

THE ROCHE SCHOOL
CALCULATION POLICY

This policy which applies to the whole school is publicly available on the school website and upon request a copy (which can be made available in large print or other accessible format if required) may be obtained from the School Office.

Information Sharing Category	Public Domain
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Responsible Area	Lee Murphy

At the Roche School, we adopt a ‘streaming’ strategy for the learning of mathematics to enable us to cater for every child’s needs and rate of progress individually. We see the progression of calculation strategies as dependent on when each child is ready to move to the next stage, rather than simply by age. As such, the timing of the progression of learning of strategies below is considered a minimum requirement in each age group, with some flexibility both for the most able and those requiring consolidation of mathematical skills.

For an overview of all calculation strategies and when they are required (*mental strategies; ** written methods; *inverse operations, estimating and checking answers; **** problem solving), see separate Progression Map documents for (1) Addition and Subtraction; (2) Multiplication and Division.**

Key skills and timings:

- **Mental calculation** skills are vital.
- Children need to have secure mental representations of numbers and number patterns. So number bonds to 20 (addition and subtraction, including bridging 10 should be known 'by heart') by KS2
- All times tables and their related divisions should (ideally) be known by the end of Spring Term in Year 4
- Children need the ability to **estimate**, so ROUNDING skills are developed early. These skills are helpful when attempting more challenging calculation problems.

PLEASE NOTE: WHILE EXPECTATIONS FOR CALCULATING WITH FRACTIONS ARE LISTED IN THIS DOCUMENT, A SEPARATE 'CALCULATING WITH FRACTIONS IN-DEPTH' DOCUMENT WILL BE AVAILABLE SEPARATELY.

UNDERSTANDING CALCULATION

From CONCRETE, through PICTORIAL to ABSTRACT

CONCRETE

PICTORIAL

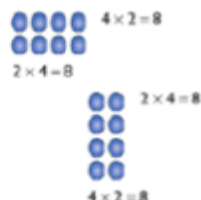
ABSTRACT

Arrays-
showing
commutative
multiplication

Create arrays using counters/ cubes to show multiplication sentences.



Draw arrays in different rotations to find **commutative** multiplication sentences.



Link arrays to area of rectangles.

Use an array to write multiplication sentences and reinforce repeated addition.



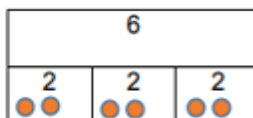
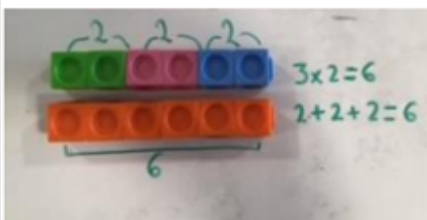
$$5 + 5 + 5 = 15$$

$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

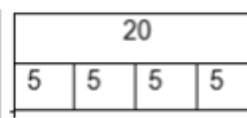
$$3 \times 5 = 15$$

Bar models
representing
multiplication.



$$2 + 2 + 2 = 6$$

$$3 \times 2 = 6$$



$$5 + 5 + 5 + 5 = 20$$

$$4 \times 5 = 20$$

$$3 \times 2 = 6$$

$$4 \times 5 = 20$$

The Roche School

Calculation Guidelines for Foundation Stage (Reception Class)

ADDITION

SUBTRACTION

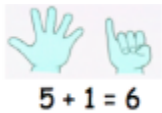
MULTIPLICATION

DIVISION

Children begin to record in the context of play or practical activities and problems.

Begin to relate addition to combining two groups of objects

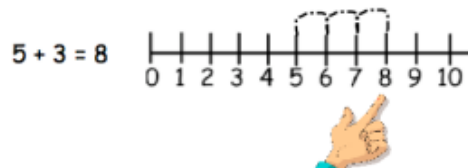
- Make a record in pictures, words or symbols of addition activities already carried out.
 - Construct number sentences to go with practical activities
 - Use of games, songs and practical activities to begin using vocabulary
- Solve simple word problems using their fingers



$$5 + 1 = 6$$

Can find one more to ten.

Higher Ability/ Gifted and Talented children progress to using a number line. They jump forwards along the number line using finger.



Begin to relate subtraction to 'taking away'

- Make a record in pictures, words or symbols of subtraction activities already carried out
- Use of games, songs and practical activities to begin using vocabulary
- Construct number sentences to go with practical activities
- Relate subtraction to taking away and counting how many objects are left.



$$5 - 1 = 4$$



$$5 - 1 = 4$$

Can find one less to ten.

Higher Ability/ Gifted and Talented Progression:

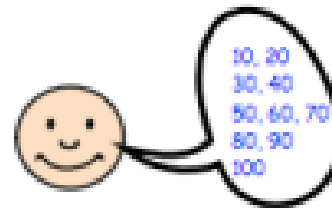


Counting backwards along a number line using finger.

Real life contexts and use of practical equipment to count in repeated groups of the same size:

- Count in twos; fives; tens

Also chanting in 2s, 5s and 10s.



Share objects into equal groups

Use related vocabulary

Activities might include:

- Sharing sweets on a child's birthday
- Sharing activities in the home corner
- Count in tens/twos
- Separate a given number of objects into two groups (addition and subtraction objective in reception being preliminary to multiplication and division)

Count in twos, tens

How many times?

How many are left/left over?

Group

Answer

Right, wrong

What could we try next?

How did you work it out?

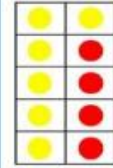
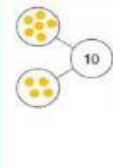
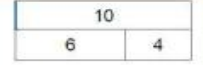



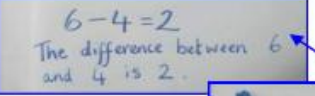
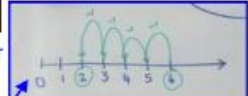

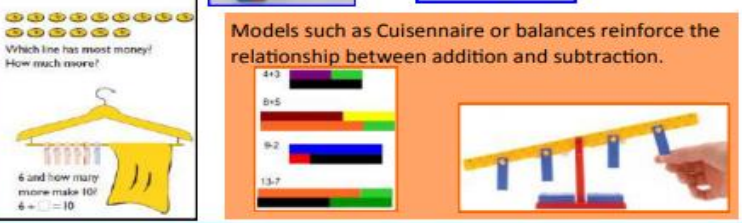
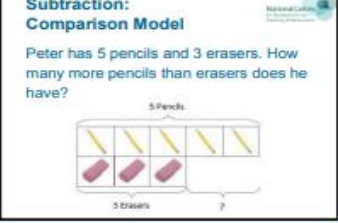
Share out

Half, halve

Key Stage 1

Year	Mental calculation	Written Calculation	Default for ALL children
	<i>Overview of KS1</i>	<p>Children in Years 1 and 2 will be given a really solid foundation in the basic building blocks of mental and written arithmetic. Through being taught place value, they will develop an understanding of how numbers work, so that they are confident in 2-digit numbers and beginning to read and say numbers above 100. A focus on number bonds, first via practical hands-on experiences and subsequently using memorisation techniques, enables a good grounding in these crucial facts, and ensures that all children leave Y2 knowing the pairs of numbers which make all the numbers up to 10 at least. They will also have experienced and been taught pairs to 20. Their knowledge of number facts enables them to add several single-digit numbers, and to add/subtract a single digit number to/from a 2-digit number. Another important conceptual tool is their ability to add/subtract 1 or 10, and to understand which digit changes and why. This understanding is extended to enable children to add and subtract multiples of ten to and from any 2-digit number. The most important application of this knowledge is their ability to add or subtract any pair of 2-digit numbers by counting on or back in tens and ones. Children may extend this to adding by partitioning numbers into tens and ones. Children will be taught to count in 2s, 3s, 5s and 10s, and will have related this skill to repeated addition. They will have met and begun to learn the associated 2x, 3x, 5x and 10x tables. Engaging in a practical way with the concept of repeated addition and the use of arrays enables children to develop a preliminary understanding of multiplication, and asking them to consider how many groups of a given number make a total will introduce them to the idea of division. They will also be taught to double and halve numbers, and will thus experience scaling up or down as a further aspect of multiplication and division. Fractions will be introduced as numbers and as operators, specifically in relation to halves, quarters and thirds.</p>	

Year		Mental calculation	Written Calculation	Default for ALL children
Year 1	<p>Addition</p> <p>Number bonds ('story' of 5, 6, 7, 8, 9 and 10) Count on in ones from a given 2-digit number Add two single-digit numbers Add three single-digit numbers spotting doubles or pairs to 10 Count on in tens from any given 2-digit number Add 10 to any given 2-digit number Use number facts to add single-digit numbers to two-digit numbers, e.g. use $4 + 3$ to work out $24 + 3$, $34 + 3$...</p> <p>Add by putting the larger number first</p>	<p>Use a range of concrete and pictorial representations, including:</p> <p>Using concrete and visual representations to show that 5 is greater than 2. Balance scales can help too.</p> <p>'Part whole' Making connections between models to help children understand the same maths represented in different ways.</p> <p>Staircase: Can you see the numbers 'hidden' in each step? e.g. $2 + 7$ inside 9</p> <p>Can you see a pattern with the number bonds for 5?</p> <p>Bridging across 10 $3 + 8 = 3 + 7 + 1$ $8 + 3 = 8 + 2 + 1$ Children can explore this using multilink, Dienes, coins and bead strings etc</p> <p>Real everyday objects</p>	<p>Representations to support mental and written calculations.</p> <p>Balance scales can help too.</p> <p>Shanghai Textbook Grade 1 (aged 6/7)</p> <p>Number tracks</p> <p>Number lines</p>	<p>Pairs with a total of 10 Counting in ones Counting in tens Count on 1 from any given 2-digit number</p>


