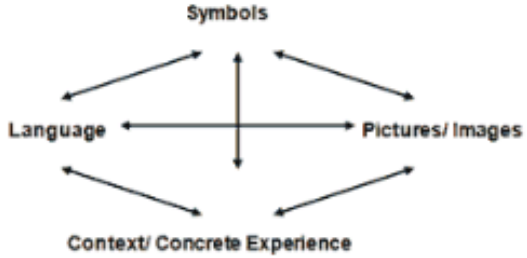
STоC's Calculation Policy

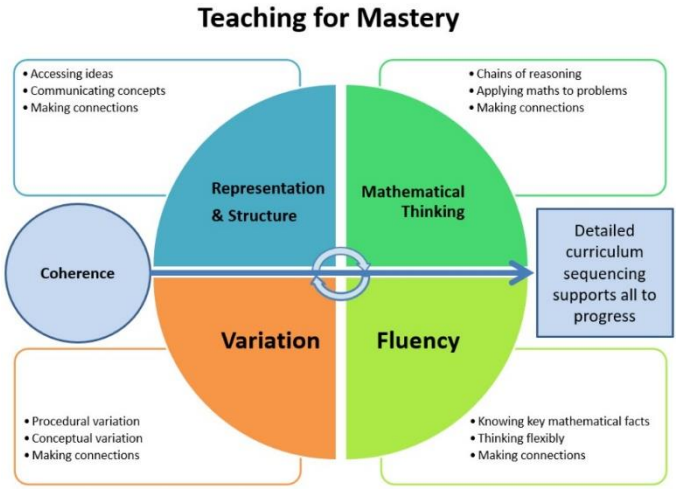
This progressive calculation policy has been devised to meet the requirements of the National Curriculum, for the teaching and learning of mathematics. It is designed to give pupils a consistent and smooth progression of learning calculation across the school, beginning with concrete experiences and developing through to mental jottings, mental strategies and on to written methods. The policy aims to develop fluent mathematicians in mental and written methods of calculation, with an understanding of the underlying mathematical concepts.

The policy builds progressively on from the content and methods established in the Early Years Foundation Stage, who follow the 'Development Matters' EYFS document. It is based on a mastery approach – that mathematical knowledge and understanding is incremental and thus it is essential to "master" each step otherwise gaps in learning will compromise future success.

We enable children to make cognitive connections to be effective learners of mathematics through interweaving the following:
- the use of concrete resources (representations) to support conceptual understanding or pictures and images to support mental imagery
- the language that will be modelled and used
- the symbols that will be used
- real-life contexts which are meaningful and will support understanding and provide opportunities to use and apply
- problem solving approaches which will help children to recognise when to use certain operations and methods when faced with problems

The Connections Model:





It is important to distinguish between children knowing facts and children using methods to get to an answer, using the facts they know.
'Knowledge-led curriculum' with three forms of knowledge:

- Factual: I know *that* ...
- Procedural: I know *how* ...
- Conceptual: I know *why* ...

Progression examples

The calculation policy includes a range of concrete and pictorial representations, more of which are featured in the scheme, along with the abstract.
Question type examples are given that are **varied** and support conceptual understanding.

