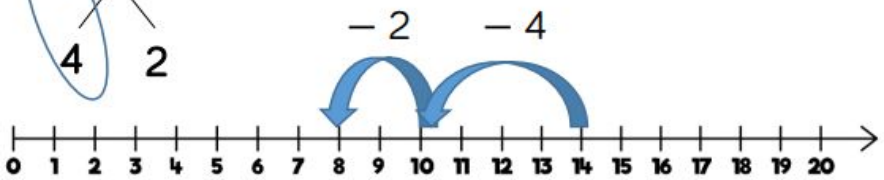
$8 + 7 = 15$

2 5



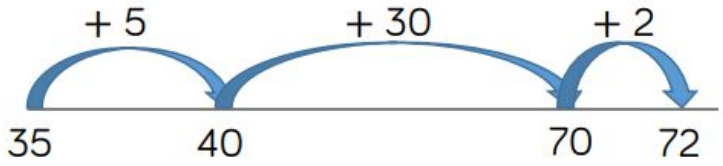
$14 - 6 = 8$

4 2

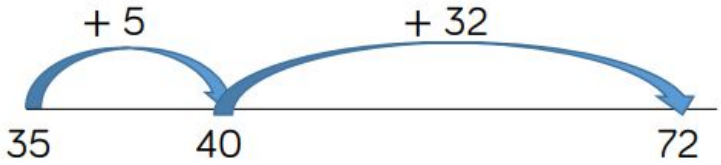


Number Lines (blank)

