



Hilderthorpe
PRIMARY SCHOOL

Aiming High - Reaching Higher

Calculation Policy

2021 - 2022



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Introduction

This calculation policy sets progression of learning in calculations across the school, taking into account Maths No Problem! - A Singaporean teaching style in Maths.

The Calculation Policy shows methods that pupils will be taught within their respective year group. It is shown in teaching order. Children should be confident in choosing and using a strategy that they know will get them to the correct answer as efficiently as possible; pupils are free to choose their preferred method to solve calculations.

Concrete, Pictorial, Abstract: A key principle is the methods used to help our pupils with calculations and has been devised to meet requirements of the National Curriculum for the teaching and learning of mathematics. It is also designed to give pupils a consistent and smooth transition between year groups.

The key pedagogy behind the Singapore Maths textbooks and Maths Mastery is based on the concrete, visual and abstract approach. Pupils are first introduced to an idea or skill by acting it out with real objects (a hands-on approach). Pupils then are moved onto the pictorial stage, where pupils are encouraged to relate the concrete understanding to pictorial representations. The final abstract stage is a chance for pupils to represent problems by using mathematical concepts. Whilst this calculation policy aims to show the CPA approach to the different calculations, it is not always noted further up the year groups. However, it is expected that the CPA approach is used continuously in all new learning and calculations even when not noted.

EYFS

Children in EYFS will learn using the White Rose scheme of learning which underpins the new Educational Programme for Mathematics (DFE July 2020) and will support teachers to deliver a curriculum that embeds mathematical thinking and talk. It allows for key mathematical concepts to be revisited and developed further across the year.

Problem Solving

Where possible, concepts should be taught in the context of real life. Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross-curricular links) to deepen their understanding.

Main Principles

What is maths mastery?

Teaching maths for mastery is a transformational approach to maths teaching which stems from high performing Asian nations such as Singapore. When taught to master maths, children develop their mathematical fluency without resorting to rote learning and are able to solve non-routine maths problems without having to memorise procedures.

Concrete, pictorial, abstract (CPA)

Concrete, pictorial, abstract (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of maths. Developed by American psychologist, Jerome Bruner, the CPA approach is essential to maths teaching in Singapore.

Number bonds

Number bonds are a way of showing how numbers can be combined or partitioned. They are used to reflect the 'part-part-whole' relationship of numbers.

Bar modelling

The bar model method is a strategy used by children to visualise mathematical concepts and solve problems. The method is a way to represent a situation in a word problem, usually using rectangles.

Fractions

In Singapore, the understanding of fractions is rooted in the Concrete, pictorial, abstract (CPA) model, where children use paper squares and strips to learn the link between the concrete and the abstract. At the heart of understanding fractions is the ability to understand that we're giving an equal part a name.

EYFS

In EYFS, pupils should be developing their concept of the number system through the use of **concrete materials and pictorial representations**. They should experience practical calculation opportunities using a wide variety of equipment, e.g. small world play, role play, counters, cubes etc. They develop ways of recording calculations using pictures, etc.

EYFS: Addition: Add two single digit numbers, counting on to find the answer.

add, more, make, sum, total, altogether, one more, ten more

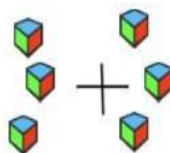
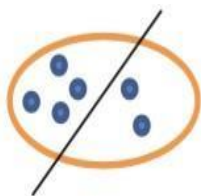
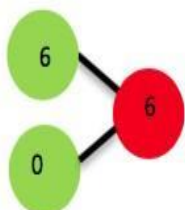
Pupils must be provided with opportunities to develop their skills so that they are able to count reliably, including one to one correspondence and count on from a given number. Pupils should be given the opportunity to count out sets of objects and then combine them to make a total.

e.g. $6 + 2 = 8$



First count out a group of 6. Then count out a group of 2. Finally combine them to find a total.

Pupils should recognise different ways of making numbers. E.g 6 can be made as:



EYFS: Subtraction: Using quantities and objects, subtract two single-digit numbers and count back to find the answer.

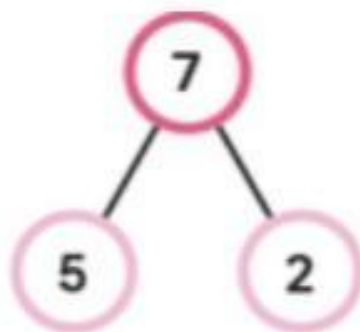
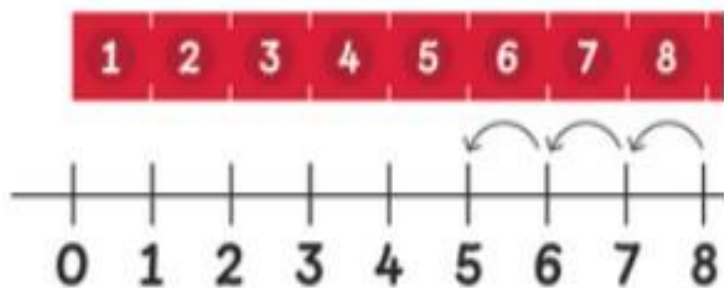
take (away), leave, how many are left/left over? How many have gone? One less, two less, how many fewer is... than...? Difference between, is the same as

Pupils should count out a group of objects, move some away and recount the total.

$$8 - 3 = 5$$



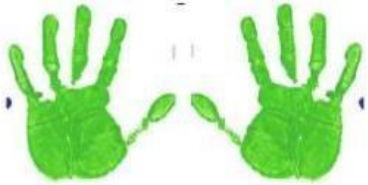
After pupils have recognised different ways of making numbers, they should use this number bond knowledge to help with subtraction facts. Children should use concrete materials to start counting back in order to solve subtraction problems. $8 - 3 =$



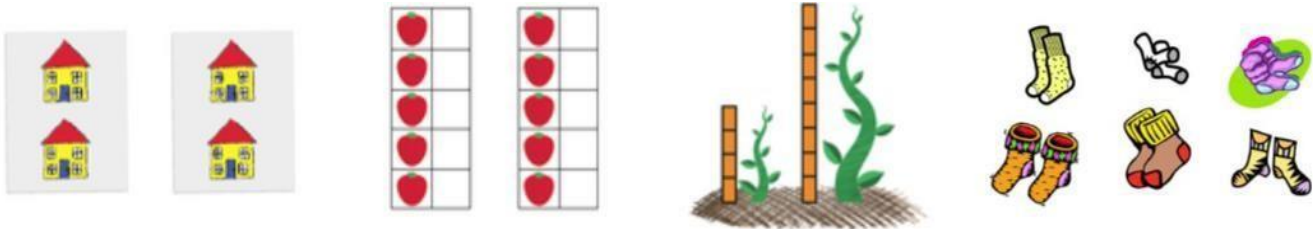
EYFS: Multiplication: Solve problems, including doubling

lots of, doubling

Children will experience equal groups of objects. They should work on practical problem-solving activities.



Use a range of concrete materials to show a number and then repeat the number to show doubling. Then move onto pictorial representations.



EYFS: Division: Solve problems, including halving and sharing.

share, share equally, groups of, how many groups?

Pupils should have many practical experiences of sharing objects e.g. sharing between 2 people, or finding $\frac{1}{2}$ of a group of objects.



Use a range of concrete materials to show a number and then share them equally. Then move onto pictorial representations.

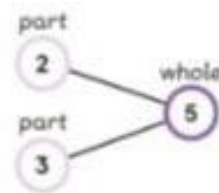
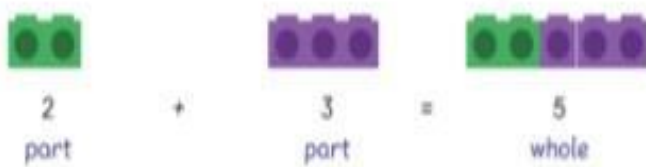


Year 1

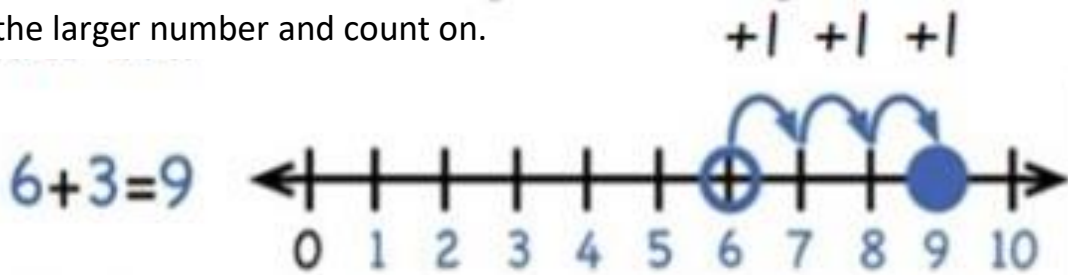
Y1: Addition: Add one-digit and two-digit numbers to 20, including zero.

add, more, plus, make, sum, total, altogether, double, near double, one more, two more, ten more, greater, units, ones, tens, count to, count on, how many?