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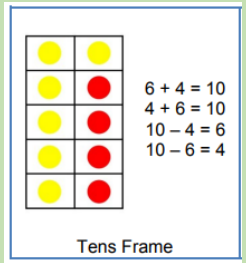
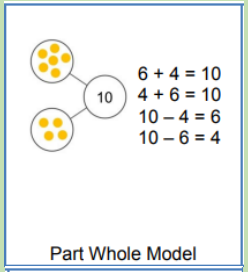
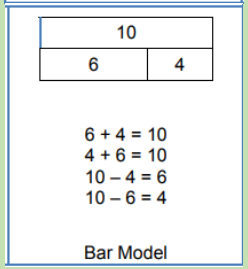
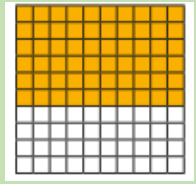
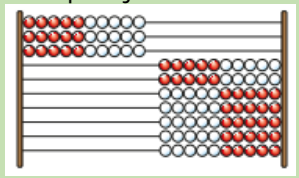
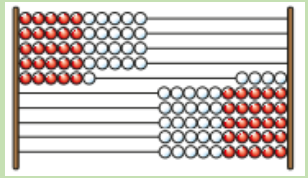
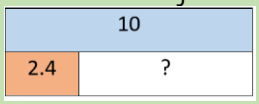
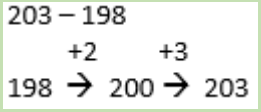
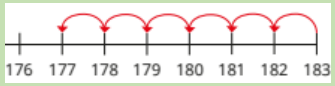
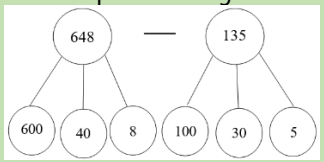
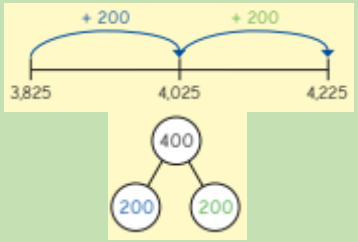
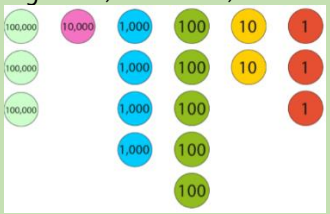
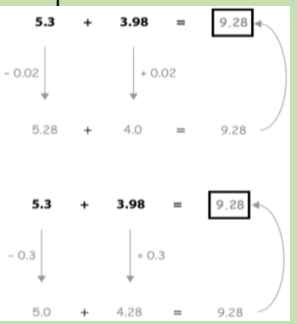
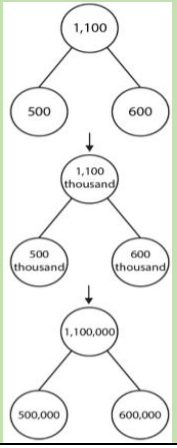
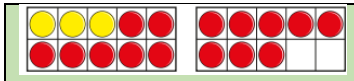
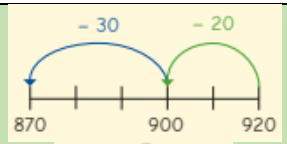
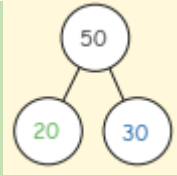
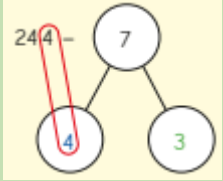
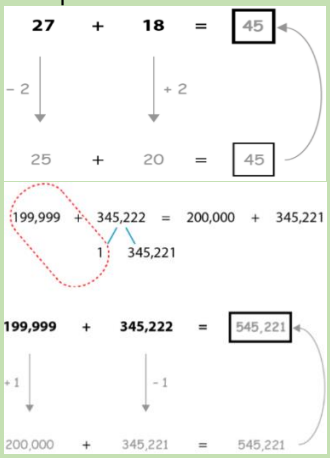
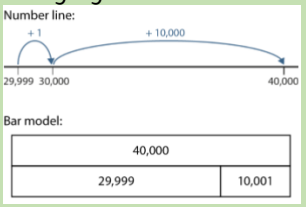
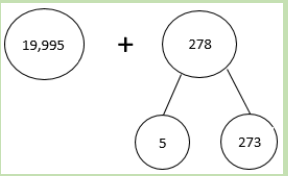
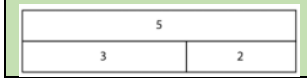
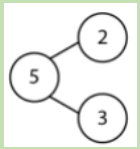
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
represent and use number bonds and related subtraction facts within 20 3 + 7 = 14 + 6 = 10 – 8 = 20 – 11 = Within 10    Within 20	recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 30 + 70 = 100 - 10 = Base 10  Abacus/ rekenrek Multiple of 10  Number bond to 100 	add and subtract numbers mentally, including: <u>a three-digit number and ones</u> 273 + 5 <u>a three-digit number and tens</u> 672 + 30 100 – 21 <u>a three-digit number and hundreds</u> 492 + 500 Strategies - Use known facts  - Partition - Count on for subtraction  - Count back  - Bridge through a multiple of 10	add and subtract numbers mentally with up to 4 digits = 6,000 - 900 5873 + 90 = 7382 + 300 8000 + 1834 = 8,275 + 82 Mental partitioning  	add and subtract numbers mentally with increasingly large numbers and decimals 2800 + 7200 500,000 – 5,000 10,000 – 5,400 199,999 + 345,666 Pictorial e.g. 314,523 + 30,000  <u>adding a whole</u> 4.32 + 4 <u>subtracting a whole</u> 9.87 – 3 <u>using known facts</u> 1.2 + 0.8 <u>subtracting from a whole</u> 9 – 1.9 8 – 6.71 <u>Reordering</u> 800 + 240 + 360 1.7 + 2.8 + 0.3	perform mental calculations, including with mixed operations, large numbers and decimals. 1,999,999 + 350,750 3,000,000 – 250,000 5.87 + 3.123 = Compensation  Part-whole 

STOC's Calculation Policy

	100 square 	  - Count on to find the difference E.g. 203 – 79 79 + 1 = 80 80 + 20 = 100 100 + 100 = 2 200 + 3 = 203 1 + 20 + 100 + 3 = 12 - Mental compensation 		58 + 47 – 38 Compensation 	Bridging  
add and subtract one-digit and two-digit numbers to 20, including zero 3 + 5 = 12 + 4 = 19 + 0 = 9 – 6 = 17 - 3 = Partitioning  Bar model 	add and subtract numbers using concrete objects, pictorial representations, and mentally. <u>a two-digit number and ones</u> 2 + 67 = = 98 + 4 = 54 – 8 bridge 100s when adding and subtracting 98 + 7 Hundred square grid	add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction 94 + 267 468 + 375 732 – 97 = 521 – 386 Concrete/ pictorial	add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction 7,064 - 502 6,155 + 501 + 649 = 5001 – 834 7,306 – 1,847 = (with and without varied 0s in the minuend) Concrete addition	add and subtract whole numbers with more than 4 digits, and with decimals including using formal written methods = 864,027 + 6,932 362,973 + 576,195 750,306 – 13,847 = (with and without varied 0s in the minuend) 56.38 + 24.7 = _____= 7 – 2.25 8 – 5.123 =	add and subtract whole numbers and decimals using formal written methods (columnar addition and subtraction) 1,823,563 + 6,832,589 27,543 + 49.326 90,802 – 47.384