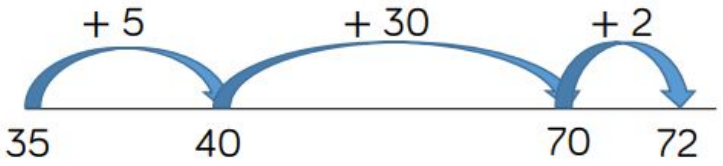
$35 + 37 = 72$



$35 + 37 = 72$

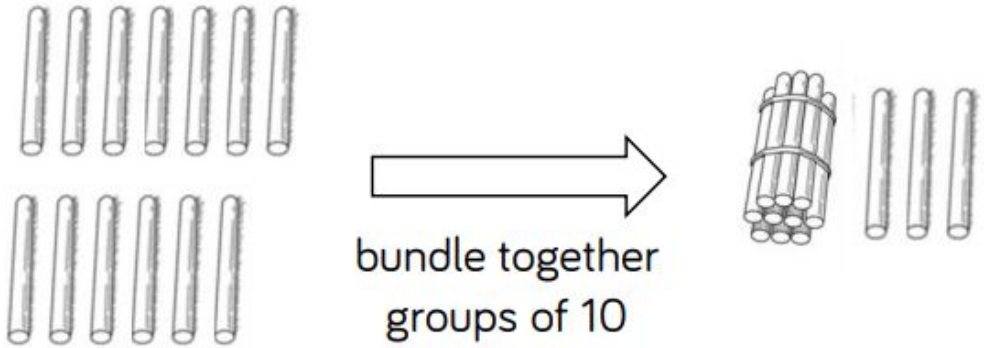


$72 - 35 = 37$

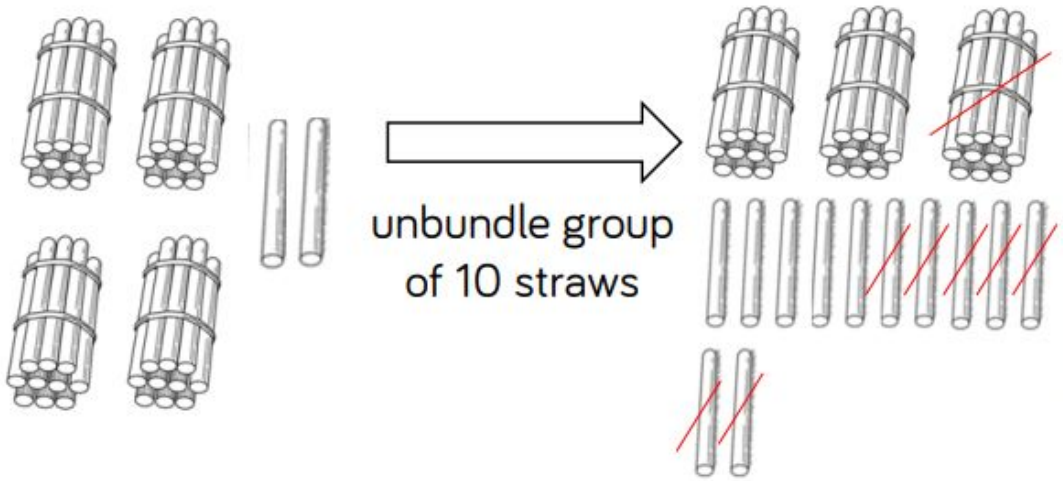


Straws

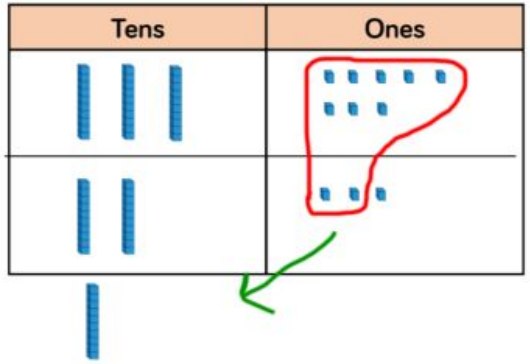
7 + 6 = 13



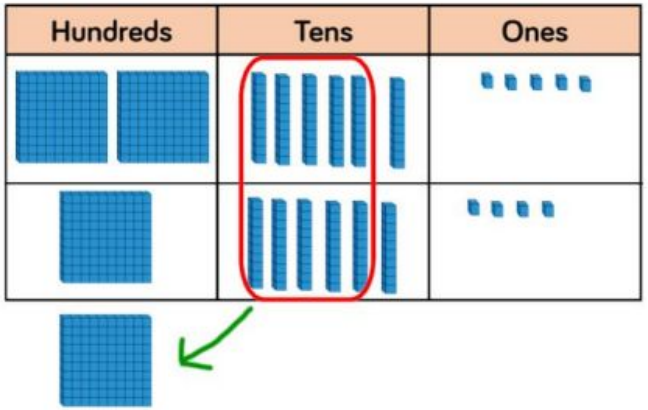
42 − 17 = 25



Base 10/Dienes (addition)

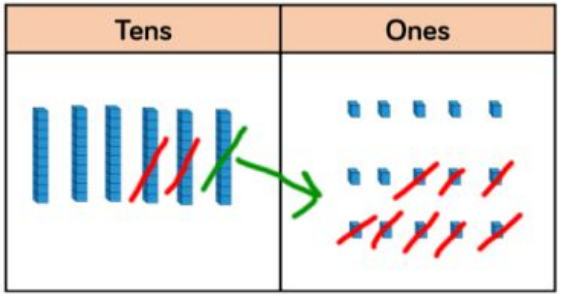


$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

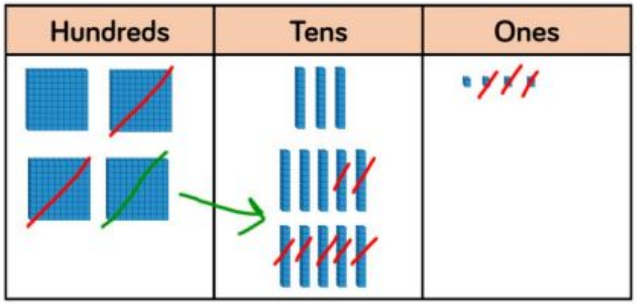


$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

Base 10/Dienes (subtraction)

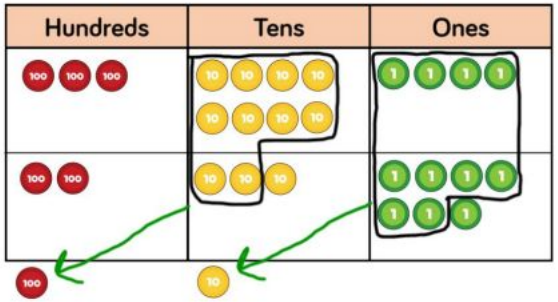


$$\begin{array}{r} {}^{5}\not{6}\,{}^{1}\not{5} \\ -\ 28 \\ \hline 37 \end{array}$$