Use objects to count on and add by using number bonds.



Use numbered number lines to add, by counting on in ones. Encourage children to start with the larger number and count on.



Add by using number bond knowledge and tens frames in order to make 10 / add the ones.

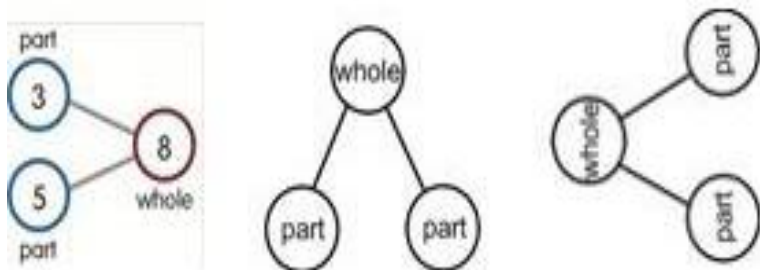
$6 + 8 = 14$

$12 + 6 = 18$

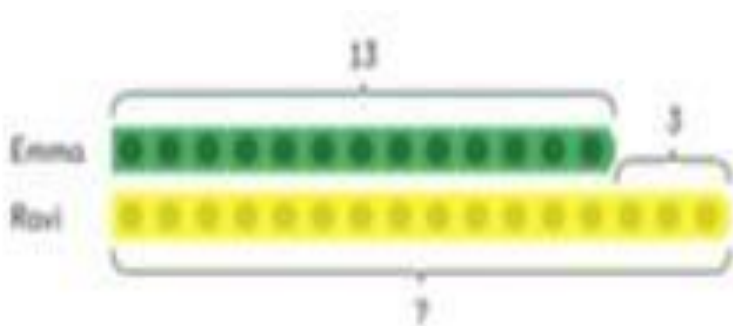
$6 + 8 = 14$

$6 + 8 = 14$

Introduce the part-part-whole method



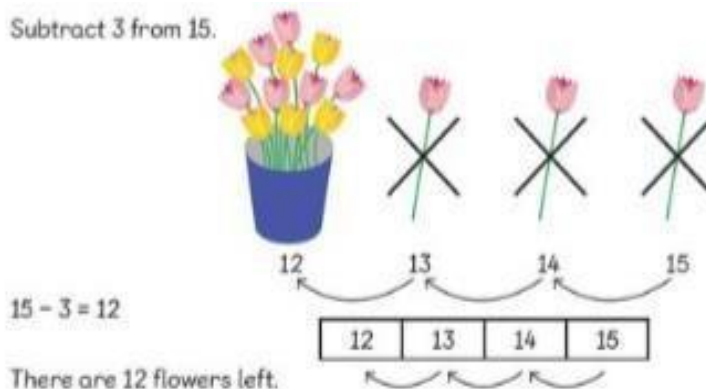
Introduce to the bar method. Use visual bars to show the calculation.



Y1: Subtraction: Subtract one-digit and two-digit numbers to 20, including zero.

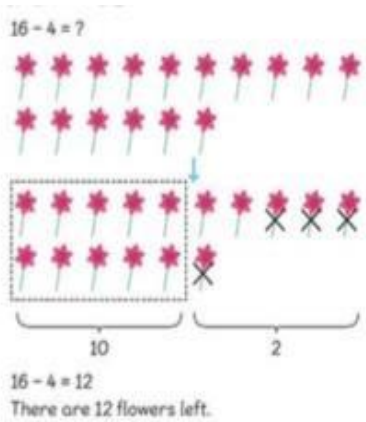
Subtract, take (away), minus, leave, how many are left/left over? How many are gone? One less, two less, ten less, how many fewer is... than...? Difference between, half, halve, = equals, sign, is the same as

Building on from the EYFS methods, children consolidate understanding of subtraction practically. Use physical objects to count back, which is then reinforced on different number squares and number lines.

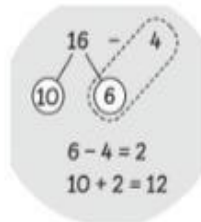


Pupils use knowledge of place value to partition 2-digit numbers in order to subtract ones from the number. They will be exposed to language such as “How much more” and “What is the difference between”.

$16 - 4 = ?$

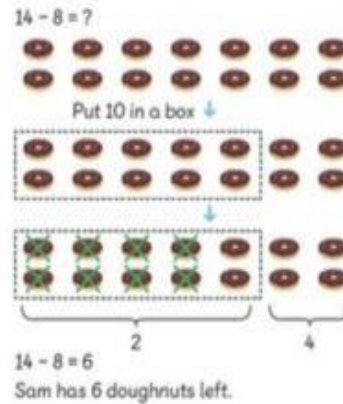


$16 - 4 = 12$
There are 12 flowers left.

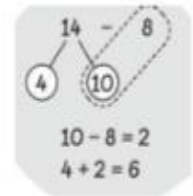


$6 - 4 = 2$
 $10 + 2 = 12$

$14 - 8 = ?$

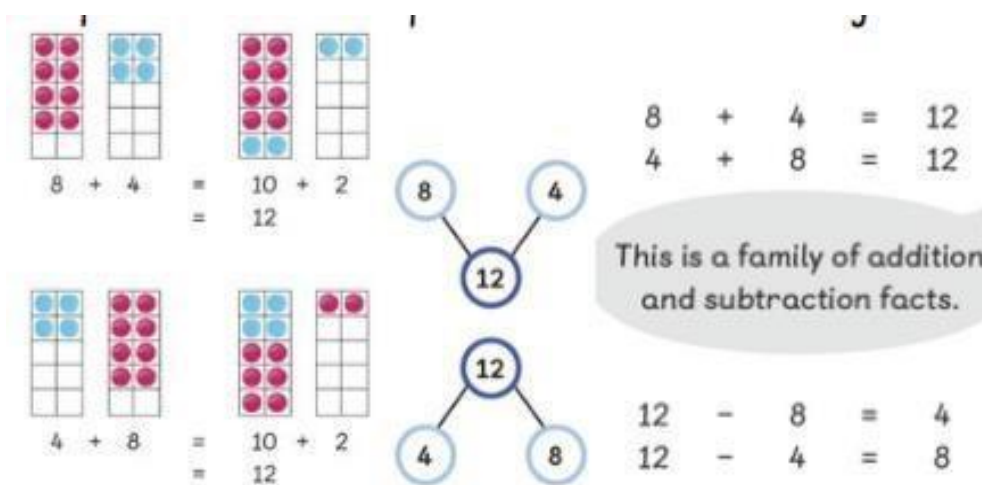


$14 - 8 = 6$
Sam has 6 doughnuts left.



$10 - 8 = 2$
 $4 + 2 = 6$

Pupils will be exposed to the idea of commutativity to understand the idea of fact families.

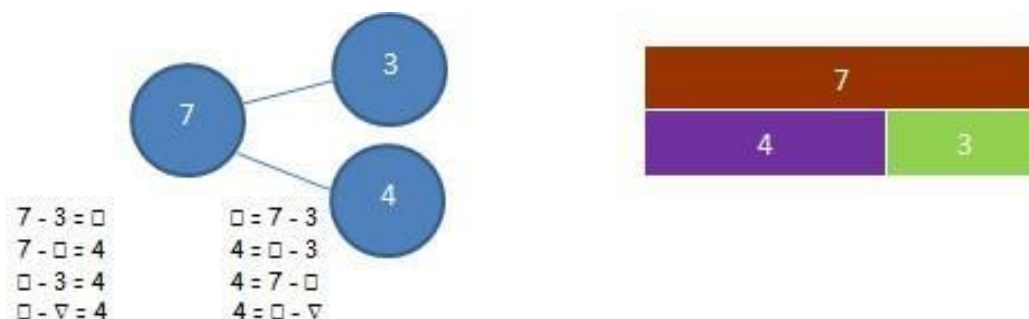


$8 + 4 = 12$
 $4 + 8 = 12$
 $12 - 8 = 4$
 $12 - 4 = 8$

This is a family of addition and subtraction facts.