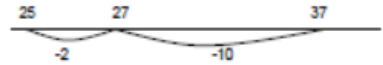

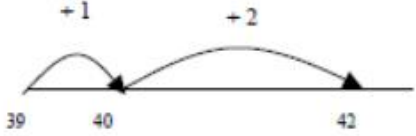
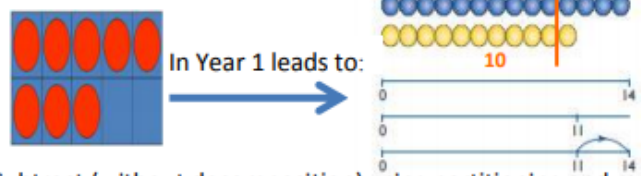

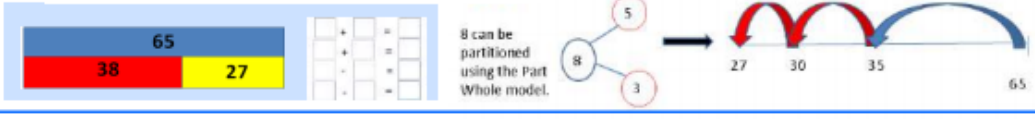
Year	Mental calculation	Written Calculation	Default for ALL children
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Subtraction</p>	<p>Number bonds ('story of' 5, 6, 7, 8, 9 and 10) Count back in ones from a given 2-digit number Subtract one single-digit number from another Count back in tens from any given 2-digit number Subtract 10 from any given 2-digit number Use number facts to subtract single-digit numbers from two-digit numbers, e.g. use $7 - 2$ to work out $27 - 2$, $37 - 2$...</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Written Calculations</p> <p>Subtract one-digit and two-digit numbers to 20, including zero. Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs .</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Tens Frame</p> </div> <div style="text-align: center;">  <p>Part Whole Model</p> </div> <div style="text-align: center;">  <p>Bar Model</p> </div> </div> <p style="text-align: center;">Represent and use number bonds and related subtraction facts within 20.</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Representations to support mental and written calculations.</p> <p>Use a range of concrete and pictorial representations, including:</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>Hands, fingers and children themselves.</p>  </div> <div style="width: 30%;"> <p>Straw bundles</p>  </div> <div style="width: 30%;"> <p>Bead strings, number tracks and lines</p>  </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="width: 30%;"> <p>Difference or comparison model</p>  </div> <div style="width: 30%;"> <p>Counting on or back.</p>  </div> <div style="width: 30%;"> <p>Part Whole</p>  </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="width: 30%;"> <p>Models such as Cuisenaire or balances reinforce the relationship between addition and subtraction.</p>  </div> <div style="width: 30%;"> <p>Subtraction: Comparison Model</p> <p>Peter has 5 pencils and 3 erasers. How many more pencils than erasers does he have?</p>  </div> </div>	<p>Pairs with a total of 10 Counting back in ones from 20 to 0 Counting back in tens from 100 to 0 Count back 1 from any given 2-digit number</p>

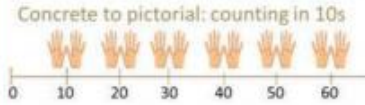


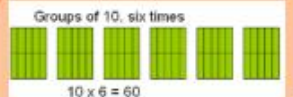
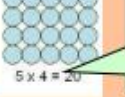

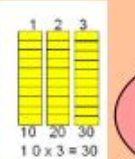



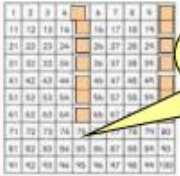
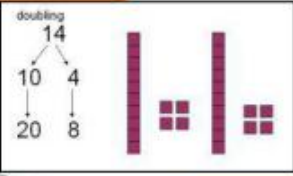
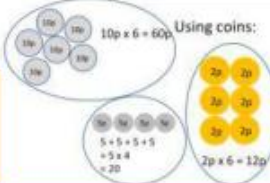
Year	Mental calculation	Written Calculation	Default for ALL children
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Multiplication</p>	<p>Begin to count in 2s, 5s and 10s Begin to say what three 5s are by counting in 5s or what four 2s are by counting in 2s, etc. Double numbers to 10</p>	<p>Although there is no statutory requirement for written multiplication in Year 1, it may be helpful to encourage children to begin to write it as a repeated addition sentence in preparation for Year 2 E.g. $2 + 2 + 2 + 2 = 8$</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Representations to support mental and written calculations:</p> <p>Use a range of concrete and pictorial representations, including:</p> <p>There are 3 sweets in one bag. How many sweets are there in 5 bags?</p> <p>4 groups of 3 3 groups of 4</p> <p>2 groups of 5 (5×2) using Numicon</p> <p>4 groups of 2p 2p multiplied by 4 $2p \times 4 = 8p$</p> <p>Can I use doubling?</p> <p>Concrete to pictorial: counting in 5s</p> <p>Anna is counting in fives: 5, 10, <input type="text"/>, 20, <input type="text"/>, <input type="text"/>, ...</p> <p>3 + 3 + 3 + 3 = 12 3 multiplied by 4 is 12 $3 \times 4 = 12$</p> <p>"2 strawberries 3 times" $2 \times 3 = 6$ $2 + 2 + 2 = 6$</p> <p>What do you notice about odd numbers?</p> <p>10 13 11 14</p> <p>Double 4 in hoops</p> <p>Contextualise the mathematics: Susie invites 6 friends to her birthday party. How many cherries are there on the plate? How many biscuits will we need if we eat 2 each? There are 5 sweets for each party bag. How many sweets do I need altogether?</p> <p>How do they count? In 1s? 2s? 5s? 10s?</p>	<p>Begin to count in 2s and 10s Double numbers to 5 using fingers</p>








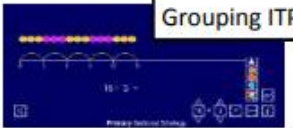
Year	Mental calculation	Written Calculation	Default for ALL children
Division	<p>Begin to count in 2s, 5s and 10s</p> <p>Find half of even numbers to 12 and know it is hard to halve odd numbers</p> <p>Find half of even numbers by sharing</p> <p>Begin to use visual and concrete arrays or 'sets of' to find how many sets of a small number make a larger number.</p>	<p>Children should experiment with the concepts of sharing and grouping in a number of contexts. Initially they use their own recording—moving towards fluent, symbolic notation in Year 2. Conceptual understanding and recording should be continuously supported by the use of arrays as a default model, as well as other representations, (see below.)</p> <div data-bbox="539 277 1800 940" style="border: 1px solid black; padding: 10px;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Representations to support mental and written calculations.</p> <p>Use a range of concrete and pictorial representations, including:</p> <ul style="list-style-type: none"> Manipulatives to support children's own recording; and understanding of <i>sharing</i> and the link with multiplication. <p>"How can we share 6 cakes between 2 people?"</p> <div data-bbox="667 435 896 582"> <p>Here, the cakes are placed in an array formation.</p> </div> <div data-bbox="1234 352 1435 454"> </div> <div data-bbox="1541 352 1778 564"> <p>Moving from concrete to pictorial, counters represent the cakes to reinforce the relationship between multiplication and division.</p> </div> <div data-bbox="1162 469 1368 564"> <p>How many 2 tiles can we fit on the 6 tile?</p> </div> Manipulatives, and real-life objects to support children's own recording; and understanding of <i>grouping</i> and the link with multiplication. <div data-bbox="667 663 840 826"> </div> <div data-bbox="848 663 1178 826"> <p>Coat hangers and socks support calculation of $8 \div 2$</p> </div> <div data-bbox="1227 647 1391 703"> <p>Bead strings</p> </div> <div data-bbox="1420 647 1778 791"> <p>$15 \div 2$ using grouping model</p> </div> <div data-bbox="1263 815 1599 871"> <p>"Double 3 is 6. Half of 6 is 3."</p> </div> <div data-bbox="1630 810 1794 900"> </div> Dominoes and dice to reinforce concepts of doubling and halving. </div>	<p>Begin to count in 2s and 10s</p> <p>Find half of even numbers by sharing</p>

