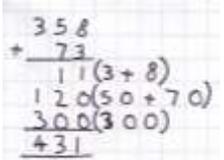Cummersdale Primary School

Calculation Policy
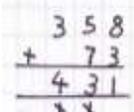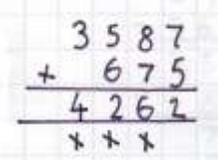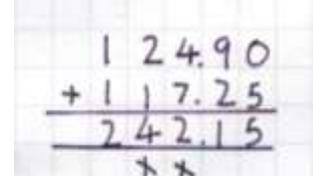
A Mathematical Policy explaining how we teach the four operations of number.

+ − x ÷

Spring 2014

ADDITION

| Year 1	Year 2	Year 3
Given a number, identify 1 more and 1 less Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs Represent and use number bonds and related subtraction facts within 20 add and subtract one-digit and two-digit numbers to 20, including 0. Realise the effect of adding or subtracting 0 Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9 <u>Number lines</u> Adding 1, 2, 5, 10 and 3 using number lines 0-20 with labelled divisions 10 + 2= 12 Begin to use a number line from a given number 15 + 3 = 18 Movements along a number line are called 'jumps'. Addition jumps are above the number line (subtraction jumps are below the number line). <u>+ and = signs and missing numbers</u> 3 + 4 = □ □ = 3 + 4 3 + □ = 7 7 = □ + 4 □ + 4 = 7 7 = 4 + □ □ + ○ = 7 7 = □ + ○	<u>Number lines</u> 23 + 12 = 35 <u>Add 9 or 11 by adding 10 and adjusting by 1</u> Using a number line and using a hundred square 35 + 9 = 44 <u>Partition into tens and ones and recombine</u> 23 + 12 =35 $23 + 12 = 35$ $20 + 10 = 30$ $3 + 2 = 5$ Recording addition and subtraction in columns supports place value and prepares for formal written methods with larger numbers. **Informal and increasingly formal written methods at KS1.** <u>+ and = signs and missing numbers</u> Continue using a range of equations as in Year 1 but with appropriate larger numbers. Extend to 14 + 5 = 10 + □ and adding three numbers 32 + □ + □ = 100, 35 = 1 + □ + 5 Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100. Add numbers including: o a two-digit number and 1s o a two-digit number and 10s o 2 two-digit numbers o adding 3 one-digit numbers Show that addition of 2 numbers can be done in any order (commutative) and subtraction of 1 number from another cannot. Recognise and use the inverse relationship between addition and subtraction and check calculations and solve missing number problems.	<u>Partition into tens and ones and recombine</u> 53 + 36= 89 (Begin to use numbers where the units exceed 10) <u>Add a near multiple of 10 to a two-digit number</u> Continue as in Year 2 but with appropriate numbers, e.g. 35 +19 is the same as 35 + 20 – 1 **Formal written methods introduced** 83 + 24 = 125 Children to work with HTU (3 digits) Children to begin to use formal written methods **down** the page. Addition sign on the left of the problem. Add numbers with up to 3 digits, using formal written methods of column addition Add numbers mentally, including: a three-digit number and 1s, a three-digit number and 10s, a three-digit number and 100s. Estimate answers and use inverse operations to check answers Solve problems, including missing number problems, using number facts, place value, and more complex addition. <u>+ and = signs and missing numbers</u> Continue using a range of equations as in Year 1 and 2 but with appropriate larger numbers. Add fractions with the same denominator within one whole [for example, $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$]