Children should start recalling subtraction facts up to and within 10 and 20, and should be able to subtract zero.

Use part-part-whole, bars and base ten to explore structure and answer missing number sentences:



$7 - 3 = \square$
 $7 - \square = 4$
 $\square - 3 = 4$
 $\square - \nabla = 4$

$\square = 7 - 3$
 $4 = \square - 3$
 $4 = 7 - \square$
 $4 = \square - \nabla$

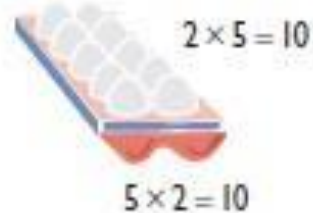
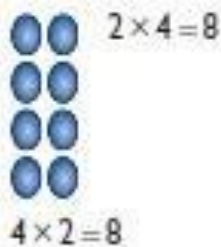
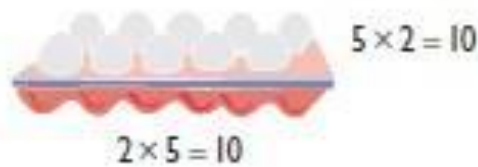
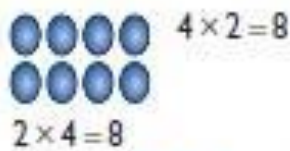
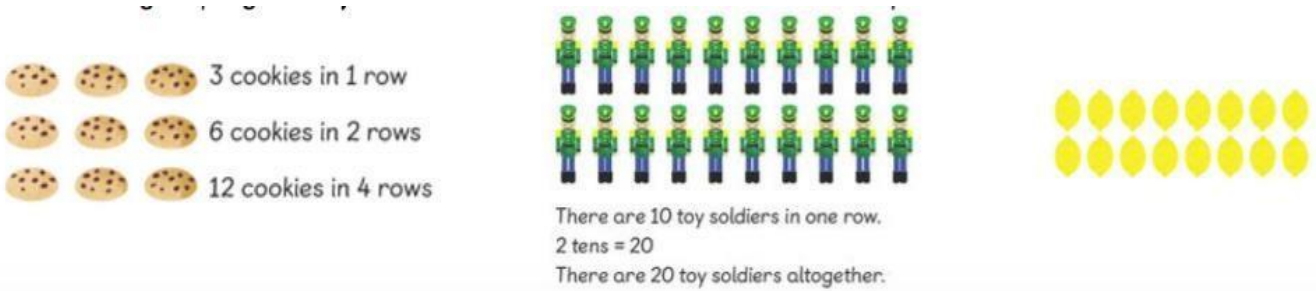
Y1: Multiplication: Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays.

lots of, groups of, multiply, times, add, steps of, jumps of, double

Children should practise making equal groups first and add them to associate repeated addition with multiplication. Use a range of concrete materials before pictorial representations.



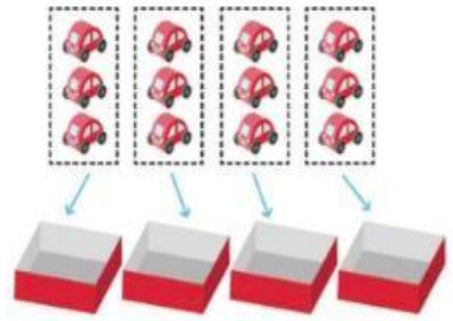
Associate grouping to equal rows so children learn to count up in the same number.



Y1: Division: Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays.

Share, share equally, groups of, divide, how many groups?

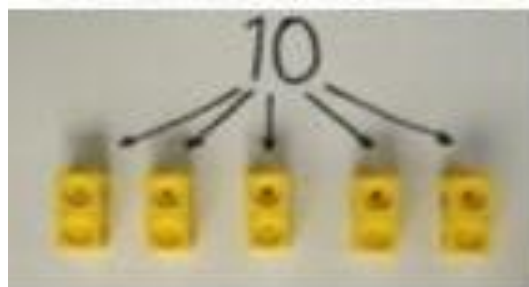
Building on multiplication knowledge and EYFS division strategies, children practise grouping concrete objects equally in order to count the amount in each group. Use a range of concrete materials before pictorial representations.



Build on practical materials by sharing and moving objects.



Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.

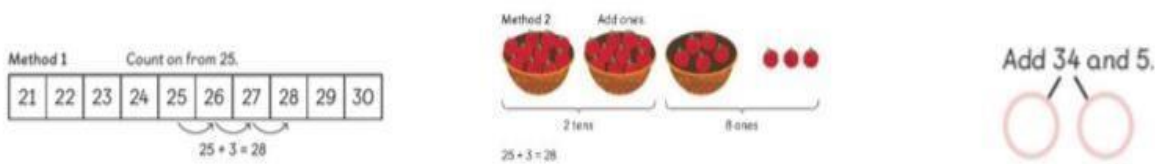


Year 2

Y2: Addition: Add with two-digit numbers.

add, more, plus, make, sum, total, altogether, double, near double, one more, two more, ten more, one hundred more, greater, units, ones, tens, hundreds, count to, count on, how many?

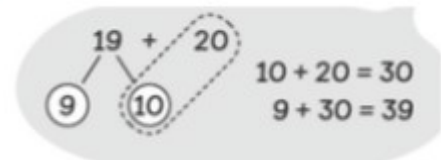
Before moving onto the written method, children should add using a range of resources and methods.



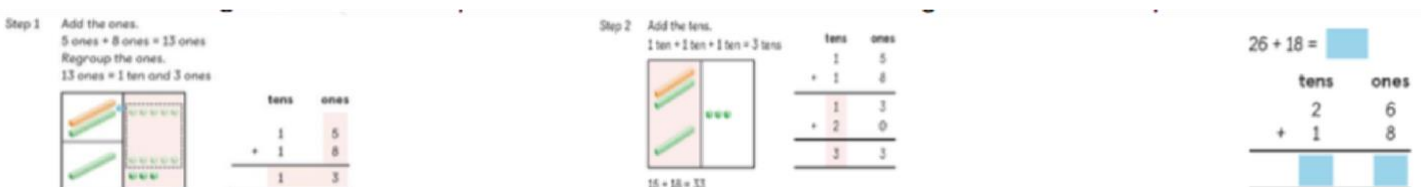
Use a range of resources to add and associate to a written method (column method)



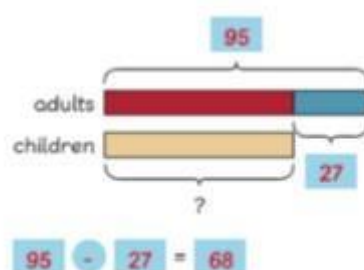
Use knowledge of number bonds to add numbers



When renaming, show the expanded method, but link straight to the compact method.



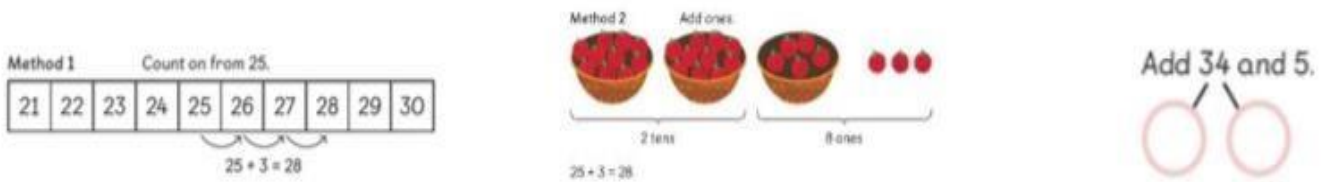
Children should use bars as a visual model to solve addition calculations and be exposed to word problems.



Y2: Subtract: Subtract with two-digit numbers.

Subtract, take away, minus, leave, how many are left/left over? One less, two less, ten less, one hundred less, how many less is... than..? how much fewer is...? Difference between half, halve, =, equals, sign, is the same as

Before moving onto the written method, children should add using a range of resources and methods, including using knowledge of number bonds to subtract numbers.