Year	Mental calculation	Written Calculation	Default for ALL children
<p>Year 2</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Addition</p>	<p>Number bonds – knowing all the pairs of numbers which make all the numbers to 12, and pairs with a total of 20</p> <p>Count on in ones and tens from any given 2-digit number</p> <p>Add two or three single-digit numbers</p> <p>Add a single-digit number to any 2-digit number using number facts, including bridging multiples of 10. (E.g. $45 + 4$, $38 + 7$)</p> <p>Add 10 and small multiples of 10 to any given 2-digit number</p> <p>Add any pair of 2-digit numbers</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Representations to support mental and written calculations.</p> <p>Use a range of concrete and pictorial representations, including:</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 30%;"> <p>Teaching equality/inequality: Use examples that children can reason about without the need to calculate e.g. $5 + 7 \square 5 + 6$ True or false? $4 + 6 + 8 > 3 + 7 + 9$</p> </div> <div style="width: 30%;"> <p>Unitising in 10s</p> <p>$60 + 2 = 62$ $62 + 2 = \square$ $62 + 12 = \square$ $62 + 22 = \square$</p> </div> <div style="width: 30%;"> <p>Use questioning to develop reasoning e.g. What's the same? what different?</p> <p>$23 + 10$ $23 + 20$ $23 + 30$ $23 + 40$</p> </div> <div style="width: 30%;"> <p>How can I use a 100 square to add $32 + 22$?</p> </div> <div style="width: 30%;"> <p>Number tracks</p> </div> <div style="width: 30%;"> <p>Bridging across tens</p> <p>$26 + 28$: $26 + 4 + 24 = 30 + 24 = 54$</p> </div> <div style="width: 30%;"> <p>Compensating using balance</p> <p>$26 + 28$ $24 + 30 =$</p> </div> </div> <p>Cuisenaire is a useful concrete resource that develops understanding of the pictorial bar model</p> <p>'Magic 10' $19 + 16 = 19 + 1 + 15 = 20 + 15 = 35$</p> <p>I can use Dienes to balance this number sentence $23 + 6 = 20 + \square$</p> <p>6 and how many more make 10! $6 + \square = 10$</p> <p>I know that 7 is greater than 6, so 5 plus 7 must be greater than 5 plus 6</p> <p>Which line has most money? How much more?</p> <p>Use a range of concrete and pictorial representations, including:</p> <p>Use a 100 square to add $32 + 22$?</p> <p>Compensating using balance</p> <p>Number tracks</p> <p>Bridging across tens</p> <p>Compensating using balance</p>	<p>Know pairs of numbers which make each total up to 10</p> <p>Add two single digit numbers</p> <p>Add a single-digit number to a 2-digit number by counting on in ones</p> <p>Add 10 and small multiples of 10 to a 2-digit number by counting on in tens</p>

$12 + 30 = 30 + 12$	$65 = 60 + 5$
$\square + 25 = 25 + 41$	$65 = 50 + 15$
$17 + 2 = 19$	$65 = 40 + 25$
$12 + 4 = 16$	$65 = 30 + 35$
$57 + 2 = 59$	$65 = 20 + 45$
$32 + 34 = 66$	$65 = 10 + 55$

Year	Mental calculation	Written Calculation	Default for ALL children
Subtraction	<p>Number bonds – knowing all the pairs of numbers which make all the numbers to 12</p> <p>Count back in ones and tens from any given 2-digit number</p> <p>Subtract a single-digit number from any 2-digit number using number facts, including bridging multiples of 10, e.g. $56 - 3$, $53 - 5$.</p> <p>Subtract 10 and small multiples of 10 from any given 2-digit number</p> <p>Subtract any pair of 2-digit numbers by counting back in tens and ones or by counting up.</p>	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Jottings to support informal methods:</p> <p>Bridge through 10 where necessary 32 - 17</p>  <p>Written recording: $37 - 12 = 37 - 10 - 2$ $= 27 - 2$ $= 25$</p>  <p>Continue to use of a range of concrete and pictorial representations from Year 1, including Bar model to support understanding of difference. (See below).</p> </div> <div style="width: 45%;">  <p>$54 - 32 = 22$</p> <p>- = signs and missing numbers Continue using a range of equations as in Year 1 but with appropriate numbers. Extend to $14 + 5 = 20 - \square$ Find a small difference by counting up $42 - 39 = 3$</p>  </div> </div> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p style="text-align: center;">Informal methods to support written subtraction calculations</p> <p>Practical partitioning of a 2-digit number</p>  <p>In Year 1 leads to:</p> <p>The difference between 11 and 14 is 3. $14 - 11 = 3$ $11 + \square = 14$</p> <p>which can lead to exploration and variation</p> <p>$4 - 1 = 3$ $14 - 11 = 3$ $24 - 21 = 3$</p> <p>Subtract (without decomposition) using partitioning and manipulatives, e.g. Dienes or straw bundles</p> <p>To calculate $35 - 22$, remove 22.  Then record: $35 - 22 = 13$.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">Pupils experience bridging through 10 using number bonds and the Part Whole model.</p>  <p>8 can be partitioned using the Part Whole model.</p> </div> </div>	<p>Know pairs of numbers which make each total up to 10</p> <p>Subtract a single-digit number from a 2-digit number by counting back in ones</p> <p>Subtract 10 and small multiples of 10 from a 2-digit number by counting back in tens</p>

Year	Mental calculation	Written Calculation	Default for ALL children
Multiplication	<p>Count in 2s, 5s and 10s Begin to count in 3s. Begin to understand that multiplication is repeated addition and to use arrays (E.g. 3 x 4 is three rows of 4 dots) Begin to learn the 2x, 3x, 5x and 10x tables, seeing these as 'lots of', e.g. 5 lots of 2, 6 lots of 2, 7 lots of 2, etc. Double numbers up to 20 Begin to double multiples of 5 to 100 Begin to double two-digit numbers less than 50 with 1s digits of 1, 2, 3 4 or 5</p>	<p>calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (\times), division (\div) and equals (=) signs • Begin to use other multiplication tables and recall facts to perform written calculations • Use a range of materials and contexts ... including arrays and repeated addition</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> $7 \times 2 = \square$ $7 \times \square = 14$ $\square \times 2 = 14$ $\triangle \times \square = 14$ </div> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Representations to support mental and written calculations.</p> <div style="border: 1px solid black; padding: 5px;"> <p>Use a range of concrete and pictorial representations, including:</p> <p>Concrete to pictorial: counting in 10s </p> <p>What multiplication sentences can you write with these numbers: 5, 10, 50?</p> <p>Counting 5 minute intervals </p> <p>Counting tally marks to support counting in 5s. </p> <p>Groups of 10, six times  $10 \times 6 = 60$</p> <p>I want five, four times  $5 \times 4 = 20$</p> <p>I want four, five times  $4 \times 5 = 20$</p> <p>What arrays can you make with 20 counters?  $10 \times 2 = 20$ $20 \times 1 = 20$ $10 \times 3 = 30$</p> <p>3 multiplied by 5 $\rightarrow 3 \times 5$ $3 + 3 + 3 + 3 + 3 =$  5×6 $? \times 5$</p> <p>Using the bar model to solve problems A book costs £5. Rosie buys twice as many as Jim. How much do they spend altogether? Rosie  Jim  } ? $5 \times 3 = 15$ They spend £15 altogether.</p> <p>What do you notice about the numbers covered up? Is there a pattern? What number is next? </p> <p>Develop an understanding of the equals sign: $10 + 10 = 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2$ $5 + 5 + 5 + 5 = 4 + 4 + 4 + 4 + 4$</p> <p>doubling  $14 \times 2 = 28$</p> <p>Using coins:  $10p \times 6 = 60p$ $2p \times 6 = 12p$</p> <p>Contextualise the maths: Would you rather have: 4 packets of biscuits with 5 in each packet, or 3 packets of biscuits with 10 in each packet? Explain your answer.</p> </div>	

Year	Mental calculation	Written Calculation	Default for ALL children
<i>Division</i>	<p>Count in 2s, 5s and 10s Begin to count in 3s Using fingers, say where a given number is in the 2s, 5s or 10s count. (E.g. 8 is the fourth number when I count in twos.) Relate division to grouping. (E.g. how many groups of five in fifteen?) Halve numbers to 20 Begin to halve numbers to 40 and multiples of 10 to 100 Find $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{3}{4}$ of a quantity of objects and of amounts (whole number answers)</p>	<p style="text-align: center;">“There are 26 straws. $\frac{1}{2}$ of the straws is equal to 13 straws.”</p> <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> $\frac{1}{2}$ of 26 = 13 $26 \div 2 = 13$ </div> <div style="background-color: orange; padding: 5px; border: 1px solid black;"> <p style="margin: 0;">Pupils decode a problem first, represent it using manipulatives and jottings; and finally record it symbolically.</p> </div> </div> <p>The importance of the relationship between known multiplication facts and the concept of division are essential for children to link their developing processing skills.</p> <div style="border: 1px solid black; padding: 10px;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">Representations to support mental and written calculations.</p> <p>Use a range of concrete and pictorial representations, including:</p> <ul style="list-style-type: none"> Arrays  $7 \times 2 = 14$ $14 \div 2 = 7$ Number lines to support grouping  $10p + 10p + 10p + 10p + 10p = 50p$ $10p \times 5 = 50p$ 5 hops of 10 Representations to support multiplicative reasoning:  <div style="border: 1px solid purple; border-radius: 15px; padding: 5px; display: inline-block;"> Using Dienes: “If $40 \div 10 = 4$ and $30 \div 10 = 3$, what do you think $70 \div 10$ would be? Why?” </div>  <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid purple; border-radius: 15px; padding: 5px; background-color: #e0e0ff;"> Is 14 an odd number? How do you know? </div>  </div> <div style="text-align: center; margin-top: 20px;">  <div style="border: 1px solid gray; border-radius: 50%; padding: 10px; display: inline-block;"> “How many groups of 5 minutes have passed when the minute hand reaches twenty past?” </div> </div> <div style="text-align: center; margin-top: 20px;">  </div> </div>	

