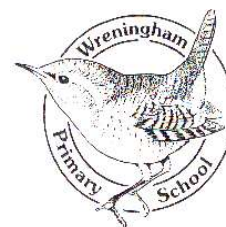


**T**ogether **E**veryone **A**chieves **M**ore

Wreningham School is committed to Safeguarding  
And promoting the Welfare of children



## Wreningham V.C. Primary school **Calculation Policy 2020**





This policy contains the key pencil and paper procedures that we will teach in school across Key Stages 1 and 2. It has been written to ensure consistency and progression throughout the school and to follow the statutory requirements from the National Curriculum 2014. **As children progress at different rates, some may need to use the strategies from previous or future year groups.**

Although the focus of this policy is on written recording, it is important to recognise that the ability to calculate mentally lies at the heart of written calculations. During Key Stage One, emphasis is placed upon developing the skills of mental calculation. However mental calculation is not at the exclusion of written recording; it is complementary to it. In every written method there is an element of mental processing. All pupils will be given regular opportunities to record and explain their mathematical thinking.

The policy concentrates on the introduction of standard symbols, the use of the empty number line as a jotting to aid mental calculation and on the introduction of more formal pencil and paper methods. It is important that children do not abandon jottings and mental methods once pencil and paper procedures are introduced. Children will always be encouraged to look at a calculation/problem and decide the best method to use; pictures, mental calculation with or without jottings or formal written procedures.

The long-term aim is for children to be able to select an **efficient** method of their choice whether this be mental or written. They will do this by always asking themselves:

'Can I do this in my head?'

'Can I do this in my head using drawings or jottings?'

'Do I need to use a pencil and paper procedure?'



# ADDITION

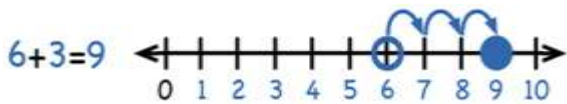
## Add with numbers up to 20

Use number tracks, part whole model, ten frames practical methods (including Numicon and number beads) and numbered number lines to add by counting on in ones, and using the addition (+) and equals (=) signs

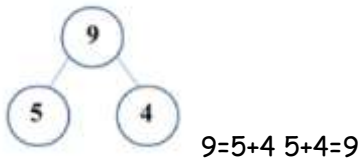
**Concrete:** Josh has 3 cars and Sam has 2. How many cars altogether?



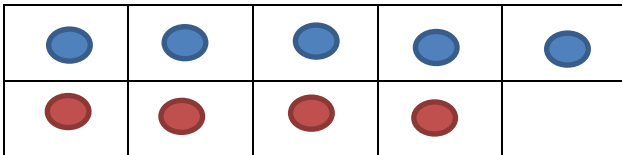
Numbered number line



Part whole model



Ten frame



Encourage children to start with the larger number and count on.

**Examples:**  $8 + 3 = \square$      $15 + 4 = \square$      $5 + 3 + 1 = \square$   
 $\square + \square = 6$ .

Fact families

Example:  $5 + 2 = 7$     $2 + 5 = 7$     $7 = 2 + 5$     $7 = 5 + 2$   
 $7 - 5 = 2$     $7 - 2 = 5$     $5 = 7 - 2$     $2 = 7 - 5$

**Key vocabulary:** *add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on and number line.*

**Key number skills needed:**

Read and write numbers to 100 in numerals, incl. 1–20 in words.

Recall bonds to 10 and 20, and addition facts within 20.

Count to and across 100.

Count in multiples of 1, 2, 5 and 10.

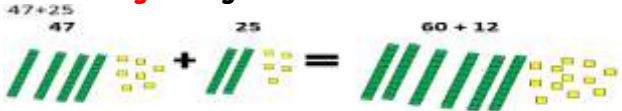
Know fact families- addition and subtractions for families of numbers.

Partition numbers to 10 and beyond.

## Add with 2-digit numbers

Partition into tens and ones and recombine using concrete objects such as base 10 and then informal written methods.