Use knowledge of subtraction to take away groups of 10.

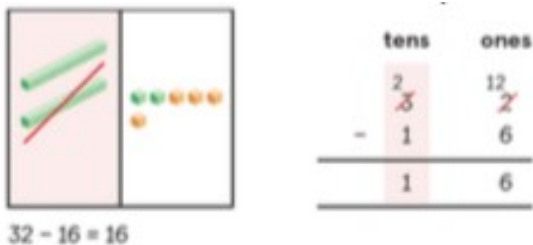
$4 - 1 = 3$ so therefore $40 - 10 = 30$.

Use a range of resources to add and associate to a written method (column method)

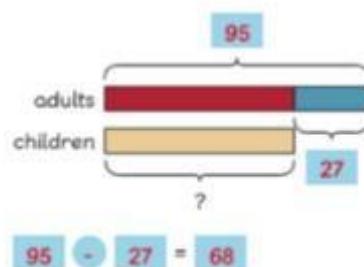


When renaming, you subtract the ones first, and then cross out the number you need to rename and write new number on top.

Use knowledge of number bonds to subtract.



Children should use bars as a visual model to solve subtraction calculations and exposed to word problems.



Y2: Multiplication: Calculate mathematical statements and solve problems for multiplication within the multiplication tables (2, 5 & 10 – these to be taught explicitly and assessed regularly to ensure rapid recall).

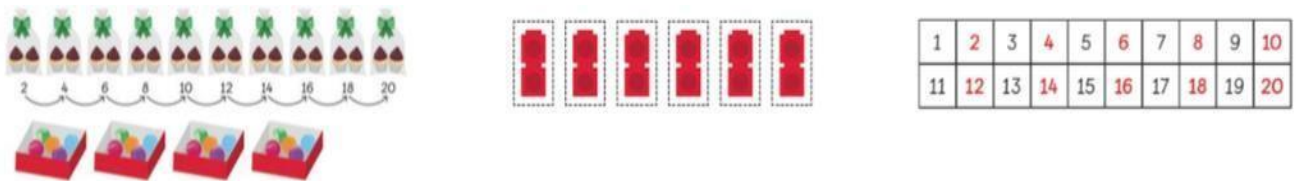
Lots of, groups of, times, multiply, x, multiplied by, multiple of, once, twice, three times, four times, five times, ten times, ... times as big (big, long, wide and so on), repeated addition, array, row, column

Begin with consolidating Year 1 repeated addition and associate to multiplication.



$3 + 3 + 3 + 3 = 12$
 4 threes = 12
 4 groups of 3 = 12
 $4 \times 3 = 12$

Before moving onto the written method, children should add using a range of resources and methods



Children will associate the law of commutativity to multiplication using arrays and practical resources to show.



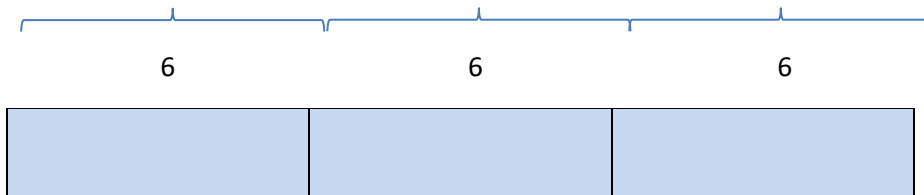
Move onto abstract route with problems.



$2 \times 3 = 6$

Include bar models to represent multiplication:

I have 3 packs of 6 eggs. How many eggs altogether?



Missing number calculations to apply and consolidate children's understanding of multiplication.

- 1) $3 \times \square = 12$ 2) $\square \times 4 = 20$ 3) $2 \times 2 + \square = 10$ 4) $\square \times 3 - 2 = 7$
 5) $\square \times 2 = 5 \times 4$ 6) $\square \times \square = 3 \times 4$ 7) $\square \times 2 = 4 \times \square$

Y2: Division: Calculate mathematical statements and solve problems for division within the multiplication tables (2, 5 & 10).

double, halve, share, share equally, one each, two each, three each... group in pairs, threes... tens, equal groups of, divide, divided by, divided into, left, left over

Build on Year 1 by consolidating grouping equally. Use a range of resources to show division.

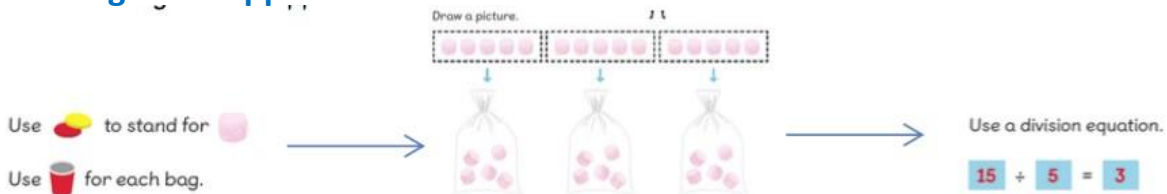
Work on each times-table in order (2, 5 then 10). Use idea of grouping before show division and link to the abstract calculation with the \div sign.



Associate to the law of commutativity to show link between multiplication and division.



Work through CPA approach.



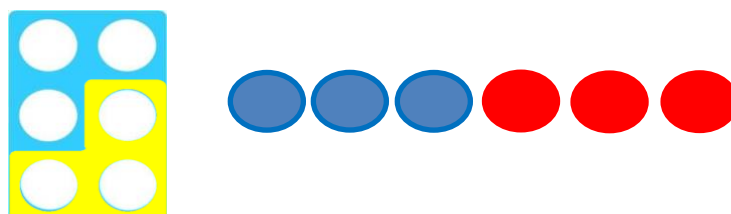
Using symbols to stand for unknown numbers to complete equations using inverse operations

$\square \div 2 = 4$ $20 \div \square = 4$ $\square \div \square = 4$

Fractions:

Find half of quantities and express these as a fraction:

$\frac{1}{2}$ of 6 = 3. Ensure practical and visual equipment used (overlying Numicon, coloured multilink, two sided counters)

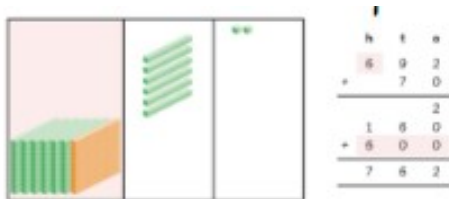


Year 3

Y3: Addition: Add numbers with 3-digits.

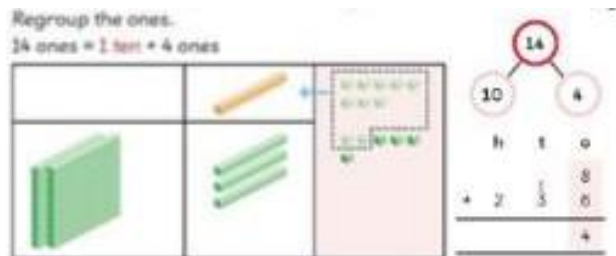
Add, more, addition, plus, make, sum, total, altogether, double, near double, one more... two more... ten more... one hundred more... greater, ones, tens, hundreds, count up, count on, how many...?

Introduce the expanded column method first using manipulatives first:



Add the ones first in preparation for the compact method.

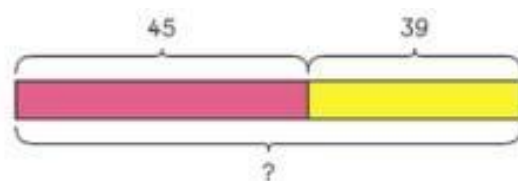
Introduce addition with renaming using the compact method with manipulatives first. Show how to rename, with partitioning.



- Add the ones first.
- Carry the numbers directly above the next number, ensuring that the carried number is recorded first.
- The + symbol is positioned to the left, away from the digits



Continue to use bars as a visual model to solve addition calculations and be exposed to word problems.



