

Calculation Policy



All of our policies are underpinned by our Vision and driven by our Values of Friendship, Family and Fulfilment

CALCULATION POLICY

Reviewed: Every 3 years

Reviewed by: Mathematics Lead Teacher, Head Teacher, LGC

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Calculation Policy

The following is an outline of the objectives and calculation methods that make up the New Mathematics Curriculum (2014).

The new curriculum aims that all children:

- **become fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- Can **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- Can **solve problems (mastery)** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

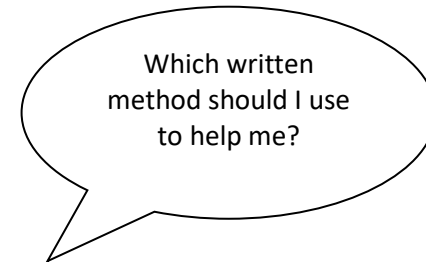
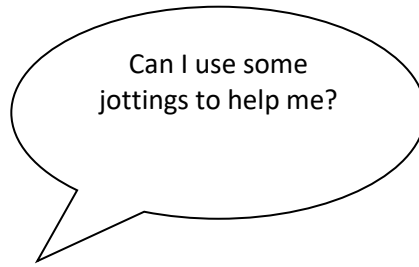
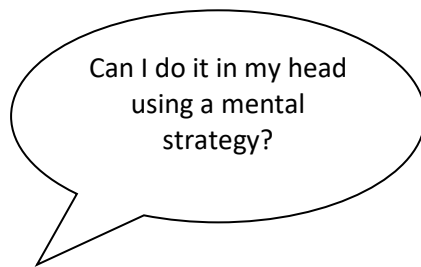
The key to this calculation policy is to thoroughly underpin mathematical learning by providing full immersion in the **concepts** before moving to **procedures**.

“Dependence on facts and procedures alone cannot ensure competence with arithmetic at the required level; competence also depends on identifying and acting on the underlying relations, equating and estimating quantities.” ACME Report on primary Arithmetic, Dec 2010

We place an emphasis on children understanding ‘number’ and what is happening to the value of digits during a calculation. This is a contrast to procedural methods where children follow a method without understanding the reasoning.

It is important that children understand the reasoning behind each strategy (what to do and why) and learn to apply the most suitable method for a particular calculation. For example, a child may be able to subtract 497 from 506 by writing it in columns without realising it is quicker to count on from 497 to 506. Some strategies encourage children to think mentally rather than always use pen and paper. Knowing how to choose sensible strategies is a skill that develops with practise and confidence.

“When solving word problems, it is often not the calculation that children can’t do – rather they are not sure which calculation they need to do” NCETM, 2013



Effective teaching provides children with a range of strategies which are within their conceptual understanding – some children will need the aid of visual prompts (cubes, numberlines) to reinforce place value whereas some children are ready for abstract thinking. Children should be able to share with their parents the strategies they apply in class and it would be helpful to familiarise parents with these methods (workshops/ information evenings) so as parents can support children at home using similar methods used in school. One strategy is that of ‘Part, Part, Whole’ in EYFS/KS1 leading on to ‘Bar Modelling’ in KS2.

Part, Part, Whole

The relationship between addition and subtraction

National Centre for Excellence in the Teaching of Mathematics

Part / whole relationships

$$a = b + c$$

$$a = c + b$$

$$a - b = c$$

$$a - c = b$$

A Consistent Picture

MathsHUBS White Rose

Progression of Learning

Key Stage 1

The focus of maths teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations including with practical resources (e.g. concrete objects and measuring tools), part, part, whole and simple bar modelling.

By the end of Year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. This will be assessed in class and as part of the KS1 SATs.

Lower Key Stage 2

The focus of Maths teaching in lower Key Stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

By the end of Year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication tables and show precision and fluency in their work. This will be assessed in class and using a formal online assessment starting in 2020.

Upper key Stage 2

The focus of Maths teaching in upper Key Stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections the pupils make between multiplication and division with fractions, decimals, percentages and ratio.