**Partitioning: Using base 10**



$$40 + 20 = 60$$

$$7 + 5 = 12$$

$$60 + 12 = 72$$

**Using place value counters:**

**Number Line**

Use a blank number line to add 2 digit numbers and 10s, progressing on to pairs of 2 digit numbers (add tens then units, starting with the largest number):

**Key vocabulary:** As before, & *sum, tens, ones, partition, addition, columns and tens boundary.*

**Key number skills needed:**

Add a 2-digit number and ones (e.g.  $27 + 6$ )

Add a 2-digit number and tens (e.g.  $23 + 40$ )

Add pairs of 2-digit numbers (e.g.  $35 + 47$ )

Add three one-digit numbers (e.g.  $5 + 9 + 7$ )

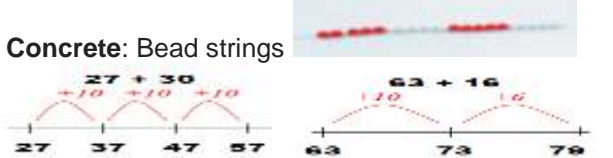
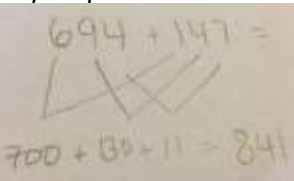
Show that adding can be done in any order.

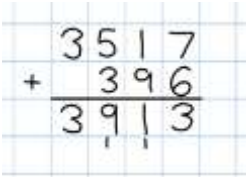

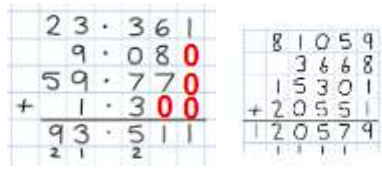
Recall bonds to 20 and bonds of tens to 100 ( $30 + 70$  etc.)

Understand the place value of 2-digit numbers (tens and units)

Compare and order numbers to 100 using  $<$   $>$  and  $=$  signs.

Read and write numbers to at least 100 in numerals and words.

<p><b>Concrete:</b> Bead strings</p> 	
<p><b>Add with numbers up to 3-digits</b> Introduce the <b>bow tie</b> method as an alternative way to partition.</p>  <p><b>Expanded column method</b> <b>Concrete:</b> Use of base 10 and place value cards.</p> <p>47+25</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <math display="block">\begin{array}{r} 40 \ 7 \\ + 20 \ 5 \\ \hline 60+12 = 72 \end{array}</math> </div> <div style="border: 1px solid black; padding: 5px;"> <math display="block">\begin{array}{r} 100 \ 20 \ 6 \\ +200 \ 60 \ 5 \\ \hline 300 \ 90 \ 1 \\ \hline 10 \end{array}</math> </div> </div> <p>Progress onto:</p>	<p><b>Key vocabulary:</b> As before, &amp; <b>hundreds boundary, increase, 'carry', expanded.</b></p> <p><b>Key number skills needed:</b> Read and write numbers to 1000 in numerals and words. Add 2-digit numbers mentally, incl. those exceeding 100. Add a three-digit number and ones mentally (175 + 8) Add a three-digit number and tens mentally (249 + 50) Add a three-digit number and hundreds mentally (381 + 400) Estimate answers to calculations, using inverse to check answers. Recognise place value of digits in 3-digit numbers (hundreds, tens, units)</p>

<p><b>Add numbers with up to 4 digits</b> Using the <b>compact column method</b>, adding units first, and 'carrying' numbers <b>underneath</b> the calculation. Pupils should also add money and measures. <b>e.g.</b> 3517 + 396 = 3913</p> 	<p><b>Key vocabulary:</b> As before &amp; <b>thousands, hundreds, digits and inverse.</b></p> <p><b>Key number skills needed:</b> Select most appropriate method: mental, jottings or written and explain why. Recognise the place value of each digit in a four-digit number. Round any number to the nearest 10, 100 or 1000. Estimate and use inverse operations to check answers. Find 1000 more or less than a given number.</p>
<p><b>Add numbers with more than 4 digits</b> including money, measures and decimals with different numbers of decimal places.</p> 	<p><b>Key vocabulary:</b> As before &amp; <b>decimal places, decimal point, tenths, hundredths and thousandths.</b></p> <p><b>Key number skills needed:</b> Add numbers mentally with increasingly large numbers. Use rounding to check answers and accuracy. Read, write, order and compare numbers to at least 1 million and determine the value of each digit. Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000.</p>
<p><b>Add several numbers of increasing complexity</b></p> <p>Add <b>'zeros'</b> where needed to show the place value</p> 	<p><b>Key vocabulary:</b> As before.</p> <p><b>Key number skills needed:</b> Perform mental calculations, including with mixed operations and large numbers.</p>