Lower Key stage 2

	Overview of LKS2	<p>In the lower juniors, children build on the concrete and conceptual understandings they have gained in the Infants to develop a real mathematical understanding of the four operations, in particular developing arithmetical competence in relation to larger numbers. In addition and subtraction, they are taught to use place value and number facts to add and subtract numbers mentally and will develop a range of strategies to enable them to discard the 'counting in ones' or fingers-based methods of the infants. In particular, they will learn to add and subtract multiples and near multiples of 10, 100 and 1000, and will become fluent in complementary addition as an accurate means of achieving fast and accurate answers to 3-digit subtractions. Standard written methods for adding larger numbers are taught, learned and consolidated, and written column subtraction is also introduced. This key stage is also the period during which all the multiplication and division facts are thoroughly memorised, including all facts up to the 12 x 12 table. Efficient written methods for multiplying or dividing a 2-digit or 3-digit number by a single-digit number are taught, as are mental strategies for multiplication or division with large but friendly numbers, e.g. when dividing by 5 or multiplying by 20. Children will develop their understanding of fractions, learning to reduce a fraction to its simplest form as well as finding non-unit fractions of amounts and quantities. The concept of a decimal number is introduced and children consolidate a firm understanding of one-place and two-place decimals (often through use of money), multiplying and dividing whole numbers by 10 and 100.</p> <p>EMPHASISE THE PLACE VALUE OF DIGITS WITHIN A NUMBER BEFORE AND DURING ANY FORMAL CALCULATION STRATEGIES.</p>
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Year
3

Addition

Know pairs with each total to 20
 Know pairs of multiples of 10 with a total of 100
 Add any two 2-digit numbers by counting on in 10s and 1s or by using partitioning
 Add multiples and near multiples of 10 and 100
 Perform place value additions without a struggle. (E.g. $300 + 8 + 50 = 358$)
 Use place value and number facts to add a 1-digit or 2-digit number to a 3-digit number. (E.g. $104 + 56$ is 160 since $104+50=154$ and $6+4=10$ and $676 + 8$ is 684 since $8=4+4$ and $76+4+4=84$)
 Add pairs of 'friendly' 3-digit numbers, e.g. $320 + 450$
 Begin to add amounts of money using partitioning.

Use expanded column addition to add two or three 3-digit numbers or three 2-digit numbers

$$\begin{array}{r} 30 + 4 \\ 20 + 5 \\ 50 + 9 \\ \hline 34 \\ +25 \\ 59 \end{array}$$

$$\begin{array}{r} 200 + 30 + 4 \\ 500 + 20 + 7 \\ 700 + 60 + 1 \\ 10 \quad 1 \\ \hline 234 \\ +527 \\ 761 \end{array}$$

Informal methods of recording are used as stepping stones to help children understand the logic of formal written methods.

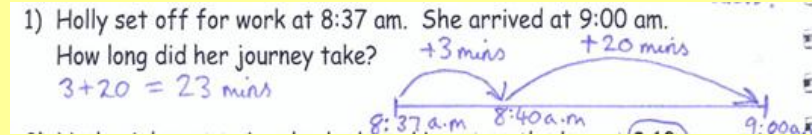
Begin to use compact column addition to add numbers with three digits.

$$587 + 475$$

$$\begin{array}{r} 587 \\ + 475 \\ \hline 1062 \\ \hline 11 \end{array}$$

Begin to add like fractions. (E.g. $\frac{3}{8} + \frac{1}{8} + \frac{1}{8}$)
 Recognise fractions that add to 1. (E.g. $\frac{1}{4} + \frac{3}{4}$ or $\frac{3}{5} + \frac{2}{5}$)

Use number lines for calculating with time.



Use a range of concrete, pictorial and abstract representations, including those below

Representations to support mental and written calculations.

Bundles of straws

0 + 50 + 3
 10 + 40 + 3
 20 + 30 + 3
 30 + 20 + 3
 40 + 10 + 3
 50 + 0 + 3

160 + 160

I can re-partition numbers mentally (& pictorially) to help with bridging through 10 and 100
 E.g. $78 + 53 = 78 + 22 + 31 = 131$

What is the same and what is different with these methods?

Use intelligent practice:
 $164 + 33 =$
 $264 + 33 =$
 $264 + 34 =$
 $64 + 33 =$
 $65 + 33 =$

64 + 33 = 97

Doubles and near doubles, using intelligent practice:
 $40 + 40 =$
 $45 + 45 =$
 $45 + 46 =$
 $130 + 130 =$
 $130 + 131 =$
 $129 + 130 =$
 $129 + 129 =$

Using empty box problems:
 $23 + \square = 67$
 $23 + \square = 68$
 $23 + \square = 69$
 $23 + \square = 70$
 $23 + \square = 71$

423 + $\square = 323 + 250$
 $523 + 150 = \square + 250$
 $623 + 50 = \square + \square$

I can explain my method using representations

leading to

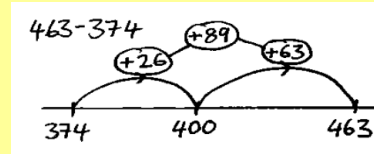
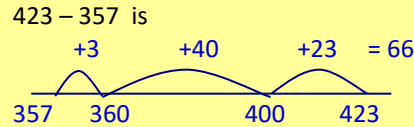
Dienes and place value counters

Know pairs of numbers which make each total up to 10, and which total 20
 Add two 2-digit numbers by counting on in tens and ones (E.g. $56 + 35$ is $56 + 30$ and then add the 5) to support mental calculation.
 Understand simple place value additions: $200 + 40 + 5 = 245$
 Use place value to add multiples of 10 or 100

Subtraction

Know pairs with each total to 20
 Subtract any two 2-digit numbers
 Perform place value subtractions without a struggle. (E.g. $536 - 30 = 506$, etc.)
 Subtract 2-digit numbers from numbers >100 by counting up. (E.g. $143 - 76$ is done by starting at 76, add 4 (80) then add 20 (100) then add 43 making the difference a total of 67)
 Subtract multiples and near multiples of 10 and 100
 Subtract, when appropriate, by counting back or taking away, using place value and number facts.
 Find change from £1, £5 and £10 (by counting on first).

Use counting up as an informal written strategy for subtracting pairs of three-digit numbers, e.g.



<p>(1) Extended columnar - no exchange</p> <p>Extended method $87 - 53 =$</p> $\begin{array}{r} 80 \text{ and } 7 \\ - 50 \text{ and } 3 \\ \hline 30 \text{ and } 4 = 34 \end{array}$	<p>(2) Extended columnar - with exchange:</p> <p>$87 - 58$ becomes</p> $\begin{array}{r} 70 + 17 \\ - 50 + 8 \\ \hline 20 + 9 \end{array}$	<p>$87 = 70 + 17$</p>
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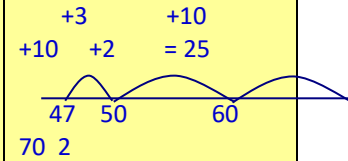
When ready begin to use formal columnar subtraction:

$$\begin{array}{r} 4 \ 12 \ 1 \\ 5 \ 3 \ 3 \\ - 1 \ 8 \ 7 \\ \hline 3 \ 4 \ 6 \end{array}$$

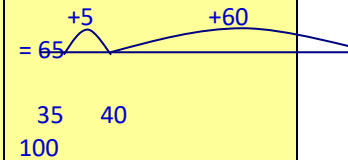
Begin to subtract like fractions. (E.g. $\frac{7}{8} - \frac{3}{8}$)

Know pairs of numbers which make each total up to 10, and which total 20

Count up to subtract 2-digit numbers: $72 - 47$ is



Subtract multiples of 5 from 100 by counting up



Subtract multiples of 10 and 100

Multiplication

Know by heart all the multiplication facts in the 2x, 3x, 4x, 5x, 8x and 10x tables
 Multiply whole numbers by 10 and 100
 Recognise that multiplication is commutative
 Use place value and number facts in mental multiplication. (E.g. 30×5 is 15×10)
 Partition teen numbers to multiply by a single-digit number. (E.g. 3×14 as 3×10 and 3×4)
 Double numbers up to 50

Use partitioning (grid multiplication) to multiply 2-digit and 3-digit numbers by 'friendly' single digit numbers. Move towards an understanding and use of formal column method when ready

Written Calculations

- write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods
- Estimate before calculating
- Ensure written methods build on/relate to mental methods

Towards the column method ...

x	20	4
6	120	24
120 + 24 = 144		

24	24 x 6 becomes
X 6	→ 12 4
120	
24	→ 1 2 4
144	

Answer: 144

Representations to support mental and written calculations.

Using arrays

Use arrays for partitioning too

2 digit x 1 digit number:
e.g. $7 \times 38 = 266$

x	30	8
7	210	56
210 + 56 = 266		

True or false?
 $4 \times 6 = 6 \times 4$

Use intelligent practice e.g.