Fractions - add fractions of the same denominator within one whole – using equipment and real-life situations to aid understanding.

$$\frac{1}{7} + \frac{4}{7}$$

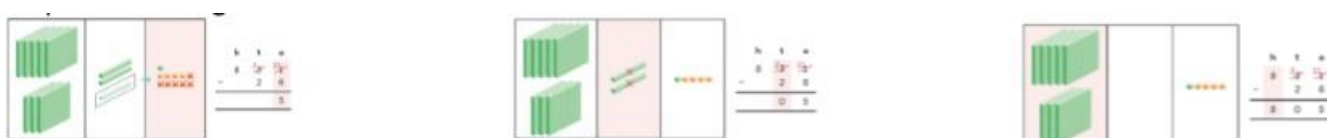
Y3: Subtraction: Subtract numbers with 3-digits.

Subtract, take (away), minus, leave, how many are left/left over? One less, two less, ten less, one hundred less, how many fewer is... than...? How much less is...? Difference between, half, halve, equals, sign, is the same as, tens boundary, hundreds boundary

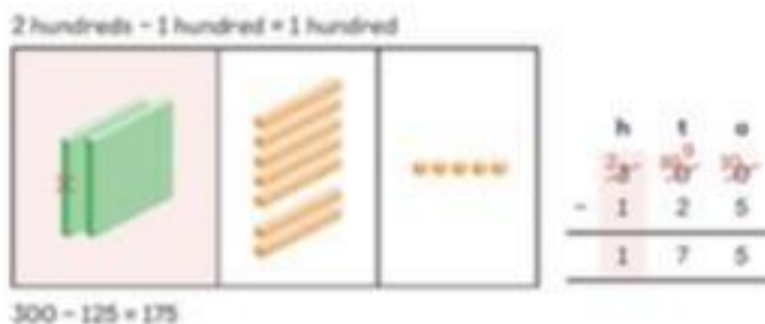
Children should use mental strategies to subtract 1-digit numbers and multiples of 10 from 3-digit numbers.

Introduce subtraction with renaming using the compact method with manipulatives first.

Show how to rename, with partitioning.

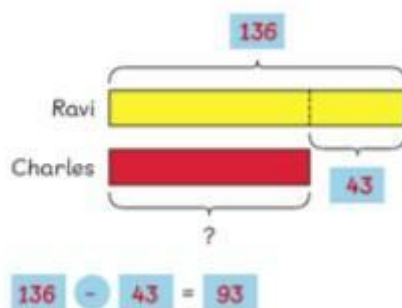


- Subtract the ones first.
- Cross out a number which needs renaming and write the new number directly on top.
- The - symbol is positioned to the left, away from the digits



Carry on, introducing multi-step renaming in single calculations.

Continue to use bars as a visual model to solve subtraction calculations and be exposed to word problems.



Y3: Multiplication: Multiply 2-digits by a single digit number and solve problems for multiplication within the multiplication tables (3, 4 & 8 – these to be taught explicitly and assessed regularly to ensure rapid recall).

Lots of, groups of, times, multiplication, multiplied by, multiple of, product, once, twice, three times, four times, five times, ten times, times as (big, long, wide and so on), repeated addition, array, row, column

Introduce by applying already known knowledge to multiples of 10. Use a range of manipulatives to show.



Consolidate repeated addition before moving onto multiplication of 2-digit numbers.

- Multiply the ones digit by the single-digit number.
- Multiply the tens digit by the single-digit number

Show partition to show how this looks, using manipulatives as a supporting mechanism. Show column method alongside.

Multiply 12 by 4.



Step 1 Multiply the ones by 4.

$$2 \text{ ones} \times 4 = 8 \text{ ones}$$



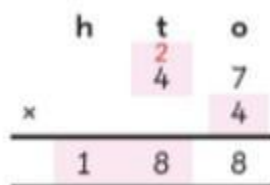
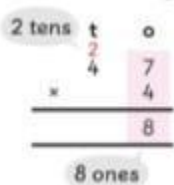
Step 2 Multiply the tens by 4.

$$1 \text{ ten} \times 4 = 4 \text{ tens}$$

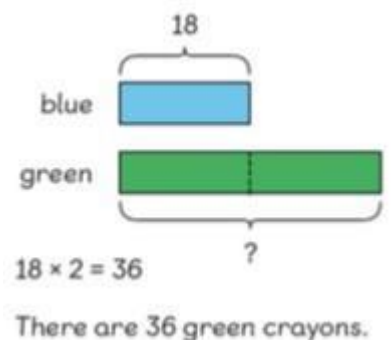


Show expanded method for conceptual understanding, but move straight onto the compact method using same techniques and break-downs.

When regrouping, always start with the larger value and write on top of the next digit.



Continue to use CPA approach and visual bars when solving multiplication and division in word problems.



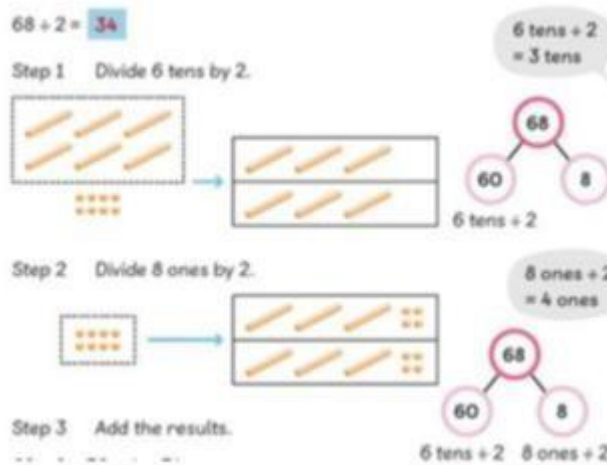
Missing number calculations to apply and consolidate children's understanding of multiplication

- 1) $3 \times \square = 12$ 2) $\square \times 4 = 20$ 3) $2 \times 2 + \square = 10$ 4) $\square \times 3 - 2 = 7$ 5) $\square \times 2 = 5 \times 4$
 6) $\square \times \square = 3 \times 4$ 7) $\square \times 2 = 4 \times \square$

Y3: Division: Divide 2-digit numbers by a single digit (where there is no remainder in the final answer)

Double, halve, share, share equally, one each, two each, three each, group in pairs, threes, tens, equal groups of... divide, division, divided by, divided into, left, left over, remainder

Introduce division by using manipulatives to divide (working on times table in order – 2, 5, 10, 3, 4, 8). Show partitioning to link in division.



Show 'chunking' method of division, using known division facts to take away chunks. Also show 'short division' method and link 2 methods together.

$$\begin{array}{r}
 12 \\
 8 \overline{) 96} \\
 \underline{- 80} \\
 16 \\
 \underline{- 16} \\
 0
 \end{array}$$

Also introduce the 'Bus Stop' method to give the children an alternative method for short division. Multiples of the divisor can be written vertically to help with the calculation.

$$\begin{array}{r}
 372 \div 3 = 124 \\
 3 \overline{) 372} \\
 \underline{124} \\
 0
 \end{array}$$

Continue to use CPA approach and visual bars when solving multiplication and division in word problems.

$36 \div 2 = 18$
 Sam has 18 beads.

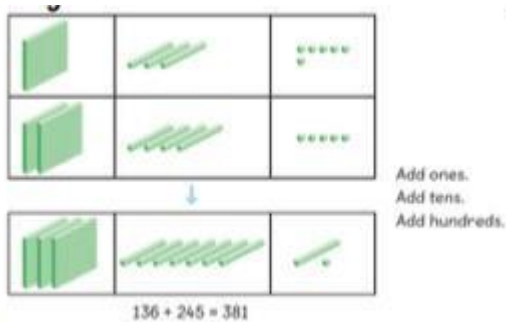
$48 \div 6 = \square$
 $\square \times 6 = 48$

Year 4

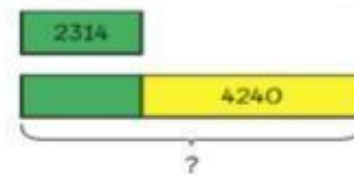
Y4: Addition: Add numbers with 4-digits.

Add, more, addition, increase, plus, make, sum, total, altogether, double, near double, one more... two more... ten more... one hundred more... greater, ones, tens, hundreds, count up, count on, how many...? Inverse

Reinforce column method by using concrete materials first:



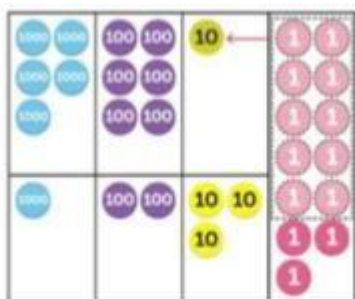
Find the sum of 2314 and 4240.