	<p>Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.</p> <p>Read, write, order and compare numbers up to 10 million and determine the value of each digit.</p> <p>Round any whole number to a required degree of accuracy.</p>
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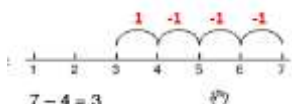
## SUBTRACTION

**Take away using real objects. Subtract from numbers up to 20.**

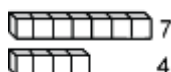
**Concrete:** Sam had 4 chocolates. He ate 2. How many has he go left?

$$4 - 2 =$$

**Count back** in ones on a numbered number line to take away:



**Find the 'difference between' —including 'how many more' and 'how many less' is introduced practically by counting on and by using the bar model**



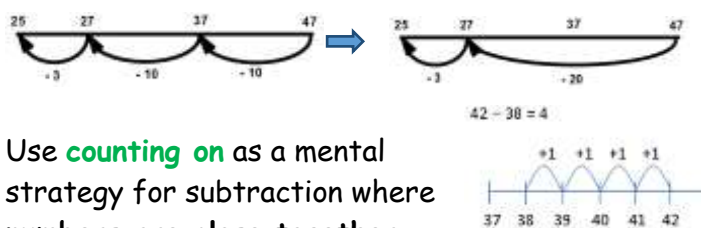
**Begin to write number sentences with - and = signs.**

**Subtract with 2-digit numbers**

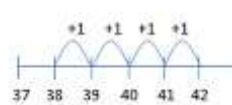
Subtract by **counting back** on a number bead string, blank number line, gradually using more efficient jumps.



$$47 - 23$$



Use **counting on** as a mental strategy for subtraction where **numbers are close together** e.g. 42-38:

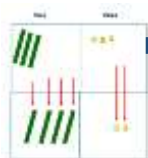


**Subtract with 2 and 3 digit numbers**

Use **expanded column subtraction** method (using base 10 and place value cards initially):

$$75 - 42 =$$

$$\begin{array}{r} 70 + 5 \\ - 40 + 2 \\ \hline 30 + 3 \end{array}$$



$$72 - 47 =$$

$$\begin{array}{r} 72 - 47 \\ \begin{array}{l} 60 + 12 \\ - 40 + 7 \\ \hline 20 + 5 \end{array} \end{array}$$

**Money:** partition as £1 + 30p + 4p

**Key vocabulary:** *equal to, take, take away, less, minus, subtract, leaves, difference between, how many more, how many fewer / less than, most, least, count back, how many left and how much less is\_?*

**Note:** children will begin by taking away from a group of pictures or apparatus, e.g. bead string, objects, cubes.

**Key number skills needed:**

Given any number, say one more or one less.

Count to and over 100, forward and back, from any number.

Represent and use subtraction facts to 20 and within 20 .

Subtract with one-digit and two-digit numbers to 20, including 0.

**Key vocabulary:** As before, & *difference, count on, strategy, partition, ten and units.*

**Key number skills needed:**

Recognise the place value of each digit in a two-digit number.

Recall and use subtraction facts to 20 fluently, and derive and use related facts up to 100.

Subtract using concrete objects, pictorial representations, 100 squares and mentally, including: a two-digit number and ones (37 - 6), a two-digit number and tens (78 - 20), and two two-digit numbers (89 - 38)

Show that subtraction cannot be done in any order.

Recognise and use inverse relationship between addition and subtraction, to check calculations and missing number problems.

**Key vocabulary:** As before, & *exchange, decrease, hundreds, value and digit.*

**Key number skills needed:**

Subtract mentally:

a 3-digit number and ones (467 - 8)

a 3-digit number and tens (472 - 50)

a 3-digit number and hundreds (789 - 400)

Estimate answers and use inverse operations to check.

Solve problems, including missing number problems.

Find 10 or 100 more or less than a given number.



Recognise the place value of each digit in a 3-digit number.

### Subtract with up to 4 -digit numbers

**Compact column subtraction** with exchanging.

$\begin{array}{r} 874 \\ - 523 \\ \hline 351 \end{array}$ <p>Answer: 351</p>	$\begin{array}{r} 932 \\ - 457 \\ \hline 475 \end{array}$ <p>Answer: 475</p>
--	--

**Key vocabulary:** As before, & **inverse and column.**

**Key number skills needed:**

Subtract by counting on where numbers are close together or are near to multiples of 10, 100 etc. (87-79, 202-197)

Estimate and use inverse operations to check answers.