- $3 \times \square + 2 = 20$
- $3 \times \square + 2 = 23$
- $3 \times \square + 2 = 26$
- $3 \times \square + 2 = 29$
- $3 \times \square + 2 = 35$
- $4 \times 5 = 10 \square 10$
- $6 \square 5 = 15 + 15$
- $6 \square 5 = 20 \square 10$
- $8 \square 5 = 20 \square 20$
- $8 \square 5 = 60 \square 20$

Spot the pattern!

Multiples of 2: 2 4 6 8 10 12 14 16 ...

Multiples of 4: 4 8 12 16 ...

Multiples of 8: 8 16 ...

What's the same? what's different about these two times tables?

4×7 7×4

Which is the odd one out? Why?
 24×3
 36×4
 13×5
 32×2

Know by heart the 2x, 3x, 4x, 5x and 10x tables
 Double given tables facts to get others
 Double numbers up to 25 and multiples of 5 to 50

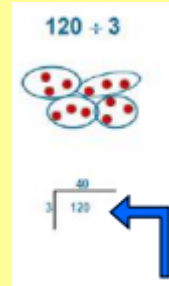
Division

Know by heart all the division facts derived from the 2x, 3x, 4x, 5x, 8x and 10x tables.
 Divide whole numbers by 10 or 100 to give whole number answers
 Recognise that division is not commutative.
 Use place value and number facts in mental division. (E.g. $84 \div 4$ is half of 42)
 Divide larger numbers mentally by subtracting the tenth multiple, including those with remainders. (E.g. $57 \div 3$ is $10 + 9$ as $10 \times 3 = 30$ and $9 \times 3 = 27$)
 Halve even numbers to 100, halve odd numbers to 20

Perform divisions just above the 10th multiple using the written layout and understanding how to give a remainder as a whole number.
 Make connections and hypotheses based on known facts:

New written methods can be modelled alongside mental or informal methods to ensure understanding.

"I know $6 \div 3 = 2$, so $60 \div 3 = 20$."
 "I know $12 \div 3 = 4$, so $120 \div 3 = 40$."



Introduce 'Chunking' to explain the process of formal short division:

3. Chunking- Using Multiples of the Divisor

$90 \div 5 = 18$

90	
- 50	(10 x 5)
40	
- 40	(8 x 5)
0	

Begin to introduce formal 'bus stop' division.

Representations to support mental and written calculations.

Use a range of concrete and pictorial resources, including:

$98 \div 7 = 14$

Answer is 14

$63 \div 3$ equals three groups of 2 tens and a one.

$3 \overline{) 63} = 21$

I know that $63 \div 3 = 21$, so $63 \div 21 = 3$, and $21 \times 3 = 63$, so $3 \times 21 = 63$.

An array for $56 \div 7$

The array is an image for division too:

Informal exploration with manipulatives supports the progression to formal written methods—which is continued in Year 4.

How could I calculate $72 \div 3$?

Know by heart the division facts derived from the 2x, 3x, 5x and 10x tables
 Halve even numbers up to 50 and multiples of ten to 100
 Perform divisions within the tables including those with remainders, e.g. $38 \div 5$.

Find unit fractions of quantities and begin to find non-unit fractions of quantities

Addition

Year 4

Add any two 2-digit numbers by partitioning or counting on
 Know by heart/quickly derive number bonds to 100 and to £1
 Add to the next hundred, pound and whole number. (E.g. $234 + 66 = 300$, $3.4 + 0.6 = 4$)
 Perform place value additions without a struggle. (E.g. $300 + 8 + 50 + 4000 = 4358$)
 Add multiples and near multiples of 10, 100 and 1000.
 Add £1, 10p, 1p to amounts of money
 Use place value and number facts to add 1-, 2-, 3- and 4-digit numbers where a mental calculation is appropriate'. (E.g. $4004 + 156$ by knowing that $6+4=10$ and that $4004+150=4154$ so total is 4160)

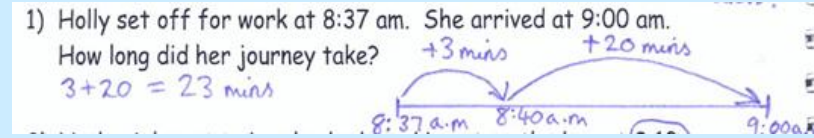
Column addition for 3-digit, 4-digit numbers and beyond.
 Begin to use addition with decimals:

$$\begin{array}{r} 24.5 \\ +17.6 \\ \hline 42.1 \\ 11 \end{array}$$

Add like fractions, e.g. $\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1 \frac{2}{5}$.

Be confident with fractions that add to 1 and fraction complements to 1. (E.g. $\frac{2}{3} + ? = 1$)

Use number lines for calculating with time.



Use physical/pictorial representations alongside expanded and columnar methods.

Representations to support mental and written calculations.

Bundles of straws
 $42 + 31 = 73$

Using Dienes
 $42 + 31 = 73$

Compensating in mental addition
 $42 + 97 = 140$
 $140 - 1 = 139$

Place value cards & counters to counters support the expanded method in readiness
 Make 9999
 $5000 + \square = 9999$
 $4000 + \square = 9999$
 $3000 + \square = 9999$
 $2000 + \square = 9999$
 $1000 + \square = 9999$

Make 9990
 $5023 + \square = 9990$
 $4023 + \square = 9990$
 $3023 + \square = 9990$

Use the bar model to reinforce the inverse relationship between addition & subtraction
 $2300 + 1200 = 3500$
 $3500 - 2300 = 1200$
 $3500 - 1200 = 2300$

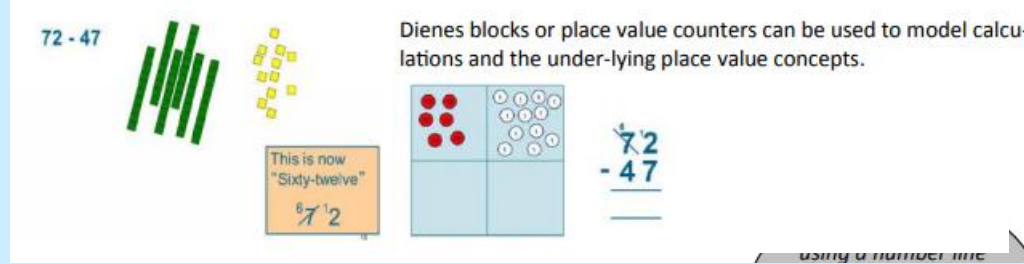
Ask what is the same and what is different about all these methods?

Add any 2-digit numbers by partitioning or counting on
 Number bonds to 20
 Know pairs of multiples of 10 with a total of 100
 Add friendly larger numbers using knowledge of place value and number facts
 Use expanded column addition to add 3-digit numbers

Subtraction

Subtract any two 2-digit numbers
 Know by heart/quickly derive number bonds to 100
 Perform place value subtractions without a struggle. (E.g. $4736 - 706 = 4030$, etc.)
 Subtract multiples and near multiples of 10, 100 and 100
 Subtract by counting up. (E.g. $503 - 368$ is done by adding: $368 + 2 + 30 + 100 + 3$ so we added 135)
 Subtract, when appropriate, by counting back or taking away, using place value and number facts.
 Subtract £1, 10p, 1p from amounts of money
 Find change from £10, £20 and £50.

Use expanded column subtraction for 3-digit and 4-digit numbers for children still grasping the concept.

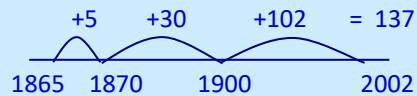


Then move onto formal columnar subtraction when a child is ready:

$$\begin{array}{r} 4 \ 12 \ 1 \\ 5 \ 3 \ 3 \\ - 1 \ 8 \ 7 \\ \hline 3 \ 4 \ 6 \end{array}$$

Use complementary addition to subtract amounts of money, and for subtractions where the larger number is a near multiple of 1000 or 100

E.g. $2002 - 1865$ is



Subtract like fractions, e.g. $\frac{1}{4} + \frac{1}{8} = \frac{3}{8}$

Use fractions that add to 1 to find fraction complements to 1, e.g. $1 - \frac{2}{3} = \frac{1}{3}$

Use counting up with confidence to solve most subtractions, including finding complements to multiples of 100.

Multiplication

Know by heart all the multiplication facts up to 12 x 12.

Recognise factors up to 12 of two-digit numbers.

Multiply whole numbers and one-place decimals by 10, 100, 1000

Multiply multiples of 10, 100, 1000 by single digit numbers. (E.g. 300 x 6 or 4000 x 8)

Use understanding of place value and number facts in mental multiplication. (E.g. 36 x 5 is half of 36 x 10 and 50 x 60 = 3000)

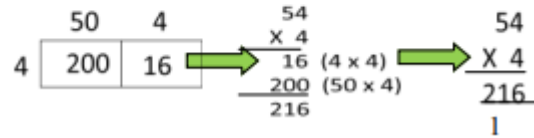
Partition 2-digit numbers to multiply by a single-digit number mentally. (E.g. 4 x 24 as 4 x 20 and 4 x 4)

Multiply near multiples using rounding. (E.g. 33 x 19 as 33 x 20 - 33)

Find doubles to double 100 and beyond using partitioning

Begin to double amounts of money. (E.g. £35.60 doubled = £71.20.)

- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- Estimate before calculating
- Ensure written methods build on/relate to mental methods (e.g. grid method) based on an understanding of place value
- Use grid and expanded column methods as stepping stones alongside



Key skills to support:

- know or quickly recall multiplication facts up to 12 x 12
- understand the effect of multiplying numbers by 10, 100 or 1000
- multiply multiples of 10, for example, 20 x 40;
- approximate, e.g. recognise that 72 x 38 is approximately 70 x 40 = 2800 and use this information to check whether their answer appears sensible

Representations to support mental and written calculations.

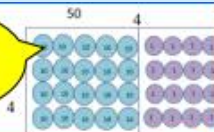
Ensure children can confidently multiply & divide by 10 and 100, that multiplying by 10 makes the number bigger and all digits move one place to the left, while dividing by 10 makes the number smaller and all the digits move one place to the right.

Moving digits ITP



$$\begin{array}{r} 245 \\ \times 6 \\ \hline 1470 \end{array}$$

I can use place value counters to model the grid method

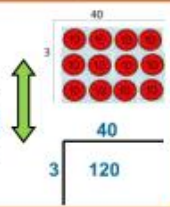


Three ways to calculate 7 x 6:
 $7 \times 6 = 7 \times 5 + 7$ $7 \times 6 = 7 \times 7 - 7$ $7 \times 6 = \square \times \square$
 Now find the answer to 6 x 9 in three different ways.

This digit is worth 200

This digit is worth 30

Use arrays made with place value counters to demonstrate the link between multiplication and division. This will support understanding of the grid method.



Children need to understand and apply the language of multiples and factors and use it in solving multiplication and division problems e.g. 'All factors of 36 are multiples of 2, true or false? Find me two factors of 48 that are also multiples of 3.'

Use intelligent practice e.g.

$2 \times 3 =$	$6 \times 7 =$	$9 \times 8 =$
$2 \times 30 =$	$6 \times 70 =$	$9 \times 80 =$
$2 \times 300 =$	$6 \times 700 =$	$9 \times 800 =$
$20 \times 3 =$	$60 \times 7 =$	$90 \times 8 =$
$200 \times 3 =$	$600 \times 7 =$	$900 \times 8 =$

Using the bar model to solve problems:

Sam has 12 football cards.
 Sally has 6 times as many football cards as Sam.
 How many cards do Sally and Sam have altogether?

12

$12 \times 7 = 78$
 Altogether they have 78 football cards

Know by heart multiplication tables up to 10 x 10
 Multiply whole numbers by 10 and 100
 Use grid method to multiply a 2-digit or a 3-digit number by a number up to and including 6

Division

Know by heart all the division facts up to $144 \div 12$.
 Divide whole numbers by 10, 100 to give whole number answers or answers with one decimal place
 Divide multiples of 100 by 1-digit numbers using division facts. (E.g. $3200 \div 8 = 400$)
 Use place value and number facts in mental division. (E.g. $245 \div 20$ is double $245 \div 10$)
 Divide larger numbers mentally by subtracting the 10^{th} or 20^{th} multiple as appropriate. (E.g. $156 \div 6$ is $20 + 6$ as $20 \times 6 = 120$ and $6 \times 6 = 36$) BEFORE moving on to the formal BUS-STOP method.
 Find halves of even numbers to 200 and beyond using partitioning
 Begin to halve amounts of money. (E.g. Half of $\pounds 52.40 = \pounds 26.20$)

Use a written method to divide a 2-digit or a 3-digit number by a single-digit number.
 Give remainders as whole numbers. For children requiring consolidation, refer back to 'chunking':

Using Chunking with remainders

$87 \div 4 = 21 \text{ r } 3$

$$\begin{array}{r} 4 \overline{) 87} \\ - 40 \text{ (10 x 4)} \\ \hline 47 \\ - 40 \text{ (10 x 4)} \\ \hline 7 \\ - 4 \text{ (1 x 4)} \\ \hline 3 \end{array}$$

For most, formal bus-stop division is expected, leading to higher level calculations by the end of Year 4, beginning of Year 5:

$$846 \div 3 = 282$$

$$\begin{array}{r} 282 \\ 3 \overline{) 846} \end{array}$$

$$423 \div 9 = 47$$

$$\begin{array}{r} 047 \\ 9 \overline{) 423} \end{array}$$

Representations to support mental and written calculations.

$693 \div 3$

3

By working through larger number calculations with manipulatives, children gain experience of exchange (re-partitioning) within division algorithms.

$492 \div 4$

1 2 3

Children can work in pairs: child A constructs the array (dividing manipulatives into 3 rows), child B checks it and records this in a formal, short division format.

By the end of Year 4, children need to have encountered remainders in a number of contexts. Pupils can be introduced to remainders using known facts: e.g. $13 \div 4$; and then progress to larger numbers. (See below).


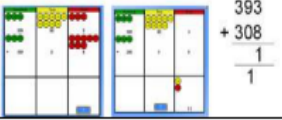
$200 \div 6 = 33 \text{ r } 2$

Money can be used instead of place value counters.

Begin to reduce fractions to their simplest forms.
 Find unit and non-unit fractions of larger amounts.

Know by heart all the division facts up to $100 \div 10$.
 Divide whole numbers by 10 and 100 to give whole number answers or answers with one decimal place
 Perform divisions just above the 10^{th} multiple using the written layout and understanding how to give a remainder as a whole number.
 Find unit fractions of amounts

Upper Key stage 2

	Overview of LKS2	<p>Children move on from dealing mainly with whole numbers to performing arithmetic operations with both decimals and fractions. They will consolidate their use of written procedures in adding and subtracting whole numbers with up to 6 digits and also decimal numbers with up to two decimal places. Mental strategies for adding and subtracting increasingly large numbers will also be taught. These will draw upon children's robust understanding of place value and knowledge of number facts. Efficient and flexible strategies for mental multiplication and division are taught and practised, so that children can perform appropriate calculations even when the numbers are large, such as $40,000 \times 6$ or $40,000 \div 8$. In addition, it is in Y5 and Y6 that children extend their knowledge and confidence in using written algorithms for multiplication and division. Fractions and decimals are also added, subtracted, divided and multiplied, within the bounds of children's understanding of these more complicated numbers, and they will also calculate simple percentages and ratios. Negative numbers will be added and subtracted.</p> <p>Use number lines for calculating with time.</p>										
Year 5	Addition	<p>Know numbers bonds to 1 and to the next whole number Add to the next 10 from a decimal number, e.g. $13.6 + 6.4 = 20$ Add numbers with two significant digits only, using mental strategies. (E.g. $3.4 + 4.8$ or $23,000 + 47,000$) Add one or two-digit multiples of 10, 100, 1000, 10,000 and 100,000. (E.g. $8000 + 7000$ or $600,000 + 700,000$) Add near multiples of 10, 100, 1000, 10,000 and 100,000 to other numbers. (E.g. $82,472 + 30,004$) Add decimal numbers which are near multiples of 1 or 10, including money. (E.g. $6.34 + 1.99$ or $£34.59 + £19.95$) Use place value and number facts to add two or more friendly numbers including money and decimals. (E.g. $3 + 8 + 6 + 4 + 7$, $0.6 + 0.7 + 0.4$, or $2,056 + 44$)</p>	<p>Use column addition to add two or three whole numbers with up to 5 digits Use column addition to add any pair of two-place decimal numbers including amounts of money and numbers with different amounts of decimal places:</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;"> $\begin{array}{r} 18,376 \\ 2,498 \\ 34,271 \\ \hline 55,145 \\ 1121 \end{array}$ </div> <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;"> $\begin{array}{r} 24.5 \\ + 3.67 \\ \hline 28.17 \\ 1 \end{array}$ </div> </div> <p>Begin to add related fractions using equivalences. (E.g. $\frac{1}{2} + \frac{1}{6} = \frac{3}{6} + \frac{1}{6}$) Choose the most efficient method in any given situation</p> <div style="border: 1px solid black; padding: 10px; background-color: #ffffcc;"> <p style="text-align: center;">Use physical/pictorial representations alongside columnar methods where needed.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>12 462 + 2300 = 12 462 + 2000 + 300 = 14 462 + 300 = 14 762</p> <p>Partitioning and recombining</p>  <p>Jottings to support mental calculation</p> </div> <div style="width: 30%; border: 1px solid orange; padding: 5px;"> <p>Use the bar model to reinforce the inverse relationship between addition & subtraction:</p> <table border="1" style="font-size: small;"> <tr><td>□ + □ = □</td><td>□ - □ = □</td></tr> <tr><td>□ + □ = □</td><td>□ - □ = □</td></tr> <tr><td>□ + □ = □</td><td>□ - □ = □</td></tr> <tr><td>□ + □ = □</td><td>□ - □ = □</td></tr> </table> <p>This supports problem solving: Sam and Tom have £67.80 between them. If Sam has £6.20 more than Tom, how much does Tom have?</p> <p>Sam: +£6.20 Tom: } £67.80</p> <p>$£67.80 - £6.20 = £61.60$ $£61.60 \div 2 = £30.80$ Tom has £30.80</p> </div> <div style="width: 30%;"> <p>$1.6 + 1.4 = 3$ Write down three more pairs of decimal numbers that sum to 3</p> <p>Place Value counters to support column addition</p>  <p>Compensating: true or false? $2741 + 1263 = 2742 + 1262$ Why? Can you use resources or draw a picture to explain your answer? How can you adjust this to make the calculation easier? $3498 + 2067$</p> <div style="border: 1px solid blue; border-radius: 15px; padding: 5px; background-color: #d0e0ff; text-align: center;"> <p>What is the same and what is different about all these methods?</p> </div> </div> </div> </div>	□ + □ = □	□ - □ = □	□ + □ = □	□ - □ = □	□ + □ = □	□ - □ = □	□ + □ = □	□ - □ = □	<p>Add numbers with only 2-digits which are not zeros, e.g. $3.4 + 5.8$ Derive swiftly and without any difficulty number bonds to 100 Add friendly large numbers using knowledge of place value and number facts Use expanded column addition to add pairs of 4- and 5-digit numbers</p>
□ + □ = □	□ - □ = □											
□ + □ = □	□ - □ = □											
□ + □ = □	□ - □ = □											
□ + □ = □	□ - □ = □											