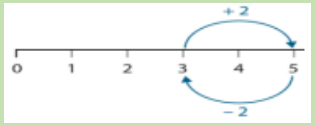
STOC's Calculation Policy

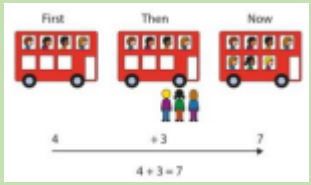
Part-whole cherries

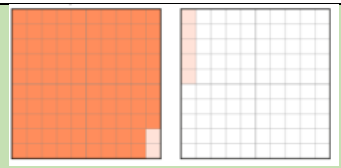


reduction

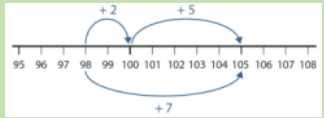
Number lines



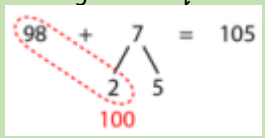




Number line



Jottings and equations



<u>a two-digit number and tens</u>

33 + 10 =

41 - 10 =

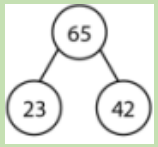
30 + 50 =

67 – 40 =

<u>two two-digit numbers</u>

58 + 32 =

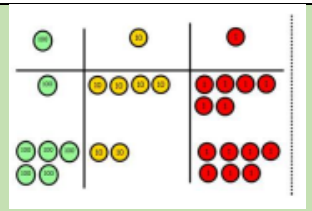
92 – 85 =



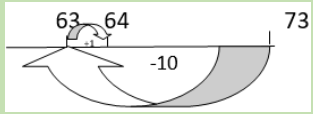
<u>adding three one-digit numbers</u>

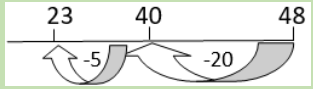
6 + 5 + 9 =

Difference

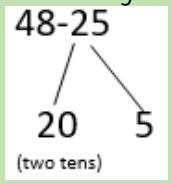


Number line



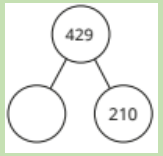


Paritioning

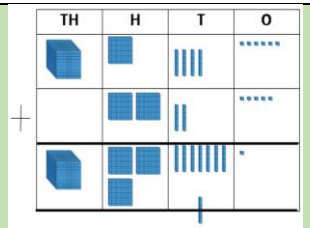


Bar model

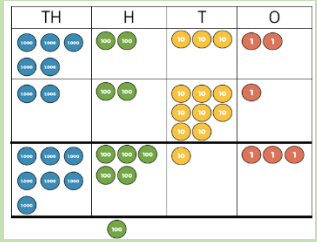
?	
53	24



Concrete column method



Pictorial addition



Abstract addition

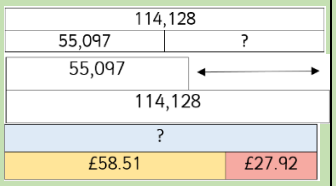
	TH	H	T	O
	5	2	3	2
+	3	2	8	1
	8	5	1	3

Concrete subtraction

Pictorial subtraction

26.43 – 2.012 =

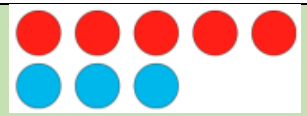
Bar models



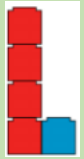
Pictorial column method

		6	4	3,	8	0 1
+		5	0	5,	3	7 0
	1,	1	4	9,	1	7 1
	1					

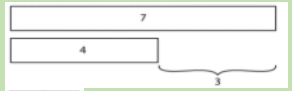
SToC's Calculation Policy

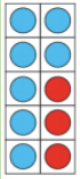


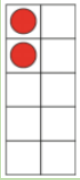
How many more etc

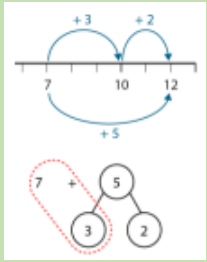


Bar model

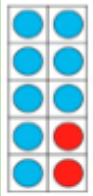


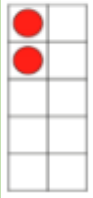


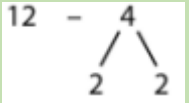




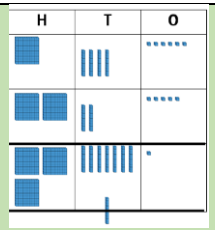
subtraction through 10



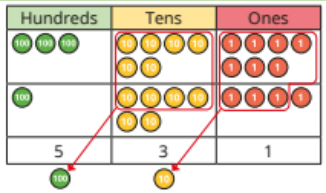