Solve addition and subtraction 2-step problems in contexts, choosing which operations and methods to use and why.

Find 1000 more or less than a given number.

Count backwards through zero to include negative numbers.

Recognise the place value of each digit in a four-digit number.

Round any number to the nearest 10, 100 or 1000.

### Subtract with at least 4-digit numbers and money, measures, decimals

$\begin{array}{r} 7769.0 \\ - 372.5 \\ \hline 6796.5 \end{array}$	$\begin{array}{r} 28128 \\ - 2128 \\ \hline 28928 \end{array}$
---	--

**Key vocabulary:** As before, & **tenths, hundredths, decimal point and decimal.**

**Key number skills needed:**

Subtract numbers mentally with increasingly large numbers.

Use rounding and estimation to check answers to calculations.

Solve addition and subtraction multi-step problems in context, deciding which operations and best methods to use and why.

Read, write, order and compare numbers to at least 1 million and determine the value of each digit.

Count forwards or backwards in steps of 10, 100, 1000, 10,000...

Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through 0.

### Subtract with increasingly large and more complex numbers and decimal values

$\begin{array}{r} 32004 \\ - 1719 \\ \hline 30285 \end{array}$	$\begin{array}{r} 32004 \\ - 1719 \\ \hline 30285 \end{array}$
--	--

**Key vocabulary:** As before.

**Key number skills needed:**

Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.

Read, write, order and compare numbers up to **10 million** and determine the value of each digit.

Round any whole number to a required degree of accuracy.

Use negative numbers in context, calculating intervals across zero.



# MULTIPLICATION

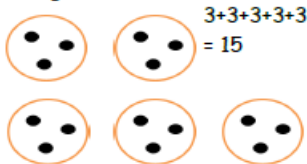
**Multiply with real objects, arrays and pictorial representations.**

How many legs will 3 teddies have?



$$2 + 2 + 2 = 6$$

There are 3 sweets in one bag.  
How many sweets are in 5 bags altogether?



**Key vocabulary:** *groups of, lots of, times, array, altogether, multiply, total and count up in...*

**Key skills for multiplication:**

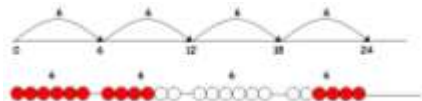
Count in 2s, 5s and 10s.

Solve 1-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Make connections between arrays, number patterns, and counting in twos, fives and tens. Begin to understand doubling using concrete objects and pictorial representations.

**Multiply using arrays and repeated addition.**

**Repeated addition to multiply:**



Use both concrete and pictorial representations of arrays.



**Multiplication Array**

4 Rows of 5 equals 20 symbols in total.

**Multiplication Sentence**

$$4 \times 5 = 20$$

Think of the Multiplication sign as meaning "Rows of."

**Key vocabulary:** As before, & *multiplied by, column, row, repeated addition, commutative, sets of, equal groups, \_ times as big as, once, twice, three times etc.*

**Key skills for multiplication:**

Count in steps of 2, 3 and 5 from 0, and in 10s from any number.

Recall and use multiplication facts from the 2, 5 and 10 multiplication tables, incl. recognising odds and evens.

Write and calculate number statements **using the x and = signs.**

Show that multiplication can be done in any order (commutative).

Solve a range of problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication facts.

**Multiply 2-digits by a single digit number using the proportional grid method.**

Children will approximate first and use visual images of the grid with arrays and Numicon or base 10 to deepen understanding.

	10	10	6
x	*****	*****	*****
3	*****	*****	*****
	*****	*****	*****

x	10	10	6
3	30	30	18

$$30 + 30 + 18 = 78$$

**Key vocabulary:** As before, & *partition, grid method, multiple, product, tens, units and value.*

**Key skills for multiplication:**

Recall and use multiplication facts for the 2, 3, 4, 5, 8 and 10 multiplication tables, and multiply multiples of ten.

Write and calculate number statements using the multiplication tables they know, incl. 2-digit x single-digit, drawing upon mental methods, and progressing to reliable written methods.

Solve multiplication problems, including missing number problems.

Develop mental strategies using commutative laws (e.g.  $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$ )

**Multiply 2 and 3 digit by a single digit using the grid method.**

If children are confident with the short method for addition they can add directly under the grid (digits must be in lined up correct columns.)  
If not, produce a separate addition calculation.