Subtraction

Subtract numbers with two significant digits only, using mental strategies. (E.g. $6.2 - 4.5$ or $72,000 - 47,000$)
 Subtract one or two-digit multiples of 100, 1000, 10,000 and 100,000. (E.g. $8000 - 3000$ or $600,000 - 200,000$)
 Subtract one or two digit near multiples of 100, 1000, 10,000 and 100,000 from other numbers. (E.g. $82,472 - 30,004$)
 Subtract decimal numbers which are near multiples of 1 or 10, including money. (E.g. $6.34 - 1.99$ or $£34.59 - £19.95$)
 Use counting up subtraction, with knowledge of number bonds to 10/100 or £1, as a strategy to perform mental subtraction. (E.g. $£10 - £3.45$ or $1000 - 782$)
 Recognise fraction complements to 1 and to the next whole number. (E.g. $1 \frac{2}{5} + \frac{3}{5} = 2$) $4 - 5$

Use compact or expanded column subtraction to subtract numbers with up to 5 digits.

932 - 457 becomes

$$\begin{array}{r} \overset{8}{9} \overset{12}{3} \overset{1}{2} \\ - 457 \\ \hline 475 \end{array}$$

Consolidate columnar methods, paying particular attention to the occurrence of zeros as place holders.

$$\begin{array}{r} 18\overset{6}{7}\overset{10}{1}1 \\ - 5456 \\ \hline 13255 \end{array}$$

$$\begin{array}{r} 178\overset{9}{0}\overset{10}{1}1 \\ - 5456 \\ \hline 12555 \end{array}$$

Use complementary addition for subtractions where the larger number is a multiple or near multiple of 1000.

Use complementary addition for subtractions of decimals with up to two places incl. amounts of money

Begin to subtract related fractions using equivalences. (E.g. $\frac{1}{2} - \frac{1}{6} = \frac{2}{6}$)

Use columnar subtraction including decimals with different numbers of decimal places:

$$\begin{array}{r} 4.2 - 0.37 \\ \overset{3}{4} \overset{1}{2} \overset{10}{0} \\ - 0.37 \\ \hline 3.83 \end{array}$$

Choose the most efficient method in any given situation

Derive swiftly and without difficulty number bonds to 100
 Use counting up with confidence to solve most subtractions, including finding complements to multiples of 1000. (E.g. $3000 - 2387$ is done by

$$\begin{array}{r} +3 \quad +10 \quad +600 \\ = 613 \\ \hline 2387 \quad 2390 \quad 2400 \\ 3000 \end{array}$$

Multiplication

Know by heart all the multiplication facts up to 12 x 12.
 Multiply whole numbers and one-and two-place decimals by 10, 100, 1000, 10,000
 Use knowledge of factors and multiples in multiplication. (E.g. 43 x 6 is double 43 x 3, and 28 x 50 is ½ of 28 x 100 = 1400)
 Use knowledge of place value and rounding in mental multiplication. (E.g. 67 x 199 as 67 x 200 – 67)
 Use doubling and halving as a strategy in mental multiplication. (E.g. 58 x 5 = half of 58 x 10, and 34 x 4 is 34 doubled twice)
 Partition 2-digit numbers, including decimals, to multiply by a single-digit number mentally. (E.g. 6 x 27 as 6 x 20 (120) plus 6 x 7 (42) making 162 or 6.3 x 7 as 6 x 7 plus 0.3 x 7)
 Double amounts of money by partitioning. (E.g. £37.45 doubled = £74.90 plus 45p doubled (90p) £74.90)

Use short multiplication to multiply a 1-digit number by a number with up to 4 digits
 Use long multiplication to multiply 3-digit and 4-digit number by a number between 11 and 20
 Choose the most efficient method in any given situation

$$\begin{array}{r} 184 \\ \times 32 \\ \hline 368 \text{ (184 x 2)} \\ 5520 \text{ (184 x 30)} \\ \hline 5888 \end{array}$$

Initially it is helpful to break these calculation out separately into 3 steps

STEP 1

$$\begin{array}{r} 184 \\ \times 2 \\ \hline 368 \end{array}$$

STEP 2

$$\begin{array}{r} 184 \\ \times 30 \\ \hline 5520 \end{array}$$

STEP 3

$$\begin{array}{r} 5520 \\ + 368 \\ \hline 5888 \end{array}$$

Written Calculations

- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

24 x 16 becomes $\begin{array}{r} 24 \\ \times 16 \\ \hline 144 \\ 240 \\ \hline 384 \end{array}$ Answer: 384

124 x 26 becomes $\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \end{array}$ Answer: 3224

124 x 26 becomes $\begin{array}{r} 124 \\ \times 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \end{array}$ Answer: 3224

2741 x 6 becomes $\begin{array}{r} 2741 \\ \times 6 \\ \hline 16446 \end{array}$ Answer: 16446

Compact methods for multiplication are efficient but often do not make the value of each digit explicit. When introducing multiplication of decimals, it is sensible to take children back to an expanded form such as the grid method where the value of each digit is clear, to ensure that children understand the process.

Revert to expanded methods if children find formal calculation method difficult (see Y3/Y4)

Representations to support mental and written calculations.

3000 500 60 7
 20 60000 10000 1200 140 71340
 4 12000 2000 240 28 14268
 Total 85608

3567
 x24
 14268
 71340
 85608

4 x 6 x 2 = x 3 x 4

8 is a multiple of 4 and a factor of 16
 6 is a multiple of 3 and a factor of
 is a multiple of 5 and a factor of
 is a multiple of and a factor of

Complete the pyramid:
 108
 6
 3
 2

Build on children's understanding: demonstrate multiplication of a decimal number alongside its whole number equivalent:

$$\begin{array}{r} 326 \\ \times 8 \\ \hline 2608 \end{array}$$

$$\begin{array}{r} 3.26 \\ \times 8 \\ \hline 26.08 \end{array}$$

12 x 6 = 24 x 3
 True or false? Prove it!

0 6 12 18 24 30 36 42 48 54 60
 0 0.6 1.2 1.8 2.4 3 3.6 4.2 4.8 5.4 6

Start multiplying by using the least significant digit for the grid method will support children with implementation of the written procedure

Find simple percentages of amounts (e.g. 10%, 5%, 20%, 155 and 50%)
 Begin to multiply fractions and mixed numbers by whole numbers ≤ 10, e.g. 4 x 2/3 = 8/3 = 2 2/3.

Know multiplication tables to 11 x 11
 Multiply whole numbers and one-place decimals by 10, 100 and 1000
 Use knowledge of factors as aids to mental multiplication. (E.g. 13 x 6 = double 13 x 3 and 23 x 5 is ½ of 23 x 10)
 Use grid method to multiply numbers with up to 4-digits by one-digit numbers.
 Use grid method to multiply 2-digit by 2-digit numbers.

Division

Know by heart all the division facts up to $144 \div 12$.
 Divide whole numbers by 10, 100, 1000, 10,000 to give whole number answers or answers with 1, 2 or 3 decimal places
 Use doubling and halving as mental division strategies. (E.g. $34 \div 5$ is $(34 \div 10) \times 2$)
 Use knowledge of multiples and factors, also tests for divisibility, in mental division. (E.g. $246 \div 6$ is $123 \div 3$ and we know that 525 divides by 25 and by 3)
 Halve amounts of money by partitioning. (E.g. Half of £75.40 = half of £75 (37.50) plus half of 40p (20p) which is £37.70)
 Divide larger numbers mentally by subtracting the 10th or 100th multiple as appropriate. (E.g. $96 \div 6$ is $10 + 6$, as $10 \times 6 = 60$ and $6 \times 6 = 36$; $312 \div 3$ is $100 + 4$ as $100 \times 3 = 300$ and $4 \times 3 = 12$)
 Reduce fractions to their simplest form.

Use short division to divide a number with up to 4 digits by a number ≤ 12 .
 Give remainders as whole numbers or as fractions.