Move onto pictorial, using bar modelling.

Show expanded method to make link of place value. Move straight onto compact method. When renaming, the number is carried directly above the number.

Use concrete materials to show renaming.



$$\begin{array}{r}
 4 \ 2 \ 5 \ 6 \\
 + 1 \ 9 \ 8 \ 7 \\
 \hline
 \ 1 \ 3 \\
 \ 1 \ 3 \ 0 \\
 + 5 \ 0 \ 0 \ 0 \\
 \hline
 6 \ 2 \ 4 \ 3
 \end{array}$$

add ones
add tens
add hundreds
add thousands

$$\begin{array}{r}
 1 \ 1 \ 1 \\
 4 \ 2 \ 5 \ 6 \\
 + 1 \ 9 \ 8 \ 7 \\
 \hline
 6 \ 2 \ 4 \ 3
 \end{array}$$

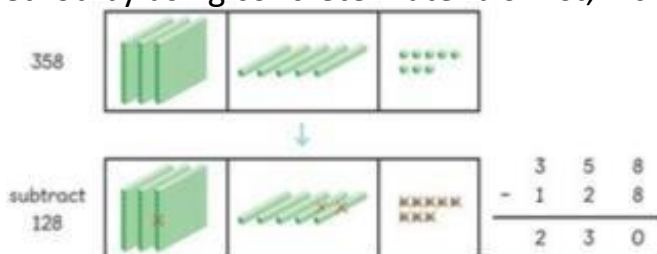
Fractions - add fractions of the same denominator going up to or beyond one whole - using equipment and real-life situations to aid understanding. (Note; improper and mixed number fractions are not taught explicitly in this year group, answers can be expressed either as improper or mixed numbers, but the link between the 2 isn't explicitly taught).

e.g. $\frac{5}{7} + \frac{4}{7}$

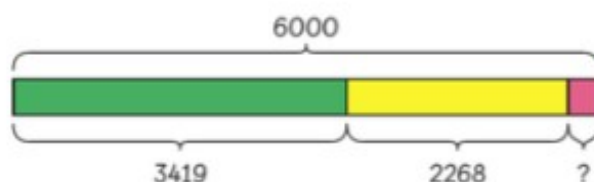
Y4: Subtraction: Subtract numbers with 4-digits.

Subtract, subtraction, take away, minus, decrease, leave, how many are left/left over? Difference between, half, halve, fewer, how many more/fewer is... than...? how much more/less is..? is the same as, equals, sign, tens boundary, hundreds boundary, inverse

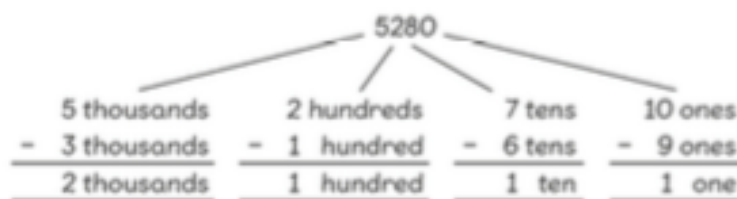
Reinforce column method by using concrete materials first, including for renaming.



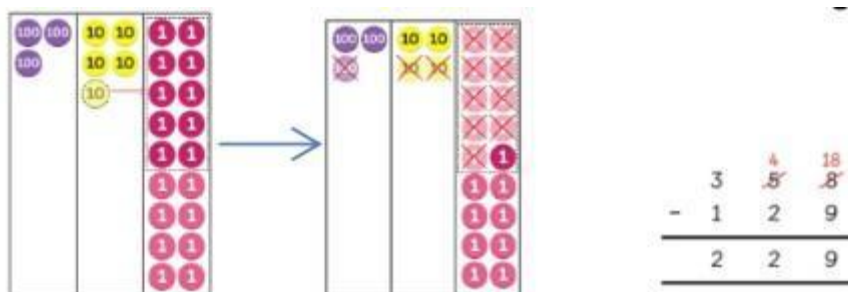
Move onto pictorial, using bar modelling.



Show expanded method to make link of place value. Move straight onto compact method.



When renaming, the number is crossed out and rewritten directly above. Use concrete materials to show renaming.



Fractions - Subtract fractions of the same denominator - using equipment and real-life situations to aid understanding. (Note; improper and mixed number fractions are not taught explicitly in this year group, answers can be expressed either as improper or mixed numbers, but the link between the 2 isn't explicitly taught).

e.g. $\frac{5}{7} - \frac{4}{7}$ or $\frac{9}{8} - \frac{4}{8}$ include diagrams $\frac{9}{8} -$ 

Y4: Multiplication: Multiply 2 and 3-digit numbers by a single digit; teach explicitly and access regularly the 6, 7, 8, 11 and 12 and use all multiplication tables up to 12x12 (ensure there is a rapid recall of all multiplications).

Lots of, groups of, times, multiplication, multiplied by, multiple of, product, once, twice, three times, four times, five times, ten times, times as (big, long, wide and so on), repeated addition, array, row, column

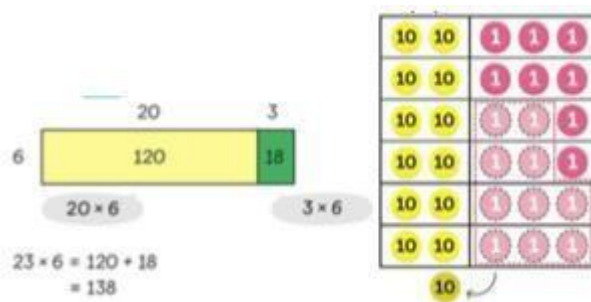
Pupils should continue to develop their knowledge and understanding of multiplying by a single digit, using short multiplication (the formal written method of compact multiplication).

Show expanded method but move straight onto compact method, as in Year 3, to show why and how to regroup.

$$\begin{array}{r} 23 \\ \times 6 \\ \hline 138 \end{array}$$

$$\begin{array}{r} 23 \\ \times 6 \\ \hline 18 \\ + 120 \\ \hline 138 \end{array}$$

Use different CPA approaches to show the same calculation.

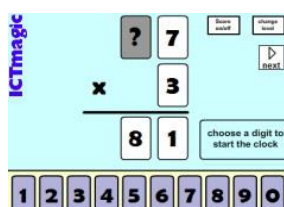


Pupils must be secure in multiplying a 2-digit number by a single digit, before moving onto 3-digit numbers. Repeat using same process as 2-digit numbers.

$$\begin{array}{r} 473 \\ \times 2 \\ \hline 946 \end{array}$$

$$\begin{array}{r} 400 \times 2 = 800 \\ 70 \times 2 = 140 \\ 3 \times 2 = 6 \\ \hline 473 \times 2 = 946 \end{array}$$

Depth of understanding:



Y4: Division: Divide up to 3-digit numbers by a single digit.

Double, halve, share, share equally, one each, two each, three each, group in pairs, threes, tens, equal groups of... divide, division, divided by, divided into, divisible by, remainder, factor, quotient, inverse

Pupils should continue to develop their knowledge and understanding of dividing by two-digits, using chunking and short division. Move onto 3-digit using the same approach.

$$\begin{array}{r} 102 \\ 4 \overline{) 408} \\ \underline{- 4} \\ 8 \\ \underline{- 8} \\ 0 \end{array}$$

Also introduce the 'Bus Stop' method to give the children an alternative method for short division.

Multiples of the divisor can be written vertically to help with the calculation.

$$372 \div 3 = 124$$

$$\begin{array}{r} 124 \\ 3 \overline{) 372} \end{array}$$

$$\begin{array}{r} 86 \text{ r } 2 \\ 5 \overline{) 432} \end{array}$$

If there is a remainder, this should be noted after the quotient.

$$\begin{array}{r} 12 \\ 6 \overline{) 75} \\ \underline{- 6} \\ 15 \\ \underline{- 12} \\ 3 \end{array}$$

$$75 \div 6 = 12 \text{ remainder } 3$$

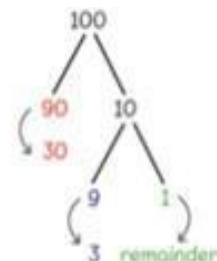
quotient

Move onto 3-digit numbers divided by a single digit number after children are secure with 2-digit numbers. Use the same concept; show chunking and short division, with CPA approach.

$$100 \div 3 = 33 \text{ remainder } 1$$

$$\begin{array}{r} 033 \text{ remainder } 1 \\ 3 \overline{) 100} \\ \underline{- 9} \\ 10 \\ \underline{- 9} \\ 1 \end{array}$$

→ 3 tens
→ 3 ones
→ remainder



Year 5

Y5: Addition: Add numbers with more than 4-digits.