	3	2	7
x			4
	1	3	0
			8
	1	2	

x	6
100	600
30	180
6	36

$$+ \begin{array}{r} 816 \\ 1 \end{array}$$

**Key vocabulary:** As before, & *square, factor, integer, decimal.*

**Key skills for multiplication:**

Count in multiples of 6, 7, 9, 25 and 1000

Recall multiplication facts for multiplication tables up to 12x12.

Recognise place value of digits in up to 4-digit numbers

Use place value, known facts and derived facts to multiply mentally, e.g. multiply by 1, 10, 100, by 0, or multiply 3 numbers.

Use commutativity and other strategies in mental calculations  $3 \times 6 = 6 \times 3$ ,  $2 \times 6 \times 5 = 10 \times 6$ ,  $39 \times 7 = 30 \times 7 + 9 \times 7$ .

**Multiply 4-digit numbers by 1 or 2 digits.**

$$\begin{array}{r} 1325 \\ \times 5 \\ \hline 25 \quad (5 \times 5) \\ 100 \quad (20 \times 5) \\ 1500 \quad (300 \times 5) \\ + 5000 \quad (1000 \times 5) \\ \hline 6625 \end{array}$$

**Key vocabulary:** As before, & *cubed, integer, square, factor, decimal and grid multiplication.*

**Key skills for multiplication:**

Identify multiples and factors, using knowledge of multiplication tables to 12x12.

Solve problems where larger numbers are decomposed into their factors.

Multiply and divide integers and decimals by 10, 100, 1000.

Recognise and use square and cube numbers and their notation.

**Use short multiplication and multiply decimals with a single digit number.**

Start with the unit one's digit first.

	3	2	7
x			4
	1	3	0
			8
	1	2	

	3	.	1	9
x				8
	2	5	.	5
				2
	1		7	

**Key vocabulary:** As before, & *tenths, hundredths, short/long multiplication and 'carry.'*

**Key skills for multiplication:**

Multiply multi-digit numbers, up to 4-digit x 2-digit using formal long multiplication.

Perform mental calculations with mixed operations and large numbers.

Estimate answers using round and approximation and determine levels of accuracy.

## LONG MULTIPLICATION:

124 × 26 becomes

$$\begin{array}{r}
 \begin{array}{cc} 1 & 2 \\ 1 & 2 & 4 \end{array} \\
 \times \quad \begin{array}{cc} 2 & 6 \end{array} \\
 \hline
 \begin{array}{ccc} 7 & 4 & 4 \end{array} \\
 \begin{array}{ccc} 2 & 4 & 8 & 0 \end{array} \\
 \hline
 \begin{array}{cccc} 3 & 2 & 2 & 4 \end{array} \\
 \begin{array}{cc} 1 & 1 \end{array}
 \end{array}$$

Answer: 3224

Round any integer to a required degree of accuracy.

## DIVISION

### Group and share small quantities

Using objects, diagrams and pictorial representations to solve problems about both grouping and sharing.

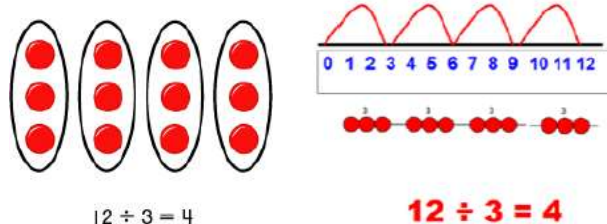


**Key vocabulary:** *share, share equally, one each, two each..., group, groups of, lots of and array.*

**Key number skills:** Solve one-step problems, calculating answers using concrete objects, pictorial representations, arrays with support. Through grouping and sharing small quantities, begin to understand division, and find simple fractions of objects, numbers / quantities. Make connections between arrays, number patterns, and counting in 2s, 5s and 10s.

### Group and share, using the ÷ sign

Use objects, arrays, diagrams and pictorial representations, and repeated addition on a number line. Record pictorially and using number lines. Practise both grouping and sharing.



**Key vocabulary:** As before, & *divide, divided by, divided into, division, grouping, number line, left and left over.*

**Key number skills:**

Count in 2s, 3s and 5s from 0. Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, recognising odds and evens. Calculate statements for multiplication and division within the multiplication tables, writing them using ×, ÷ and = signs. \*Show that division cannot be done in any order. Solve problems in context using materials, arrays, repeated addition, mental methods, multiplication and division facts.

### Divide 2-digit numbers by a single digit (no remainders in the final answer)

Continue to explore sharing and grouping.