By the end of Year 6, pupils should be fluent in written methods for all 4 operations, including long multiplication and division, and in working with fractions, decimals and percentages. This will be assessed both in class and as part of the KS2 SATs.

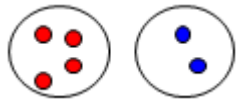
How you can help your child

- Familiarise yourself with the calculation strategies used in school
- Use practical situations to develop their maths and place it in a context (Use of the Maths Booklet for Parents)
 - Cooking – encourage them to measure mass and capacity
 - Provide opportunities to measure length – height chart
 - Shopping – find the total, work out the change, find the cheapest
 - Time – many children in school may find telling the time very difficult. Children need to learn the analogue time before the digital time
- Help your child learn their tables – children are expected to know all of their tables (multiplication and division) by the end of Year 4
- Practise number bonds (9 to 10, 20, 50, 100 and 1000) and doubles and halves

Number - addition and subtraction

Number - multiplication and division

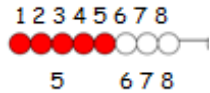
add two single digit numbers
aggregation
Counters on plates



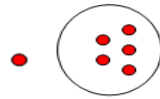
1, 2, 3, 4, 5, 6.

Bead strings or bead bars can be used to illustrate addition including bridging ten by counting on 2 then 3.

$5 + 3 = 8$



subtract two single digit numbers
reduction
Counters on plates



6 take away 1 leaves
1, 2, 3, 4, 5.

Cross out drawn objects to represent what has been taken away:

3 take away 2 is 1



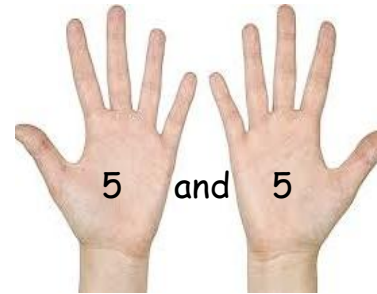
Start with 3 ... 2, 1.

solve problems including doubling

Practically double a group of objects to find double of a number by combining then counting the two groups:



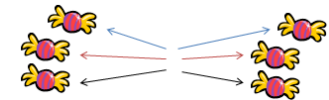
Double 4 is 8.



is 10

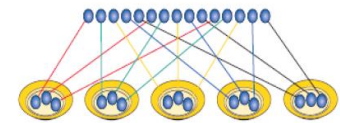
solve problems including halving and sharing

Sharing objects



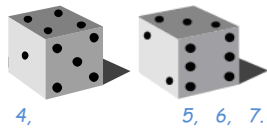
One for you. One for me...
Is it fair? How many do we each have?

15 shared between 5 is 3.



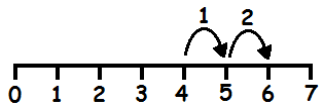
Count on to find the answer
augmentation
Practically with objects, fingers etc.
 $5 + 2$ "Put 5 in your head, 6, 7."

Dice... $4 + 3 = 7$



On a prepared number line (start with the bigger number)...

$2 + 4 = 6$



Count on or back to find the answer
Practically, for example:
Group objects on a table then cover some to visualize the calculation:

2 less than 4 is 2



Start with 2... 3, 4.

Coins



I had 10 pennies. I spent 4 pence. How much do I have left? Start with 10... 9, 8, 7, 6.

Grouping objects

Put groups of objects on plates.

How many groups of 4 are there in 12 stars?



understand and use vocabulary for addition

add, more, and, make, sum, total, altogether, score, double, one more, two more, ten more... how many more to make...? how many more is... than...?

is the same as

understand and use vocabulary for subtraction

take (away), leave, how many are left/left over? how many have gone? one less, two less... ten less... how many fewer is... than...? difference between

is the same as

understand and use vocabulary for multiplication

count on (from, to), count back (from, to), count in ones, twos... tens...

is the same as

understand and use vocabulary for division

half, halve, count out, share out, left, left over

is the same as

Year 1

Number - addition and subtraction

Number - multiplication and division

represent and use number bonds up to 20

represent and use number bond facts related subtraction up to 20

count in multiples of twos, fives and tens (from number and place value)

group and share small quantities





Start with number bonds to 10 then build. Use a wide range of objects

Start with number bonds to 10 then build. Use a wide range of objects





Counting using a variety of practical resources

Practical activities involving sharing.