ADDITION

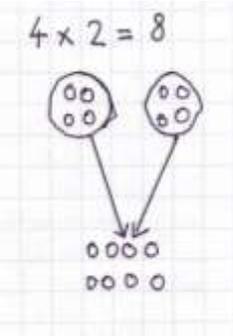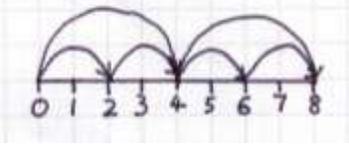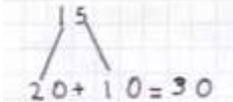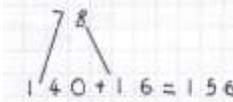| Year 4	Year 5	Year 6
Informal jottings / Mental methods continue Add the nearest multiple of 10 or 100, then adjust with appropriate numbers, e.g. 458 + 79 is the same as 458 + 80 -1 Partition into tens and ones and recombine **Formal written methods** 358 + 73 = 431 Leading to column addition: (Up to 4 digits by 3 digits) Children to cross out the 'carried' numbers until they are comfortable with the method. Extend to numbers with at least 4 digits, 3587 + 675 = 4262 and add numbers with up to 4 digits using the formal written methods of column addition where appropriate. Children use formal written methods **down** the page, setting out calculation sums neatly and working accurately. Addition sign on the left of the problem. Extend to decimals in the case of money. **+ and = signs and missing numbers** Continue using a range of equations as but with appropriate larger numbers. Estimate and use inverse operations to check answers to a calculation Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why. Add fractions with the same denominator within one whole [for example, $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$]	**Formal written methods** Add numbers with at least 4 digits 3587 + 675 = 4262 (as for Year 4) and use formal written methods for calculating numbers Hth, Tth, T, H, T, U Extend to decimals (same number of decimal places) and adding several numbers (with different numbers of digits). Include adding zero as a 'place holder'. Children confidently use formal written methods **down** the page, setting out calculation sums neatly and working accurately, checking their work by using the inverse operation. Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy Solve addition multi-step problems in contexts, deciding which operations and methods to use and why. **+ and = signs and missing numbers** Continue using a range of equations with appropriate larger numbers. Add fractions with the same denominator, and denominators that are multiples of the same number [for example, $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$] and for example, , $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$]	**Formal written methods** Extend to decimals (with and without a different numbers of digits). Include adding zero as a 'place holder'. Partition into hundreds, tens and ones and decimal fractions and recombine Refine previous years to: 35.8 + 7.3 = 43.1 Add the nearest multiple of 10, 100 or 1000, then adjust Continue as in earlier years, but with appropriate numbers, including extending to adding 0.9, 1.9, 2.9, etc. Use knowledge of the order of operations to carry out calculations involving the 4 operations; e.g:.BODMAS (Brackets Orders Division Multiplication Addition Subtraction) Multiplication is done before addition; in the expression 2 + 3 × 4, the answer is 14. Brackets, may be used to avoid confusion, 2 + (3 × 4), but multiplication still has precedence without them. 3 + 4 × 5 = 4 × 5 + 3 = 23. Using the number line, add positive and negative integers for measures such as temperature. Add fractions with different denominators and mixed numbers, using the concept of equivalent fractions Use and understand the addition of fractions with different denominators by identifying equivalent fractions with the same denominator. Start with fractions where the denominator of one fraction is a multiple of the other (for example, $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$] and progress to varied and increasingly complex problems. Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

SUBTRACTION

Year 1	Year 2	Year 3

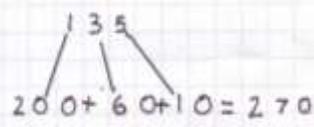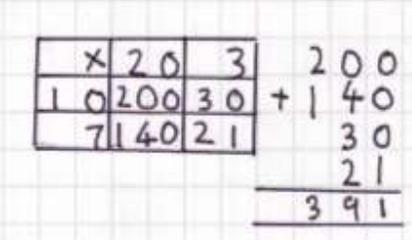**Year 1**

Counting
Counting forwards and backwards in jumps of 1and 2 on a number line.

Number lines Counting back 1, 2, 5, 10 and 3 using number lines 0-20 with labelled divisions. Movements along a number line are called 'jumps'. Subtraction jumps are below the number line.

10 – 2 = 8
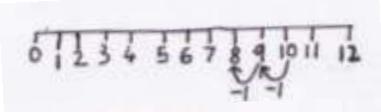
Begin to use a number
line from a given number
15 – 3 = 12
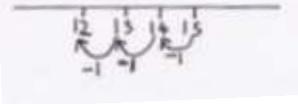
Subtract single digit from 2 digit –numbers up to 99, subtract one-digit and two-digit numbers to 20, including 0

Informal jottings **across** the page – no formal written methods.

Read, write and interpret mathematical statements involving subtraction (–) and equals (=) signs

Solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? – 9

- and = signs and missing numbers

7 - 3 = □	□ = 7 - 3
7 - □ = 4	4 = □ - 3
□ - 3 = 4	4 = 7 - □
□ - ○ = 4	7 = □ - ○

Problems should include the terms: put together, add, altogether, total, take away, distance between, difference between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.