subtraction from 10

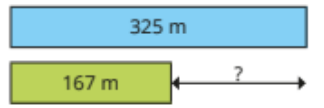


Pictorial column method

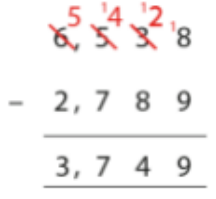


Abstract column method

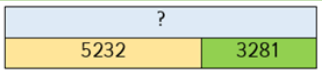
Bar model

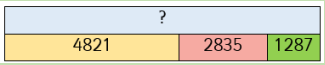


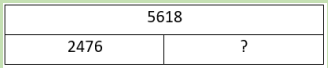
Abstract subtraction



Bar models

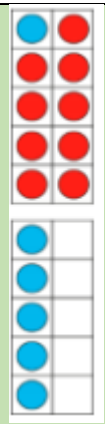
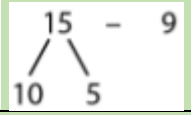
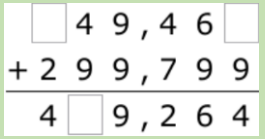
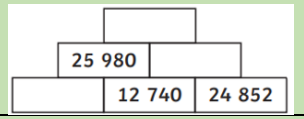
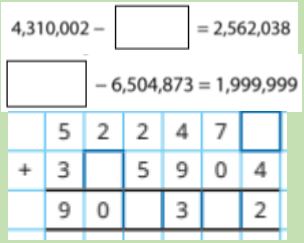




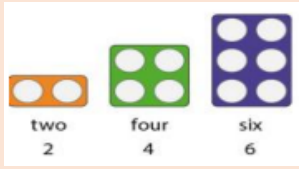
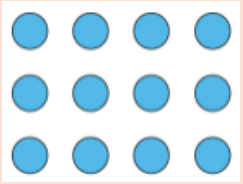
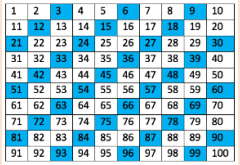
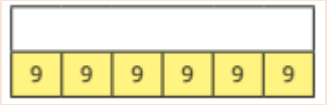
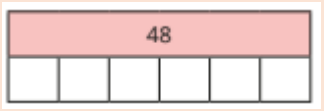
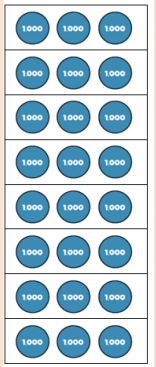


Same difference

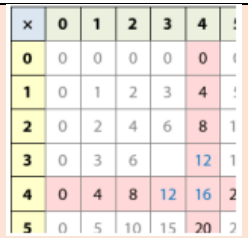
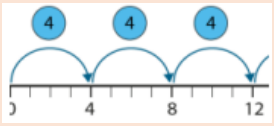
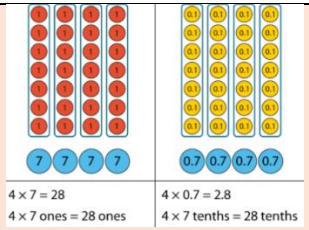
STOC's Calculation Policy

	 				
solve missing number problems 7 = ___ - 9	solve problems (including using the inverse). 8 + ☐ + 4 = 17 60 + ☐ = 89 ☐ + 25 = 37 ☐ - 50 = 50 100 - ____ = 52	solve missing number problems 10 + ☐ = 302 ☐ - 10 = 298 _____ + 70 = 485 _____ + 5 = 341 826 = 800 + + 6 602 - ☐ = 594	solve missing number problems 6,562 + ___ + 628 = 8,432 ☐ - 2,746 = 4,218 7.2 + __ = 8 3 , ☐ 4 ☐ + ☐ , 5 ☐ 7 7 , 8 7 9 7 , ☐ 8 ☐ – ☐ , 2 ☐ 4 4 , 4 7 5	solve missing number problems ____ + 310,853 = 923,684 ☐ - 523,972 = 285,167 802,423 - _____ = 283,941 84 – _____ = 6.952  	solve missing number problems ____ + 3,953,854 = 5,273,987 ☐ - 4,538,902 = 2,785,169 8,502,413 - _____ = 3,573,946 537 – _____ = 9.845 
					Use their knowledge of the order of operations to carry out calculations involving the four operations