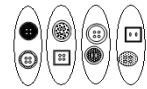
(including fingers!) and images to model the bonds, e.g. interlocking cubes.

$0 + 7 = 7$  $7 = 7 + 0$
 $1 + 6 = 7$  $7 = 6 + 1$
 $2 + 5 = 7$  $7 = 5 + 2$
 $3 + 4 = 7$  $7 = 4 + 3$

(including fingers!) and images to model the bonds, e.g. interlocking cubes.


$7 - 0 = 7$  $0 = 7 - 7$
 $7 - 1 = 6$  $1 = 7 - 6$
 $7 - 2 = 5$  $2 = 7 - 5$
 $7 - 3 = 4$  $3 = 7 - 4$

Counting in 2s e.g. counting socks, shoes, animals in the ark...
Counting in 10s e.g. hundred square, towers of cubes...



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.


Grouping
 Sorting objects into 2s / 3s / 4s etc
 How many pairs of socks are there?


There are 12 crocus bulbs. Plant 3 in each pot. How many pots are there?
Jo has 12 Lego wheels. How many cars can she make?

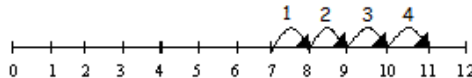
add one-digit and two-digit numbers to 20, including zero

Bead strings or bead bars can be used to illustrate addition including bridging ten by counting on 2 then 3.

8 + 5



On a prepared number line... $7 + 4 = 11$



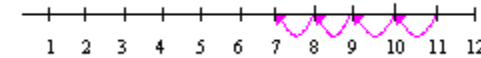
On a hundred square... $3 + 4$

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

subtract one-digit and two-digit numbers to 20, including zero

Practically with objects, fingers etc.
 $5 - 2$ "Put 5 in your head, 4, 3."

Taking away
Number lines (numbered and unnumbered, prepared and child constructed)

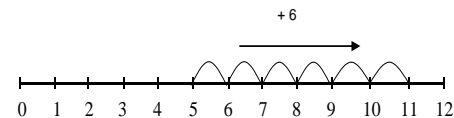


Hundred Square
 $17 - 3$

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

Finding the difference

Number lines (numbered and unnumbered, prepared and child constructed)

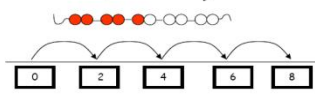


Use practical equipment (such as numicon or cuisenaire) to identify the 'difference':

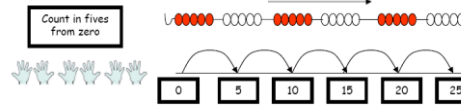


"The difference between 7 and 4 is 3" or "Seven is 3 more than four".

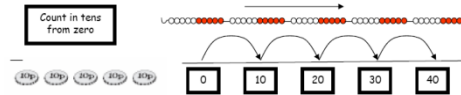
Count in twos from zero



Count in fives from zero



Count in tens from zero



Use rhymes, songs and stories involving counting on and counting back in ones, twos, fives and tens.
Use 2p, 5p and 10p coins.

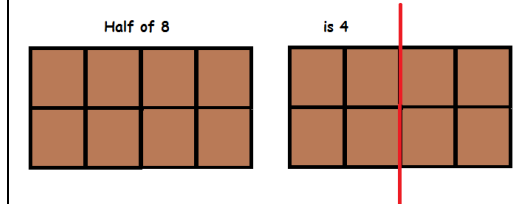
double numbers and quantities

Practically double a group of objects and/or quantities to find double of a number by combining then counting the two groups.
Progress onto using known facts and counting (in 1s, 2s, 5s and 10s) to double more efficiently.



half numbers and quantities

Practically halve objects and/or quantities by sharing them out into two piles and then counting the number of objects in each pile, or cutting/folding pictures of objects in half.
Progress onto using known facts and counting (in 1s, 2s, 5s and 10s) to halve more efficiently.



read, write and interpret mathematical statements involving addition (+) and equals (=) signs

It is important to that children have a clear understanding of the concept of equality, before using the '=' sign. Calculations should be on either side of the '=' to that children don't misunderstand '=' as to mean 'the answer'.