**Key vocabulary:** As before & *chunking and multiple.*

**Key number skills needed:**

Recall and use multiplication/ division facts for 2, 3, 4, 5, 8, 10 multiplication tables (through doubling, connect the 2, 4 and 8s). Write and calculate number statements for multiplication and division using multiplication

<div data-bbox="119 123 766 481"> </div> <p>Children may use pictorial aids for support with table facts and remainders.</p>	<p>tables that they know, including for 2-digit numbers <math>\times</math> 1-digit numbers.</p> <p>Solve problems, in contexts, and including missing number problems, involving multiplication and division.</p> <p>Develop efficient mental methods, e.g. using multiplication and division facts (e.g. using <math>3 \times 2 = 6</math>, <math>6 \div 3 = 2</math> and <math>2 = 6 \div 3</math>) to derive related facts (<math>30 \times 2 = 60</math>, so <math>60 \div 3 = 20</math> and <math>20 = 60 \div 3</math>).</p>
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<p><b>Divide up to 3-digit numbers by a single digit (without remainders)</b></p> <p><b>SHORT DIVISION:</b></p> <p><math>872 \div 4 =</math>                      <math>185 \div 4 =</math></p> <div data-bbox="103 1030 694 1198"> </div> <p>Children can make use of bead strings to aid division facts.</p>	<p><b>Key vocabulary:</b> As before &amp; <i>divisible by, carry, short division and factor.</i></p> <p><b>Key number skills needed:</b></p> <p>Recall all multiplication and division facts up to <math>12 \times 12</math>. Use place value, known and derived facts to multiply and divide mentally, incl. multiplying and dividing by 10 and 100 and</p> <p>Use short division with exact answers.</p> <p>Extend mental methods to 3-digit numbers, deriving facts, for example <math>200 \times 3 = 600</math> so <math>600 \div 3 = 200</math></p> <p>Solve 2-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as three cakes shared equally between 10 children.</p>
<p><b>Divide up to 4 digits by a single digit, including those with remainder answers.</b></p> <p><b>SHORT DIVISION:</b></p> <p><math>5309 \div 8 =</math></p> <div data-bbox="103 1556 582 1713"> </div>	<p><b>Key vocabulary:</b> As before &amp; <i>quotient, prime number, prime factors and composite number (non - prime)</i></p> <p><b>Key number skills needed:</b></p> <p>Recall multiplication / division facts for all numbers up to <math>12 \times 12</math>. *Identify multiples and factors of any number.</p> <p>Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.</p> <p>Work out if numbers to 100 are prime, recalling primes to 19. *Use multiplication and division as inverses.</p> <p>Express remainder answers as fractions, decimals or rounded numbers, as appropriate to the context of the problem.</p>
<p><b>Divide at least 4-digit numbers by 1 or 2 digits (incl. decimal numbers / quantities)</b></p>	<p><b>Key vocabulary:</b> As before, &amp; <i>common factor</i></p> <p><b>Key number skills needed:</b></p> <p>Use multiplication and division facts for all numbers to <math>12 \times 12</math> for more complex calculations.</p> <p>Identify common factors, common multiples and prime numbers *Solve problems which require answers to be rounded to specified degrees of accuracy, and remainders to be expressed as rounded numbers, fractions or decimals.</p>

## SHORT DIVISION:

496 ÷ 11 becomes

$$\begin{array}{r} 0812.125 \\ 8 \overline{) 6497.000} \end{array}$$

$$\begin{array}{r} 45r1 \\ 11 \overline{) 496} \\ \underline{11} \phantom{00} \\ 49 \phantom{0} \\ \underline{44} \phantom{0} \\ 56 \\ \underline{55} \\ 1 \end{array}$$

Answer:  $45\frac{1}{11}$

Use estimation to check answers to calculations.

## LONG DIVISION:

Using short division bus stop method.

For example:

		0	1	2	9
1	3	1	6	7	9

We don't know the 13 times table but we know  $1 \times 13$  and  $10 \times 13$  and half of that which is  $5 \times 13$ . This gives us an idea of where to look

1292 ÷ 13 = 99 r5

13 (1x)  
26 (2x)  
39 (3x)  
52 (4x)  
65 (5x)  
78 (6x)  
91 (7x)  
104 (8x)  
117 (9x)  
130 (10x)

1292 ÷ 13 = 99 r5

5 ÷ 2 = 2.5

Use a simple number like 2 to find the remainder to pass on