Year 2

Informal jottings (eg Number lines) can be used
62 – 39 = 23
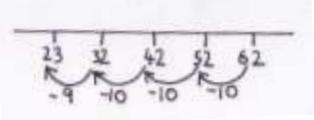
Subtraction facts to 20 fluently, and derive and use related
 facts up to 100
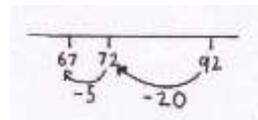
Subtract numbers; a two-digit number and 1s, a two-digit number and 10s, 2 two-digit numbers and adding 3 one-digit numbers

Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Subtract 9 or 11, begin to subtract 19 / 21   eg; 35 - 9 = 26

Partition into tens and ones and recombine 37 – 12 = 25   57 – 31 = 26

(Early work to be done with base 10 equipment)

Formal Written methods may be introduced for more able

No exchange

With exchange
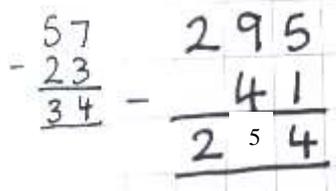
- and = signs and missing numbers
Continue using a range of equations as in Year 1 but with appropriate larger numbers.
Extend to
14 + 5 = 20 - □

Year 3

Subtract mentally a 'near multiple of 10' to or from a 2-digit number.   Continue as in Year 2 but with appropriate numbers e.g. 78 – 49 is the same as 78 – 50 + 1

Use known number facts and place value to subtract
Continue as in Year 2 but with appropriate numbers e.g. 97 – 25 = 72
Subtract numbers mentally, including: a three-digit number and 1s, a three-digit number and 10s, a three-digit number and 100s
Subtract numbers with up to 3 digits, using formal written methods of column subtraction.

Estimate the answer to a calculation and use inverse operations to check answers.

Solve problems, including missing number problems, using number facts, place value, and more complex subtraction.

Formal written methods Pencil and paper procedures
Refine Year 2 work
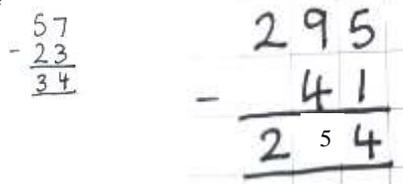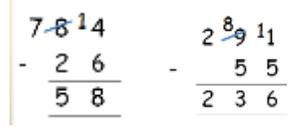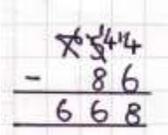
Children to begin to use formal written methods **down** the page
Subtraction sign on the left of the problem

- and = signs and missing numbers
Continue using a range of equations as in Year 1 but with appropriate larger numbers.

SUBTRACTION

Year 4	Year 5	Year 6
<u>Consolidate number facts and calculation strategies from Year 3</u>	<u>Consolidate number facts and calculation strategies from Year 4</u>	<u>Consolidate number facts and calculation strategies from Year 5</u>

Year 4

<u>Consolidate number facts and calculation strategies from Year 3</u>

Subtract numbers with up to 4 digits using the formal written methods of column subtraction where appropriate

Estimate and use inverse operations to check answers to a calculation

solve subtraction two-step problems in contexts, deciding which operations and methods to use and why

Children to cross out the number which they exchange from

Extend to decimals in the case of money

Children to begin to use formal written methods **down** the page

(Subtraction sign always on the left of the problem)

Year 5

<u>Consolidate number facts and calculation strategies from Year 4</u>

Formal written methods
<u>Pencil and paper procedures</u>

6467 – 2684 = 3783

<u>Use known number facts and place value to subtract</u>
E.g. 6.1 – 2.4 = 3.7

Children to cross out the number which they exchange from
Extend to decimals in the case of money

Subtract whole
numbers with more than 4 digits, including using formal written methods (column subtraction)

Subtract numbers mentally with increasingly large numbers
Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy

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

Year 6

<u>Consolidate number facts and calculation strategies from Year 5</u>

Pupils practise subtraction for larger numbers, using the formal written methods of column subtraction. They undertake mental calculations with increasingly large numbers and more complex calculations.

Decomposition with decimals up to 2dp including different numbers of decimal places. Work with numbers with up to 6 digits.

534.6 – 29.65= 504.95

<u>Use known number facts and place value to subtract</u>
E.g. 0.5 – 0.31 = 0.19

read, write, order and compare numbers up to 10,000,000 and determine the value of each digit

round any whole number to a required degree of accuracy
use negative numbers in context, and calculate intervals across 0