15 + 2 = 17
15 = 3 + 12


read, write and interpret mathematical statements involving and subtraction (-) equals (=) signs

It is important to that children have a clear understanding of the concept of equality, before using the '=' sign. Calculations should be on either side of the '=' to that children don't misunderstand '=' as to mean 'the answer'.

15 - 2 = 13
15 = 18 - 3

make connections between arrays and number patterns


Arrays



Looking at columns
 $2 + 2 + 2$
3 groups of 2

Looking at rows
 $3 + 3$
2 groups of 3

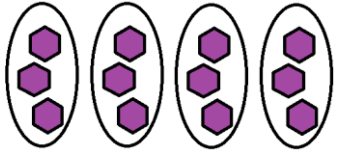
Arrays and repeated addition



4×2 or $4 + 4$

2×4
or $2 + 2 + 2 + 2$

make connections between arrays and number patterns



There are 4 groups of 3 in 12.
12 shared between 4 is 3.

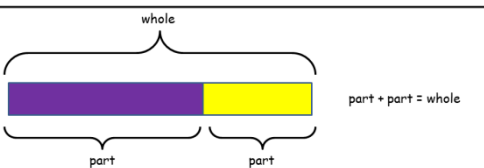
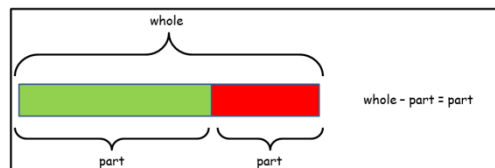
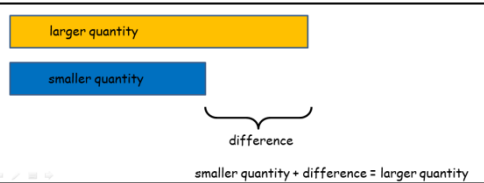
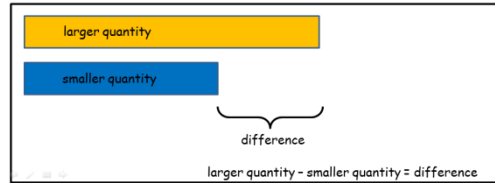
solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \square + 4$

To support this, when solving calculations, missing numbers should be placed in all possible places:

$3 + 4 = \square$ $\square = 4 + 3$
 $3 + \square = 7$ $7 = \square + 4$
 $4 + \square = 7$ $7 = 3 + \square$
 $\square + 7 = 7$ $7 = \square + 7$

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

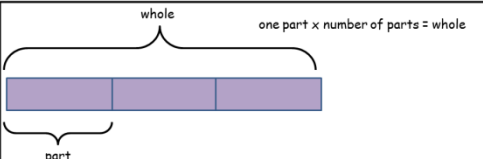
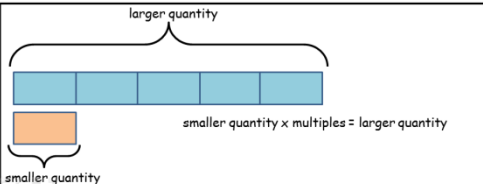
solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \square - 9$

To support this, when solving calculations, missing numbers should be placed in all possible places:

$16 - 9 = \square$ $\square = 16 - 9$
 $16 - \square = 7$ $7 = \square - 9$
 $\square - 9 = 7$ $7 = 16 - \square$
 $\square - 7 = 7$ $7 = \square - 7$

Use all the models and images mentioned above. Discuss which is most effective and why.