Add, more, addition, increase, plus, make, sum, total, altogether, double, near double, one more... two more... ten more... one hundred more... greater, ones, tens, hundreds, count up, count on, how many...? Inverse, ones boundary, tenths boundary

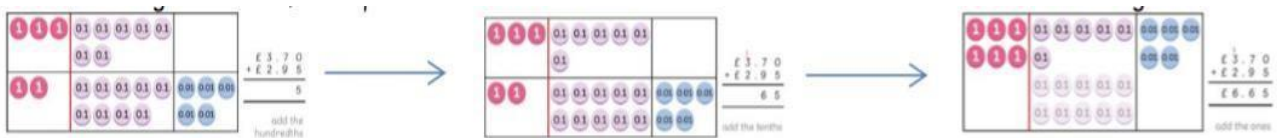
Carry on using previous methods taught in previous years to add, using the same terminology. Continue up to place value being taught.

Extend to numbers with at least five digits and include decimals. Add numbers with different amounts of digits, e.g. 4 digit and 5 digit, presented horizontally, so children have to consider place value when setting out in column format)

$$3587 + 675 = 4262$$

$$\begin{array}{r} 23587 \\ + 4675 \\ \hline 28262 \\ 111 \end{array}$$

When adding decimals, use place value counters to show addition and use when renaming.



Extend to up to two places of decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

$$\begin{array}{r} 372.8 \\ 127.7 \\ + 54.6 \\ \hline 555.1 \\ 112 \end{array}$$

$$\frac{2}{8} + \frac{3}{8}$$

$$\frac{6}{8} + \frac{9}{8} = \frac{7}{8} + \frac{8}{8} \text{ (manipulation)}$$

$$\frac{7}{8} + \frac{14}{8}$$

$$3\frac{3}{8} + \frac{15}{8}$$

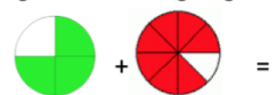
Fractions - Add fractions with the same denominator or denominators which are multiples of the same number.

Representations are used to support this.

e.g.: $\frac{2}{4} + \frac{3}{8}$ $3\frac{2}{4} + 6\frac{3}{8}$ $\frac{7}{4} + 1\frac{3}{8}$ Include:

Include:

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



Y5: Subtraction: Subtract numbers with more than 4-digits.

Subtract, subtraction, take away, minus, decrease, leave, how many are left/left over? Difference between, half, halve, fewer, how many more/fewer is... than...? how much more/less is..? is the same as, equals, sign, tens boundary, hundreds boundary, inverse

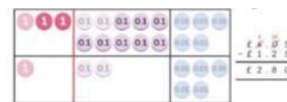
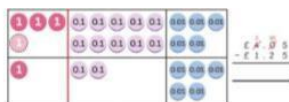
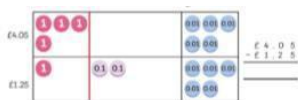
Carry on using previous methods taught in previous years to subtract, using the same terminology. Continue up to place value being taught.

Refine compact decomposition methods, ensuring the method is being used for the right type of question, avoid using it for questions such as $3005 - 1897$, as it is much more appropriate to use manipulation or counting on (as difference is small).

$$\begin{array}{r} 4 \text{ } 1 \text{ } 5 \text{ } 1 \\ 5 \text{ } 5 \text{ } 5 \text{ } 1 \\ - 3 \text{ } 6 \text{ } 2 \text{ } 4 \\ \hline 1 \text{ } 9 \text{ } 3 \text{ } 7 \end{array}$$

Include where there is one zero on top line – but more than this and manipulation should really be used.

When subtracting decimals, use place value counters to show subtraction and use when renaming.



Fractions: Subtract fractions with the same denominator or denominators which are multiples of the same number.

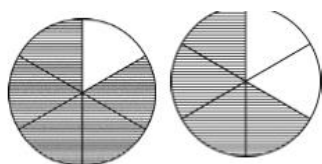
$$\frac{5}{8} - \frac{3}{8} \qquad 1\frac{6}{8} + \frac{9}{8} = 1\frac{6}{8} + 1\frac{1}{8} \qquad \frac{14}{8} + 1\frac{5}{8}$$

$$3\frac{3}{8} + 2\frac{7}{8} = 3\frac{4}{8} + 3 = 4\frac{4}{8} \text{ (Use of manipulation makes this very easy!)}$$

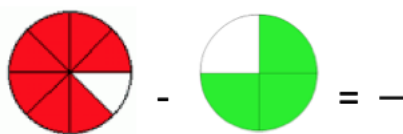
Note – answers do not have to be in simplest form.

Representations are used to support this include:

e.g.: $\frac{3}{4} - \frac{3}{8}$ $6\frac{2}{4} - 3\frac{3}{8}$ $\frac{9}{4} - 1\frac{3}{8}$



$$1\frac{1}{3} =$$



Y5: Multiplication: Multiply numbers up to / more than 4-digits.

Lots of, groups of, times, multiplication, multiplied by, multiple of, product, once, twice, three times, four times, five times, ten times, times as (big, long, wide and so on), repeated addition, array, row, column

Carry on using previous methods taught in previous years to multiply, using the same terminology. Continue up to place value being taught. Start with 4 digits multiply by 1 digit before slowly adding further digit.

Continue short multiplication ThHTO x O and TO.ths x O (with numbers up to 2 decimal places).

$$\begin{array}{r} 238 \\ \times 7 \\ \hline 1666 \\ \hline \end{array}$$

2 5

Moving on to:

$$\begin{array}{r} 1 \\ 4 \\ 28 \\ \times 26 \\ \hline 168 \\ + 56 \\ \hline 728 \end{array}$$

→ 28 × 6
→ 28 × 20

$$\begin{array}{r} 247 \\ \times 18 \\ \hline 1976 \\ 35 \\ \hline 2470 \\ \hline 4446 \\ \hline 11 \end{array}$$

Use knowledge of relationships to manipulate multiplication:

e.g. I know that $16 \times 4 = 8 \times 8$ or $25 \times 48 = 50 \times 24 = 100 \times 12$

$$24 \times 15 = 12 \times 30 = 360$$

$$36 \times 16 = 72 \times 8 = 576$$

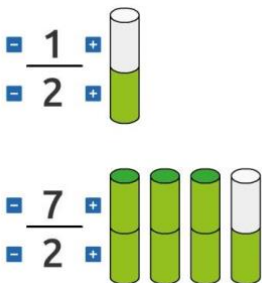
$$c \times 25 = 64 \times 100$$

$$162 \times c = 81 \times 30$$

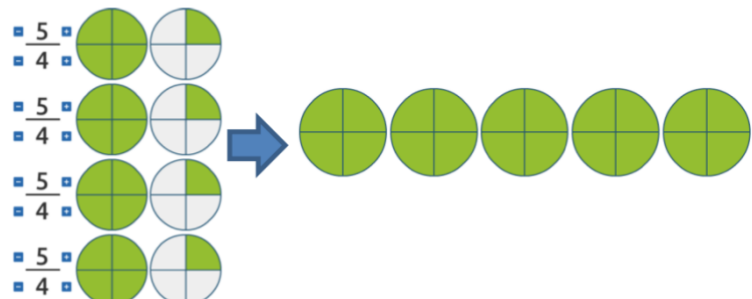
Fractions: Multiply proper, mixed number and improper fractions by whole numbers:

$$\frac{1}{2} \times 7$$

Use pictorial representations:



At Pizza Palace each of the 4 family members eats five quarters of pizza. How many whole pizzas were eaten?



Y5: Division: Divide at least 4-digits by single digit numbers.

Double, halve, share, share equally, one each, two each, three each, group in pairs, threes, tens, equal groups of... divide, division, divided by, divided into, divisible by, remainder, factor, quotient, inverse

Carry on using previous methods taught in previous years to divide, using the same terminology. Continue up to place value being taught. Start with 4 digits divide by 1 digit before slowly adding further digits.

Show chunking and short division method. When chunking, show partitioning as value.