STOC's Calculation Policy

					6 + 4 ÷ 2 = 62 + 10 = 60 ÷ (30 – 24) = 92 - 36 ÷ 9 =
		estimate the answer to a calculation and use inverse operations to check answers	estimate and use inverse operations to check answers to a calculation	use rounding to check answers to answers to a calculation	use rounding to check answers to answers to a calculation
count in multiples of twos, fives and tens 2, 4, __, 8, 10, __ Count from 0 in 5s to 50. Count back in 10s from 50. Numicon  Skip counting on a number line  	recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables 2 x 7 = = 10 x 5 5 x 6 = 24 ÷ 2 = 15 ÷ 5 = 60 ÷ 5 = 100 ÷ 10 = Concrete  Highlight multiples on a 100 square  	recall and use multiplication and division facts for the 4, 8 and 3. multiplication tables including missing numbers 4 x 6 = = 3 x 8 32 ÷ 4 = Concrete  Pictorial  Patterns on a 100 square or multiplication grid  	recall multiplication and division facts for multiplication tables up to 12 × 12, including missing numbers = 9 x 6 99 ÷ 11 = __ x 7 = 42 108 ÷ ___ = 12 Concrete  Bar models   	multiply and divide numbers mentally drawing upon known facts 2,400 ÷ 2 = ☐ = 240 ÷ 8 1,080 ÷ 9 = Pictorial e.g. 3000 x 8  4 x 0.7	perform mental calculations, including with mixed operations and large numbers 32 ÷ 0.8 = 40 0.32 ÷ 0.8 = 0.4 2,4000 ÷ 20 = 90 ÷ __ = 4.5 __ = 4.5 x 20 __ = 4.5 x 2 37.184 x 2 24.638 ÷ 2

STOC's Calculation Policy

		  Bar model 			
			use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers 0 × 989 = 838 ÷ 1 = = 3 x 4 x 6 6 × 10 × 11 =	recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3) 9^2 4^3	
use multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays <u>Doubles to 10</u> Show 3 x 2 using an array (concrete/ pictorial)	calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs Show as repeated addition and in a commutative way:	write and calculate mathematical statements for multiplication and 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	multiply two-digit and three-digit numbers by a one digit number using formal written layout 9 x 41 = ☐ = 596 × 7 ___ ÷ 7 = 67 ___ ÷ 9 = 64	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 607 x 83	multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication 4078 x 67 Area model

STOC's Calculation Policy

Halves within 20

Show 18 ÷ 2 using an array (concrete/ pictorial)

5 x 3

__ = 60 ÷ 5

__ x 10 = 110

5 x __ = 45

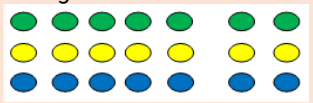
__ ÷ 2 = 12

80 ÷ __ = 10

Repeated addition

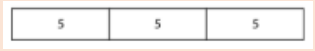
Items/ pictorial

Array

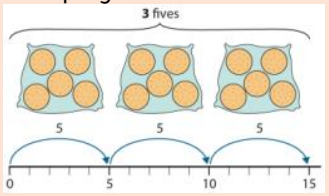


Numicon

Bar model



Grouping



5+5+5 = 15

15 ÷ 5 = 3

Fifteen divided into groups of five is equal to three.

89 x 4

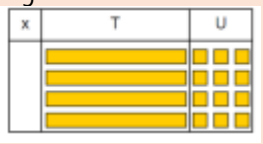
2 x 45

__ = 27 x 8

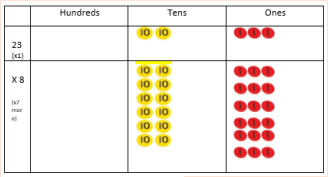
__ ÷ 3 = 36

Concrete

e.g. 13 x 4



Pictorial



3 x 8 = 24

20 x 8 = 160

Abstract

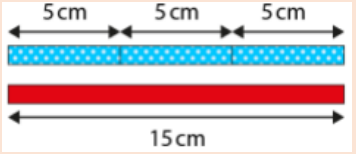
23

X 8

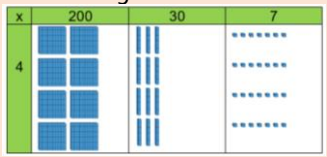
184

2

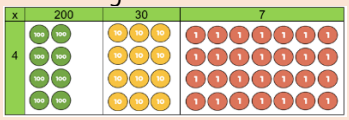
Bar model



Concrete grid method



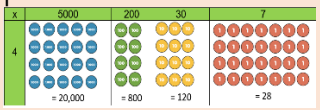
Pictorial grid method



Abstract grid method

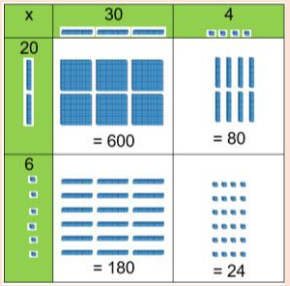
x	200	30	7
4	800	120	28

Grid to short method: pictorial to abstract



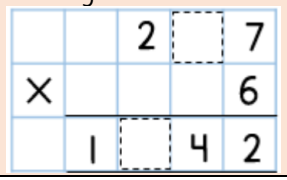
	TTH	TH	H	T	O
		5	2	3	7
x					4
	2	0	9	4	8
			1	2	

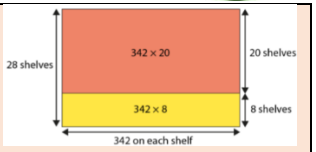
Grid to long method: concrete to abstract