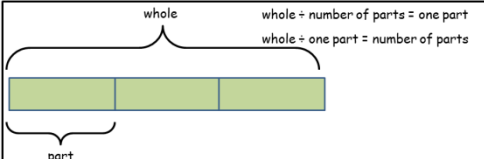
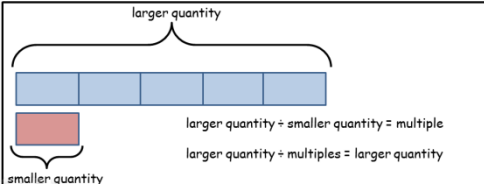
Singapore Bar Method

solve one-step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support

Use all the models and images mentioned above. Discuss which is most effective and why.

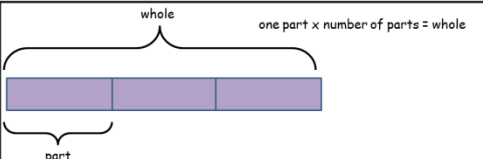
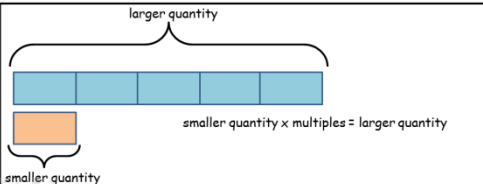
Singapore Bar Method

solve one-step problems involving division, by calculating the answer using concrete objects, pictorial representations and arrays with the support

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

understand and use vocabulary for addition, e.g. put together, add, altogether, total and more than

+ add, more, plus, make, total, altogether, score, double, near double, one more, two more... ten more,

= equals, sign, is the same as

How many more to make...? How many more is... than...? How much more is...?

Repetition of facts with different vocabulary:
 "What is 2 add 5?" "What is 2 more than 5?"
 "What is 2 plus 5?" "What is the total of 2 and 5?" etc

understand and use vocabulary for addition and subtraction, e.g. take away, distance between, difference between and less than

- subtract, take (away), minus, leave, how many are left/left over? how many have gone? one less, two less, ten less... how many fewer is... than...? how much less is...? difference between, half, halve, counting up/back...

= equals, sign, is the same as

Repetition of facts with different vocabulary:
 "What is 7 take away 3?" "What is 3 less than 7?"
 "What is 7 subtract 3?"
 "What is the difference between 3 and 7?" etc

use a variety of language to describe multiplication

count on (from, to), count back (from, to), count in ones, twos, threes, fours, fives... count in tens, lots of, groups of, x, times, multiply, multiplied by, multiple of, once, twice, three times... ten times... times as (big, long, wide... and so on), repeated addition, array, row, column, double, halve

= equals, sign, is the same as

use a variety of language to describe division

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

= equals, sign, is the same as

Number - addition and subtraction

Number - multiplication and division

recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100

Play games, chant, test etc to increase speed of recalling facts to 20. Make models and images to display facts. Investigate related facts to 100 and repeat above.

recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100

Play games, chant, test etc to increase speed of recalling facts to 20. Make models and images to display facts. Investigate related facts to 100 and repeat above.

recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers

Play games, chant, test etc to increase speed of recalling facts to 20. Make models and images to display facts. Investigate related facts to 100 and repeat above.

recall and use division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers

Play games, chant, test etc to increase speed of recalling facts to 20. Make models and images to display facts. Investigate related facts to 100 and repeat above.

add numbers using concrete objects, pictorial representations, and mentally, including:

- a two-digit number and ones or tens

Counting on
 $15 + 2$ "Put 15 in your head, 16, 17."

Partition number and recombine
 $27 + 9 = 20 + 7 + 9 = 20 + 16 = 36$

Count on by splitting units to make next multiple of ten
 $36 + 8 = 36 + 4 + 4 = 40 + 4 = 44$

Adding near numbers and adjusting
 $33 + 9 = 33 + 10 - 1$

Hundred Square
 $17 + 30$

subtract numbers using concrete objects, pictorial representations, and mentally, including:

- a two-digit number and ones or tens

Counting back
 $63 - 20$ "Put 63 in your head, 53, 43."