Show chunking and short division method. When chunking, show partitioning as place value.

$5048 \div 8 = 631$
 5048
 4800 248
 240 8

$8 \overline{) 5048}$
 $\underline{- 4800}$
 248
 $\underline{- 240}$
 8
 $\underline{- 8}$
 0

Continue using the 'Bus Stop' method to give the children an alternative method for short division. Multiples of the divisor can be written vertically to help with the calculation.

$4 \overline{) 872}$
 218
 3

$432 \div 15 = 28 \text{ r}12$
 $15 \overline{) 432}$
 28_{r12}

Move on to long division method as a more efficient method without remainders:

$12 \overline{) 156}$
 $\underline{- 12}$
 36
 $\underline{- 36}$
 0 ← There's no remainder.

Year 6

Y6: Addition: Add numbers with more than 4-digits.

Add, more, addition, increase, plus, make, sum, total, altogether, double, near double, one more... two more... ten more... one hundred more... greater, ones, tens, hundreds, count up, count on, how many...? Inverse, ones boundary, tenths boundary

Carry on using previous methods taught in previous years to add, using the same terminology. Continue up to place value being taught.

Manipulate numbers where possible in order to add mentally

Continue as in Year 2, 3, 4 and 5 but with appropriate numbers including extending to adding 0.9, 1.9, 2.9 etc

e.g $54.8 + 12.7 = 55.0 + 12.5 = 67.5$ using manipulation to the nearest whole number

Extend to numbers with any number of digits and decimals with 1, 2 and/or 3 decimal places.

$$13.86 + 9.481 = 23.341$$

13.860
+ 9.481
<u>23.341</u>
1 1 1

Revert to expanded methods if the children experience any difficulty.

Fractions: Add fractions with different denominators – understanding equivalence is vital before this work commences. Answers should be expressed in their lowest form or as mixed numbers if appropriate. e.g.

$$\frac{2}{4} + \frac{3}{7} = \frac{14}{28} + \frac{12}{28} = \frac{26}{28} = \frac{13}{14}$$

Add a mixture of proper, improper and mixed number fractions. E.g.

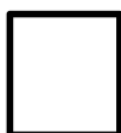
$$\frac{8}{9} + 4\frac{3}{10} = \frac{80}{90} + 4\frac{27}{90} = 4 + \frac{107}{90} = 5\frac{17}{90}$$

(this is a more challenging example – children would start with smaller and easier denominators to begin with).

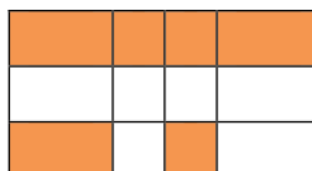
Mastery: $6\frac{5}{8} + \frac{17}{9}$



+



$$= 2\frac{3}{4}$$



$$+ 2\frac{5}{6} =$$

Y6: Subtraction: Subtract numbers with more than 4-digits.

Subtract, subtraction, take away, minus, decrease, leave, how many are left/left over? Difference between, half, halve, fewer, how many more/fewer is... than...? how much more/less is..? is the same as, equals, sign, tens boundary, hundreds boundary, inverse

Carry on using previous methods taught in previous years to subtract, using the same terminology. Continue up to place value being taught.

Children will extend into using the decomposition method efficiently for decimals and large numbers, knowing when it is appropriate to use this method and when it is appropriate to count up or manipulate numbers.

e.g. $21476 - 18739$ (use column) $20008 - 19993$ (count up) $14.3 - 10.92$ (manipulate to $14.38 - 11.00$)

Fractions: Subtract fractions with different denominators – understanding equivalence is vital before this work commences. Answers should be expressed in their lowest form or as mixed numbers if appropriate. Answers **do not** have to be expressed in their **simplest form** however it is good practise to do so.

$$\text{e.g. } 1\frac{2}{4} - \frac{3}{7} = \frac{42}{28} - \frac{12}{28} = \frac{30}{28}$$

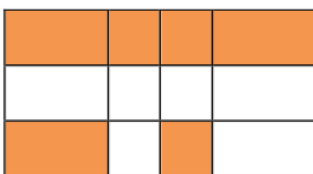
Subtract a mixture of proper, improper and mixed number fractions:

$$\text{e.g. } 2\frac{8}{9} + 1\frac{3}{10} = 2\frac{80}{90} + 1\frac{27}{90} = 3\frac{107}{90}$$

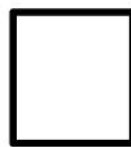
(this is a more challenging example – children would start with smaller and easier denominators to begin with).

Mastery:

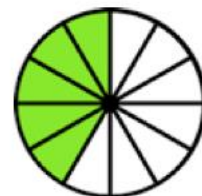
$$6\frac{5}{8} - \frac{17}{9}$$



$$- \frac{1}{6} =$$



-



Y6: Multiplication: Multiply numbers up to / more than 4-digits.

Lots of, groups of, times, multiplication, multiplied by, multiple of, product, once, twice, three times, four times, five times, ten times, times as (big, long, wide and so on), repeated addition, array, row, column

Carry on using previous methods taught in previous years to multiply, using the same terminology. Continue up to place value being taught. Start with 4 digits multiply by 1 digit before slowly adding further digits.

$$\begin{array}{r} 247 \\ \times 18 \\ \hline 1976 \\ 35 \\ 2470 \\ \hline 4446 \\ 11 \end{array}$$

When multiplying decimals, use the same method but ensure the decimal point is in with all values carefully written, in line, on either side.

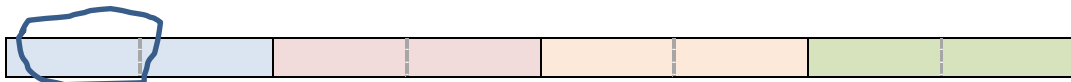
$$\begin{array}{r} 3.19 \\ \times 8 \\ \hline 25.52 \end{array}$$

Fractions: Multiply simple pairs of proper fractions (express answer in simplest form).

$\frac{1}{4} \times \frac{1}{2}$ Begin by ensuring full understanding of manipulation of fractions such as doubling a fraction or halving a fraction (and also manipulating multiplication by doubling one number and halving the other).

e.g. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8} \times 1 = \frac{1}{8}$ $\frac{3}{4} \times \frac{1}{4} = \frac{3}{8} \times \frac{1}{2} = \frac{3}{16} \times 1 = \frac{3}{16}$

Explain that $\frac{1}{4} \times \frac{1}{2}$ is also half lots of $\frac{1}{4}$

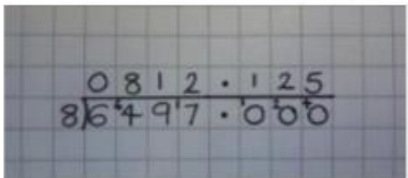


This can then lead to seeing the relationship between the denominators/numerators being multiplied.

Y6: Division: Divide at least 4-digits by single digit numbers.

Double, halve, share, share equally, one each, two each, three each, group in pairs, threes, tens, equal groups of... divide, division, divided by, divided into, divisible by, remainder, factor, quotient, inverse

Carry on using previous methods taught in previous years to divide, using the same terminology. Continue up to place value being taught. Start with 4 digits divided by 1 digit before slowly adding further digits. Teach how to express a remainder as a decimal and as a fraction.



$$3 \ 5 \overline{) 14.6} = 2 \ 8 \ 12$$

$$376 \text{ ml} \div 5 = 75 \frac{1}{5} \text{ ml}$$

Continue with partitioning where necessary for mental calculation (see year 4 bar partitioning)

$$136 \div 25$$

$$= 272 \div 50$$

$$= 544 \div 100 = 5.44$$

$$27 \div 1.5 = 54 \div 3$$

Carry on using long division method, introduce remainders:

Long division: $12 \overline{) 156}$. The quotient is 13. A note says "There's no remainder." with an arrow pointing to the 0.

Long division: $20 \overline{) 542}$. The quotient is 27 with a remainder of 2.

Fractions: Divide proper fractions by whole numbers: $\frac{4}{5} \div 2$ Use pictures to represent this:

Divide whole numbers by fractions:

$6 \div \frac{1}{2}$ how many halves make 6? Suddenly, this becomes easy.

However, with understanding of division manipulation they can make fractional division easy:

$$24 \div \frac{1}{4} = 48 \div \frac{1}{2} = 96 \div 1$$