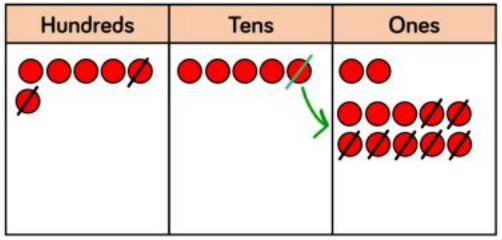


$$\begin{array}{r} {}^{3}\not{4}\,{}^{1}\not{3}\not{5} \\ -\ 273 \\ \hline 262 \end{array}$$

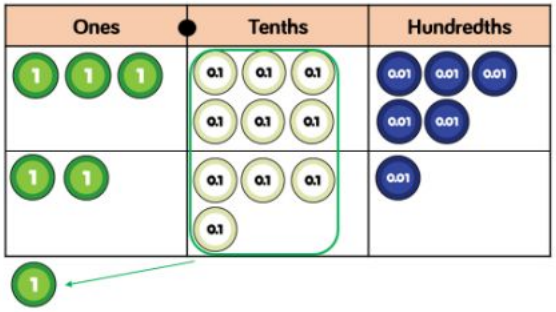
Using place value counters for addition and subtraction



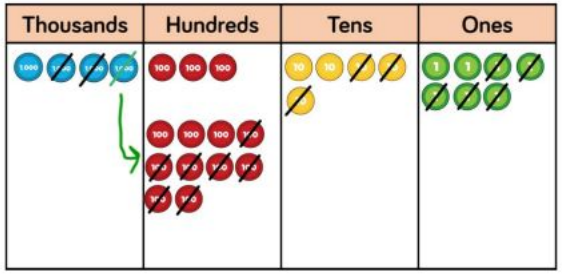
$$\begin{array}{r} 384 \\ +\ 237 \\ \hline 621 \\ \hline 1\ \ 1 \end{array}$$



$$\begin{array}{r} {}^{4}6\not{5}^{1}\not{2} \\ -\ 207 \\ \hline 445 \\ \hline \end{array}$$



$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$



$$\begin{array}{r} {}^{3}\not{4}^{1}357 \\ -\ 2735 \\ \hline 1622 \\ \hline \end{array}$$

THE END-OF-RECEPTION TARGETS (EARLY LEARNING GOALS) IN MATHS

Number ELG

Children at the expected level of development will:

- Have a deep understanding of number to 10, including the composition of each number;
- Subitise (recognise quantities without counting) up to 5;
- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

Numerical Patterns ELG

Children at the expected level of development will:

- Verbally count beyond 20, recognising the pattern of the counting system;
- Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity;

- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.

A ROUGH GUIDE TO ADDITION EXPECTATIONS EACH YEAR

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

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
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

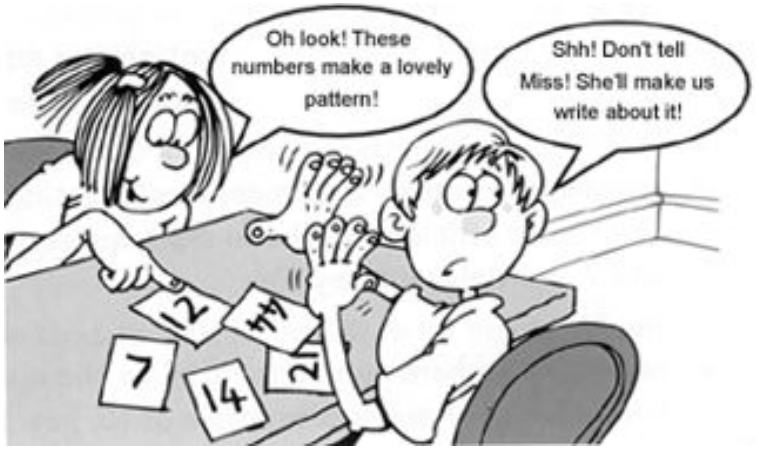
A ROUGH GUIDE TO SUBTRACTION EXPECTATIONS EACH YEAR

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

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

REMEMBER WHAT IS IMPORTANT IN MATHS

- Use maths in a **real life context.**
- Ask children to **explain** how they have calculated something using a method that suits them.
- Use concrete resources when possible and encourage them to draw pictures to help! This helps them to 'visualise' when they…
- …focus on **mental calculations.**
- Support children with **formal methods**, but only when they are ready.



ANY QUESTIONS?