solve number and practical problems that involve all of the above

MULTIPLICATION

Year 1	Year 2	Year 3
Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher **Arrays and repeated addition** Also through the use of pictures and hands on activities Grouping and sharing $4 \times 2 = 8$ Introduce mathematical vocabulary of multiply and divide. Doubles up to 10 Children to learn number bonds . Informal jottings only - no formal written methods at Year 1 Counting in 2s, 5s and 10s Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	**Arrays and repeated addition** Also through the use of pictures O O O O 4×2 or $4 + 4$ O O O O 2×4 or $2 + 2 + 2 + 2$ 'Groups of' Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs. Show that multiplication of 2 numbers can be done in any order (commutative). Solve problems involving multiplication using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts. **Doubling multiples of 5 up to 100 and multiples of 10** Double 15 = 30 Double 78= 156 $20 + 10 = 30$ $140 + 16 = 156$ Children to complete through the school number bonds scheme and to begin the times tables scheme – 2's, 5's and 10's Counting in 2s, 3s, 4s, 5s and 10s **x = signs and missing numbers** $7 \times 2 = \square$ $\square = 2 \times 7$ $7 \times \square = 14$ $14 = \square \times 7$ $\square \times 2 = 14$ $14 = 2 \times \square$ $\square \times O = 14$ $14 = \square \times O$ Informal jottings and also formal written methods where appropriate.	**x = signs and missing numbers** Continue using a range of equations as in Year 2 but with appropriate numbers **Arrays and repeated addition** Continue to understand multiplication as repeated addition and continue to use arrays (as in year 2) **Doubling three digit numbers and multiples of 5, 10 and 100** $200 + 60 + 10 = 270$ Double 135 = 270 **Paper and pencil procedures** **Use known facts and place value to carry out simple multiplications** Use the same method as above (partitioning) to solve simple 2 by 1-digit multiplication Up to 3 by 1-digit multiplication $32 \times 3 = 96$ Children to begin to use formal written methods Counting in 2s, 3s, 4s, 5s, 6s and 10s. Children to know the 3,4, and 8 times tables

MULITPLICATION

Year 4	Year 5	Year 6
Doubling as in Year 3 with appropriate numbers and children to use formal written methods	Pencil and paper procedure	Doubling as in Year 5 with appropriate numbers and decimals
Pencil and paper procedure - Grid method	Grid method	Pencil and paper procedure
23 x 7 is approximately 20 10 = 200	172 x 38 is	372 x 24 is approximately 400 x 20 = 8000
123 x 7 = 861	approximately 200 x 40 = 8,000 172 x 38 = 6,536	372 x 24 = 8,928
Extend the grids to TU x TU	Column method (known as long multiplication)	Extend to decimals with up to two decimal places and different numbers of decimal places
23 x 17 is approximately 20 x 20 = 400 23 x 17 = 391	72 x 38 = 2,736	Column method (known as long multiplication)
Multiply two-digit and three-digit numbers by a one-digit number using formal written layout	Identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers	372 x 24= 8,928 4.51 x 23 = 103.73
multiplying together 3 numbers	By the end of Year 5 children should have progressed to working with simple decimals with one decimal place.	Extend to working with up to two decimal places and with numbers with a different number of decimal places. Count the decimal places and put the decimal point in after the calculation. E.g. 23 x 451 = 10373 2.3 x 4.51 = will have 3dp so 10.373 23 x 4.51 = will have 2dp so 103.73 0.23 x 45.1 = will have 3dp so 10.373
Recall multiplication and division facts for multiplication tables up to 12 × 12	Multiply whole numbers and those involving decimals by 10, 100 and 1,000	Counting in 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s and 10s and in multiples of 10, 0.1, 100, etc.
	Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})	BRACKETS & MULTIPLICATION – BODMAS Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9.
	Counting in 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s and 10s and in multiples of 10	
	Recall multiplication and division facts for multiplication tables up to 12 × 12	

DIVISION

Year 1	Year 2	Year 3
<u>Understand division as sharing and grouping</u> Ideas modelled through pictures, drawings and by using counters, etc. Solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher Halving numbers to 20 Informal jottings only - no formal written methods at Year 1 Children to work through the school number bonds scheme	Solve problems involving division, using materials, repeated subtraction, mental methods, and division facts, including problems in contexts. <u>Understand division as sharing and grouping</u> 6 ÷ 2 can be modelled as: <u>Sharing</u> 6 sweets can be shared between 2 people, how many do they have each? <u>Grouping</u> There are 6 sweets, how many people can have 2 each? (How many 2's make 6) <u>Halving even numbers up to 100</u> eg Half of 24 = 12 Recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers Children to complete through the school number bonds scheme and to begin the times tables scheme. Informal jottings used and formal written methods may be introduced towards the end of Year 2 where appropriate Divisibility rules – understanding that multiples of 2 are even numbers and multiples of 10 end in 0. Calculate mathematical statements for division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs E.g. 6 ÷ 2 = □ □ = 6 ÷ 2 6 ÷ □ = 3 3 = 6 ÷ □ Show that multiplication of 2 numbers can be done in any order (commutative) and division of 1 number by another cannot.	Continue using a range of equations as in Year 2 but with appropriate numbers. <u>Understand division as sharing and grouping (repeated subtraction)</u> eg 36 ÷ 4 = 9 can be modelled as: 36 can be shared between 4 people, how many do they have each? <u>Grouping and remainders linked to times tables</u> How many 3's make 16? How many left over? 16 ÷ 3 = 5 r 1 <u>Halving even numbers up to 100 and multiples of 10</u> Half of 480 = 240 Children to use informal written methods and formal written methods Divisibility rules – for the 2, 3, 4, 5, 8. 10 and 100 times tables. Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods. Solve problems, including missing number problems, involving division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