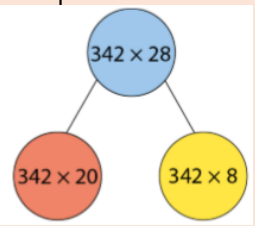
	H	T	O	
		3	4	
x		2	6	
	2	0	4	(24 x 6)
+	6	8	0	(34 x 20)
	8	8	4	

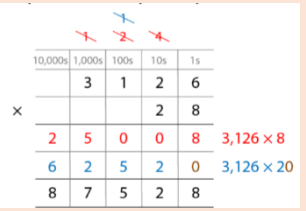
Missing numbers

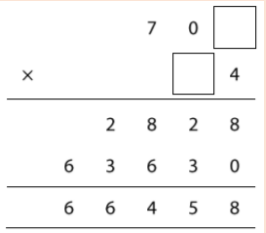




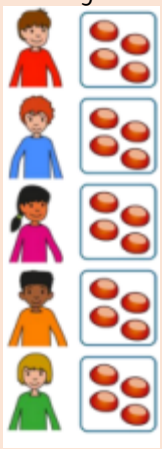
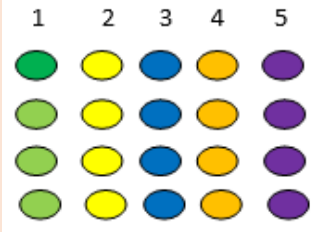
Part-part-whole



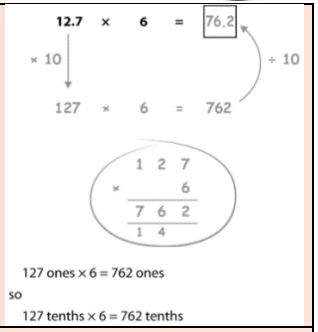
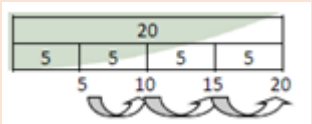
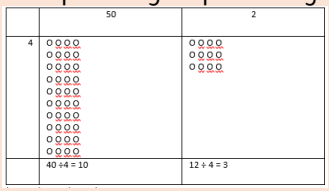
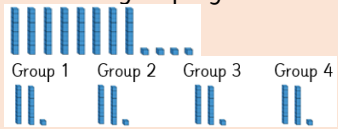
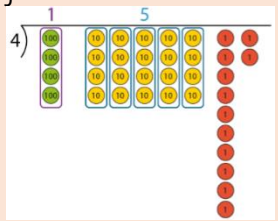
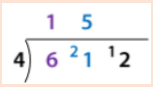
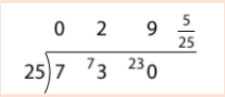
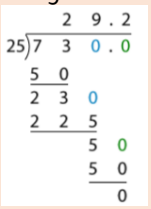




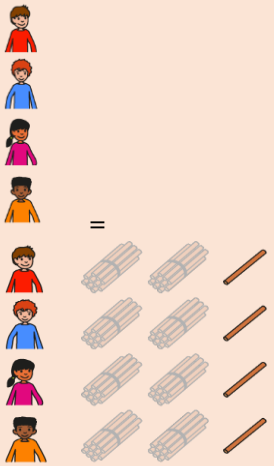
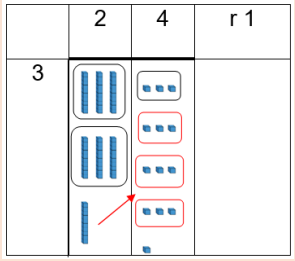
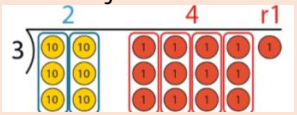
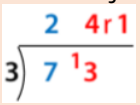
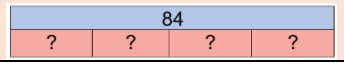
STOC's Calculation Policy

	Sharing  Twenty conkers are shared equally between five children. Each child gets four conkers. Group counters in arrays 				
					multiply one-digit numbers with up to two decimal places by whole numbers 0.5 x 28 3.9 x 30

SToC's Calculation Policy

					
		write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers 52 ÷ 4 = ____ = 81 ÷ 3 Concrete/ pictorial grouping  Bar model  Group on a grid pictorially 	divide numbers up to 3 digits by a one digit number using the formal written method of short division and interpret remainders appropriate for the context <u>2 digits</u> 91 ÷ 7 = ___ = 76 ÷ 4 86 ÷ 3 = (with remainder) <u>3 digits</u> 441 ÷ 9 = ___ = 228 ÷ 6 473 ÷ 7 = (with remainder) Concrete grouping  Concrete/ pictorial sharing 	divide numbers up to 4 digits by a one-digit number using the formal written method of short division including with and without remainders <u>3 digits</u> 840 ÷ 5 = (no remainder) 587 ÷ 6 = (with remainder) Pictorial to abstract formal method   <u>4 digits</u> 2,534 ÷ 7 =	divide numbers up to 4 digits by a two-digit whole number using the formal written method of long or short division, and interpret remainders as whole number remainders, fractions or 2 decimal places 60 ÷ 15 = 672 ÷ 21 = (factorise) 888 ÷ 37 = 3066 ÷ 73 = Short division  Long division 