Handwritten examples:
 $846 \div 3 = 282$
 $423 \div 9 = 47$

Printed examples:
 $98 \div 7$ becomes 14 (Answer: 14)
 $432 \div 5$ becomes $86 \text{ r } 2$ (Answer: 86 remainder 2)
 $496 \div 11$ becomes $45 \frac{1}{11}$ (Answer: $45 \frac{1}{11}$)

Know by heart division facts up to $121 \div 11$
 Divide whole numbers by 10, 100 or 1000 to give answers with up to one decimal place.
 Use doubling and halving as mental division strategies
 Use efficient chunking to divide numbers ≤ 1000 by 1-digit numbers.
 Find unit fractions of 2 and 3-digit numbers

Representations to support mental and written calculations.

Can we divide this token into 6 equal groups?, then we must exchange it for ten tokens. Can we divide into 6 groups now?

Short division with exchange.

Understanding remainders.

Practical experience with manipulatives is vital for children to talk through the language of division e.g. *exchange*, *remainder*; and to embed conceptual understanding.

2 out of a whole group of 4 = $\frac{2}{4} = \frac{1}{2} = 0.5$

$98 \div 4 = \frac{98}{4} = 24 \text{ r } 2 = 24 \frac{1}{2} = 24.5$

What is the same? What's different about the ways that these remainders are expressed?

Find non-unit fractions of large amounts.

Turn improper fractions into mixed numbers and vice versa.
 Choose the most efficient method in any given situation

Subtraction

Use number bonds to 100 to perform mental subtraction of any pair of integers by complementary addition. (E.g. $1000 - 654$ as $46 + 300$ in our heads)

Use number bonds to 1 and 10 to perform mental subtraction of any pair of one-place or two-place decimal numbers using complementary addition and including money. (E.g. $10 - 3.65$ as $0.35 + 6$, $£50 - £34.29$ as $71p + £15$)

Use number facts and place value to perform mental subtraction of large numbers or decimal numbers with up to two places. (E.g. $467,900 - 3,005$ or $4.63 - 1.02$)

Subtract multiples of powers of ten and near multiples of the same.

Subtract negative numbers in a context such as temperature where the numbers make sense.

Use column subtraction to subtract numbers with up to 6 digits.

932 - 457 becomes

$$\begin{array}{r} 8 \quad 12 \quad 1 \\ 9 \quad 3 \quad 2 \\ - 4 \quad 5 \quad 7 \\ \hline 4 \quad 7 \quad 5 \end{array}$$

Consolidate columnar methods, paying particular attention to the occurrence of zeros as place holders.

$$\begin{array}{r} 1 \quad 8 \quad 6 \quad 10 \quad 1 \quad 1 \\ - 5 \quad 4 \quad 5 \quad 6 \\ \hline 1 \quad 3 \quad 2 \quad 5 \quad 5 \end{array}$$

$$\begin{array}{r} 1 \quad 7 \quad 8 \quad 9 \quad 10 \quad 1 \quad 1 \\ - 5 \quad 4 \quad 5 \quad 6 \\ \hline 1 \quad 2 \quad 5 \quad 5 \quad 5 \end{array}$$

Use complementary addition for subtractions where the larger number is a multiple or near multiple of 1000 or 10,000.

Use complementary addition for subtractions of decimal numbers with up to three places including money.

Use columnar subtraction of increasing complexity, including decimals with different numbers of decimal places:

$$\begin{array}{r} 4.2 - 0.37 \\ 3 \quad 4 \quad 2 \quad 0 \\ - 0 \quad 3 \quad 7 \\ \hline 3 \quad 8 \quad 3 \end{array}$$

Subtract mixed numbers and fractions with different denominators.

Use number bonds to 100 to perform mental subtraction of numbers up to 1000 by complementary addition. (E.g. $1000 - 654$ as $46 + 300$ in our heads.)

Use complementary addition for subtraction of integers up to 10,000. E.g. $2504 - 1878$

Use complementary addition for subtractions of one-place decimal numbers and amounts of money. (E.g. $£7.30 - £3.55$)

Multiplication

Know by heart all the multiplication facts up to 12 x 12.
 Multiply whole numbers and decimals with up to three places by 10, 100 or 1000, e.g. $234 \times 1000 = 234,000$ and $0.23 \times 1000 = 230$
 Identify common factors, common multiples and prime numbers and use factors in mental multiplication. (E.g. 326×6 is 652×3 which is 1956)
 Use place value and number facts in mental multiplication. (E.g. $40,000 \times 6 = 24,000$ and $0.03 \times 6 = 0.18$)
 Use doubling and halving as mental multiplication strategies, including to multiply by 2, 4, 8, 5, 20, 50 and 25 (E.g. 28×25 is $\frac{1}{4}$ of $28 \times 100 = 700$)
 Use rounding in mental multiplication. (34×19 as $(20 \times 34) - 34$)
 Multiply one and two-place decimals by numbers up to and including 10 using place value and partitioning. (E.g. 3.6×4 is $12 + 2.4$ or 2.53×3 is $6 + 1.5 + 0.09$)
 Double decimal numbers with up to 2 places using partitioning
 e.g. 36.73 doubled is double 36 (72) plus double 0.73 (1.46)

Use short multiplication to multiply a 1-digit number by a number with up to 4 digits
 Use long multiplication to multiply a 2-digit by a number with up to 4 digits
 Use short multiplication to multiply a 1-digit number by a number with one or two decimal places, including amounts of money.
 Use long multiplication to multiply whole numbers by numbers including decimals:

$$\begin{array}{r} \text{£ } 6.23 \\ \times \quad 27 \\ \hline 43.61 \\ 124.60 \\ \hline \text{£ } 168.21 \end{array}$$

Representations to support mental and written calculations.

Look at long-multiplication calculations containing errors, identify the errors and determine how they should be corrected

Using the bar model to solve problems:
 A gardener plants tulip bulbs in a flower bed. She plants 3 red bulbs for every 4 white bulbs. She plants 60 red bulbs.
 How many white bulbs does she plant?

Use empty box questions:
 $\square \times \square = 864$
 $\square \times \square \times \square = 864$

What's the same? What's different?

Use questioning to develop conceptual understanding e.g.
 Which is the odd one out?
 24×3 36×4 13×5 32×2

BODMAS

- 8-4 x 3 + 8-4 x 7
- 6-7 x 5 - 0-67 x 50
- 93 x 0-2 + 0-8 x 93
- 7-2 x 4 + 3-6 x 8

Multiply fractions and mixed numbers by whole numbers.
 Multiply fractions by proper fractions.
 Use percentages for comparison and calculate simple percentages.

Know by heart all the multiplication facts up to 12 x 12.
 Multiply whole numbers and one-and two-place decimals by 10, 100 and 1000.
 Use an efficient written method to multiply a one-digit or a teens number by a number with up to 4-digits by partitioning (grid method).
 Multiply a one-place decimal number up to 10 by a number ≤ 100 using grid method.

Division

Know by heart all the division facts up to $144 \div 12$.
Divide whole numbers by powers of 10 to give whole number answers or answers with up to three decimal places.
Identify common factors, common multiples and prime numbers and use factors in mental division. (E.g. $438 \div 6$ is $219 \div 3$ which is 73)
Use tests for divisibility to aid mental calculation.
Use doubling and halving as mental division strategies, e.g. to divide by 2, 4, 8, 5, 20 and 25. (E.g. $628 \div 8$ is halved three times: 314, 157, 78.5)
Divide one and two place decimals by numbers up to and including 10 using place value. (E.g. $2.4 \div 6 = 0.4$ or $0.65 \div 5 = 0.13$, $\pounds 6.33 \div 3 = \pounds 2.11$)
Halve decimal numbers with up to 2 places using partitioning e.g. *Half of 36.86 is half of 36 (18) plus half of 0.86 (0.43)*
Know and use equivalence between simple fractions, decimals and percentages, including in different contexts.
Recognise a given ratio and reduce a given ratio to its lowest terms.

Consolidate all of the division work established in previous years.
Use short division to divide a number with up to 4 digits by a 1-digit or a 2-digit number
Use long division to divide 3-digit and 4-digit numbers by 'friendly' 2-digit numbers.

$432 \div 16 = 27$

$\begin{array}{r} 27 \\ 16 \overline{) 432} \\ \underline{- 320} \\ 112 \\ \underline{- 112} \\ 0 \end{array}$	<p><i>(20x16)</i> +</p> <p><i>(4x16)</i> +</p> <p><i>(2x16)</i> +</p> <p><i>(1x16)</i> +</p>
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What I know

$1 \times 16 = 16$
$2 \times 16 = 32$
$4 \times 16 = 64$
$8 \times 16 = 128$
$10 \times 16 = 160$
$20 \times 16 = 320$

Give remainders as whole numbers or as fractions or as decimals
Divide a one-place or a two-place decimal number by a number ≤ 12 using multiples of the divisors.
Divide proper fractions by whole numbers.

Know by heart all the division facts up to $144 \div 12$.
Divide whole numbers by 10, 100, 1000 to give whole number answers or answers with up to two decimal places.
Use efficient chunking involving subtracting powers of 10 times the divisor to divide any number of up to 1000 by a number ≤ 12 . (E.g. $836 \div 11$ as $836 - 770$ (70×11) leaving 66 which is 6×11 . So that we have $70 + 6 = 76$ as the answer).
Divide a one-place decimal by a number ≤ 10 using place value and knowledge of division facts.