DIVISION
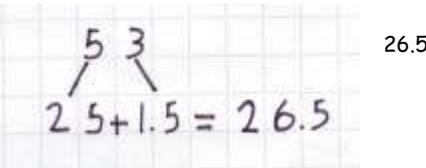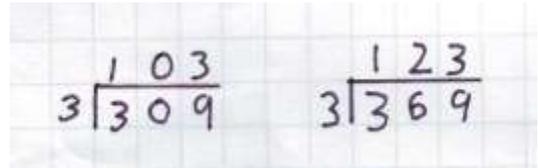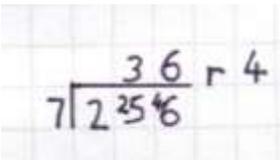
Year 4	Year 5	Year 6
<u>÷ = signs and missing numbers</u> Continue using a range of equations as in other years but with appropriate numbers. <u>Sharing and grouping</u> 30 ÷ 6 can be modelled as: <u>Sharing</u> Shared amongst 6 , the number given to each is 5, or <u>Grouping</u> Groups of 6 taken away and the number of groups counted <u>Halving numbers up to 100 including 0.5 answers</u> Half of 53 = 26.5 $$53 \swarrow \searrow$$ $$25 + 1.5 = 26.5$$ <u>Pencil and Paper Procedures</u> Up to 3 by 1-digit division with remainders but no 'carrying' within the problem. 309 ÷ 3 = 103 369 ÷3 = 123 $$3 \overline{)309} = 103 \qquad 3\overline{)369} = 123$$ Children to use formal written methods Children begin to use the terms 'carry' and 'division box' Divisibility rules – for the multiplication tables up to 12 × 12 Use place value, known and derived facts to divide mentally, including: dividing by 1; Recognise and use factor pairs and commutativity in mental calculations.	<u>Sharing and grouping</u> Continue to understand division as both sharing and grouping (repeated subtraction). <u>Halving numbers up to 1,000 including simple decimals -</u> As in Year 4 with harder numbers <u>Pencil and Paper Procedures</u> <u>Remainders</u> Quotients expressed as remainders - r3. 256 ÷ 7 = 36 r4 $$7 \overline{)256} = 36 \, r4$$ Up to 4 by 1-digit division with remainders, decimals and 'carrying' within the problem. Simple money problems with 2 decimal places. 4,352 ÷ = 1,088 $$4 \overline{)4352} = 1088$$ Children to use formal written methods. Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context. Children using the terms 'carry' and 'division box' <u>Remainders</u> Quotients expressed as fractions or decimals: 12.48 ÷ 4 = 3.12 $$4\overline{)12.48} = 3.12$$ Divisibility rules – for the multiplication tables up to 12 and x 100 Multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000. Solve problems involving division, including scaling by simple fractions and problems involving simple rates.	<u>Sharing and grouping</u> Continue to understand division as both sharing and grouping (repeated subtraction). <u>Halving numbers up to 1,000 including decimals with up to 2dp</u> As in Year 5 with harder numbers <u>Pencil and Paper Procedures – including decimals!</u> <u>Remainders</u> Quotients expressed as fractions or decimals: 153 ÷ 4 = 38 $\frac{1}{4}$ or $$4\overline{)153} = 38r1 = 38\tfrac{1}{4}$$ 12.48 ÷ 4 = 3.12 £231 ÷ 6 = £38.50 $$4\overline{)12.48} = 3.12 \qquad 6\overline{)231.00} = £38.50$$ Up to 4 by 1-digit division with remainders, decimals and 'carrying' within the problem. Simple money, metric problems with 2 decimal places. Introduce long division of 3 by 2-digit division. 977 ÷ 36 = 27 r5 $$36\overline{)977} = 27 r5 = 27\tfrac{5}{36}$$ Divisibility rules – for the multiplication tables up to 12 and 10, 20, 25 and 100 times tables. Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.