STOC's Calculation Policy

			 Concrete formal method  Pictorial formal method  Abstract formal method  Bar model 	(no remainder) 4,947 ÷ 8 (with remainder)	

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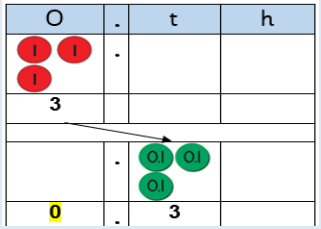
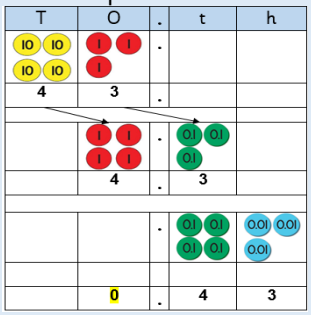
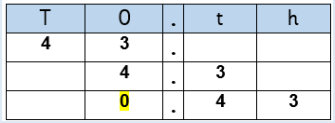
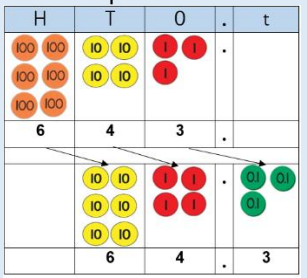
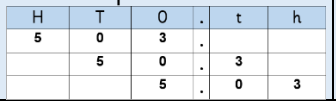
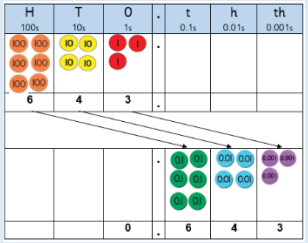
		estimate the answer to a calculation and use inverse operations to check answers	estimate and use inverse operations to check answers to a calculation	estimate and use inverse operations to check answers to a calculation	use estimation to check answers to calculations
		find the effect of dividing a one-digit number by 10 8 ÷ 10 = __ = 5 ÷ 10 Pictorial place value chart  	find the effect of dividing a one- or two-digit number by 10 and 100 48 ÷ 10 = __ = 6 ÷ 100 = 95 ÷ 100 = Pictorial place value chart  Abstract place value chart  	multiply and divide whole numbers and those involving decimals by 10, 100 and 1000 1,010 x 10 = = 25.34 x 10 13.05 x 1,000 = 0.1 ÷ 100 = Pictorial place value chart  Abstract place value chart  	multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places 2.12 ÷ 10 = 0.9 ÷ 100 = 1,010 x 1,000 = Pictorial place value chart 

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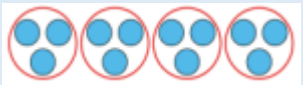
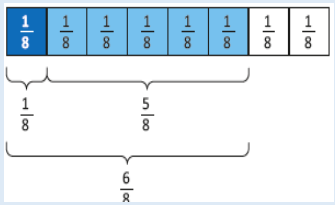
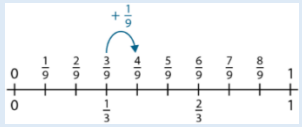
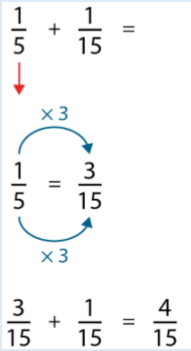
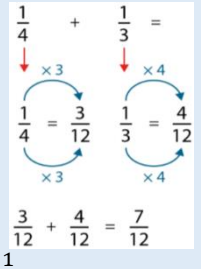
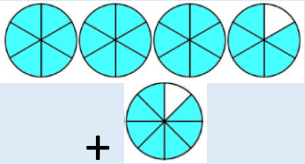
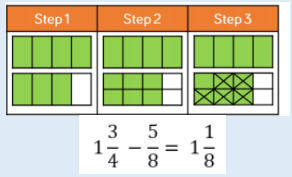
		add and subtract fractions with the same denominator within one whole $\frac{5}{7} + \frac{1}{7}$ $\frac{9}{11} - \frac{4}{11}$ Varied representations     	add and subtract fractions with the same denominator $\frac{1}{11} + \frac{3}{11} + \frac{5}{11}$ $\frac{7}{8} - \frac{1}{8} - \frac{3}{8}$ $1 - \frac{2}{3}$ $1 - \frac{2}{5} - \frac{1}{5}$  Find the difference 	add and subtract fractions with the same denominator and multiples of the same number, including > 1 as a mixed number $\frac{1}{3} + \frac{1}{9}$ Number line  Abstract  Other variations $\frac{2}{5} + \frac{4}{5} = \frac{6}{5} = 1\frac{1}{5}$ $\frac{4}{9} + \frac{2}{3}$ $1\frac{3}{4} + \frac{3}{4} =$	add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions $\frac{1}{2} + \frac{1}{3}$  $\frac{2}{7} - \frac{1}{9}$ $\frac{2}{3} + 2\frac{1}{3}$  $2\frac{1}{2} - \frac{2}{3}$  $1\frac{1}{5} + 2\frac{1}{10}$

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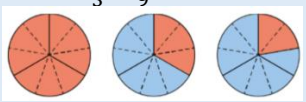
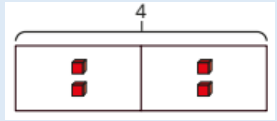
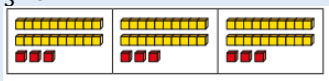
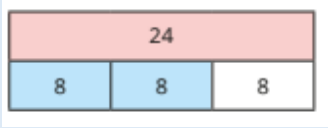
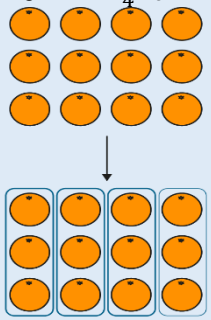
				$1\frac{3}{7} - \frac{4}{7}$ $2 - \frac{2}{5}$ $3 - \frac{4}{7} - \frac{1}{7}$ $1 - ? = \frac{1}{3} - \frac{2}{9}$ 	$4\frac{2}{3} + 1\frac{6}{7}$ $10 - 2\frac{1}{4}$
	find fractions of a set of objects or quantity and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$ $\frac{1}{2}$ of 6 Concrete  Pictorial  $\frac{1}{2}$ of 40 / $\frac{1}{2}$ of 90	find and write fractions of an amount: unit fractions and non-unit fractions with small denominators $\frac{1}{3}$ of 36 $\frac{3}{4}$ of 32 Concrete $\frac{1}{3}$ of 69  Pictorial bar model 	recognise, find and write fractions of an amount $\frac{1}{6}$ of 72 $\frac{7}{10}$ of 30 $\frac{2}{5}$ of 150 $\frac{3}{4}$ of 1,000 = Concrete/ pictorial e.g. circle $\frac{3}{4}$ of the oranges 	find fractions with a denominator of a multiple of 10 or 25 $\frac{3}{20}$ of 100 $\frac{5}{75}$ of 150	find the original amount $\frac{1}{6}$ of ___ = 12

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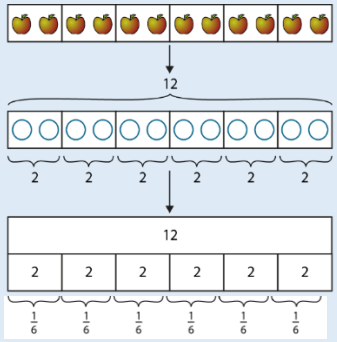
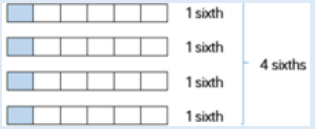
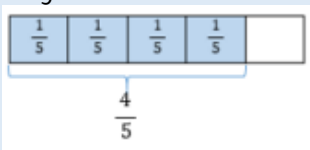
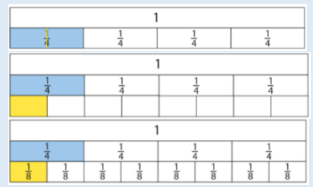
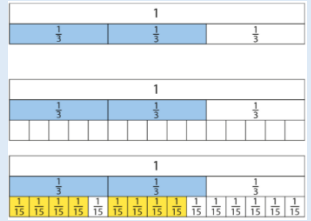
	 $\frac{1}{4}$ of 12  $\frac{2}{4}$ of 36		Bar model 		
				multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams $\frac{4}{5} \times 400 =$ $\frac{1}{6} \times 4 = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$ Bar model  Single bar  $1\frac{3}{4} \times 10$	multiply simple pairs of proper fractions, writing the answer in its simplest form $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$  $\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{3}{10}$ 

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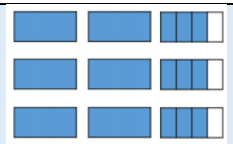
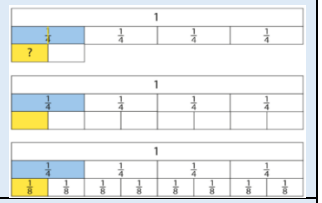
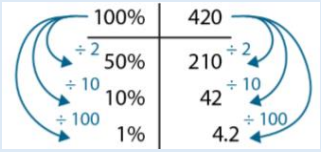
				 $2 \times 3 = 6$ $\frac{3}{4} \times 3 = \frac{9}{4} = 2\frac{1}{4}$ $6 + 2\frac{1}{4} = 8\frac{1}{4}$	
					divide proper fractions by whole numbers $\frac{1}{4} \div 2 =$ 
				Find percentages of amounts where they are equivalent to the fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ 50% of 100 25% of 3,200 20% of 1,200  	finding percentages of numbers. 2% of 3,000 80% of 115 15% of 360 Bar model