Use unprepared numbered lines to subtract, by counting back in units:
 $16 - 4 = 12$

Hundred Square
 $43 - 30$

- two two-digit numbers

Use known number facts and place value to subtract (partition second number only)
 $37 - 12 = 37 - 10 - 2 = 27 - 2 = 25$

Find a small difference by counting up
 $42 - 39 = 3$

Subtract mentally a number near 10 to or from a two-digit number
 $35 - 19 = 35 - 20 + 1$

- two two-digit numbers

Use empty number lines to add two 2 digits numbers, by counting on in multiples of ten then multiples of one.
 $63 + 16 = 79$

Partition into tens and ones and recombine
 $12 + 23 = 10 + 2 + 20 + 3 = 10 + 20 + 2 + 3 = 30 + 5 = 35$

Hundred Square
 $32 + 23$

Refine to partitioning the second number only:
 $23 + 12 = 23 + 10 + 2 = 33 + 2 = 35$

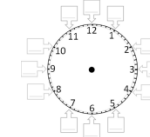
- adding three one-digit numbers

Use knowledge of adding, for example number bonds first or largest numbers first.

$$3 + 9 + 7 = (3 + 7) + 9 = 10 + 9 = 19$$

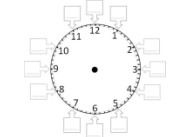
connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face

H	T	U
	1	0
	2	0
	3	0
	4	0



connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face

H	T	U
	1	0
	2	0
	3	0
	4	0



relate multiplication to arrays and to repeated addition using a range of materials and contexts

Practically combine groups of objects (2s, 5s and 10s) and verbalise (then record) what has been found out: There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there? 2 add 2 add 2 equals 6



Mum washed 5 pairs of socks, how many socks did she get out of the washing machine? 2 + 2 + 2 + 2 + 2 = 10

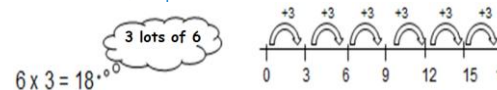


Use arrays for repeated addition and relate this to the x calculation: (Use counters or objects as well as visual representations to support understanding)

$$5 + 5 + 5 = 15 \quad 3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15 \quad 3 \times 5 = 15$$

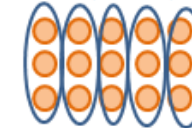
Use a number line for repeated addition:



relate division to grouping and sharing discrete and continuous quantities, to arrays and to repeated subtraction using a range of materials and contexts

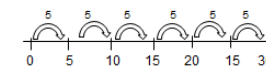
Initially, pupils to practically 'share' and 'group' using practical equipment and pictorial representation. Move on to using arrays to identify groups, use physical counters before pictorial representations:

How many groups of 3 are in 15?

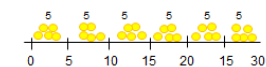


Grouping using a number line:

There are 30 children in the class, how many groups of 5 can we get into?



Use counters to support pupils understanding:



record addition and subtraction in columns

Use partitioned column method.

Solve calculations that do not cross the tens boundary, until they are secure with the method. Then solve calculations that do cross the tens boundary. Use base 10 (diennes) to support the understanding of 'carrying' and the value of 'digits'.

$$\begin{array}{r} 20 + 3 \\ + 30 + 4 \\ \hline 50 + 7 \\ \hline = 57 \end{array}$$

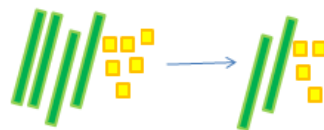
$$\begin{array}{r} 20 + 8 \\ + 10 + 3 \\ \hline 40 + 1 \\ \hline 41 \\ \hline 10 \\ \hline = 51 \end{array}$$

record subtraction in columns

Introduce partitioned column method where no exchanging is required:

$$46 - 22 = 24 \quad \begin{array}{r} 40 + 6 \\ - 20 + 2 \\ \hline 20 + 4 \end{array}$$

use base 10 (diennes) to support understanding



calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (x) and equals (=) signs

$$3 \times 4 = 12$$

Repetition of sentence with different vocabulary:

"3 times 4 equals 12"

"3 lots of 4 are 12"

"3 multiplied by 4 equals 12"

"The product of 3 and 4 is 12"

calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs

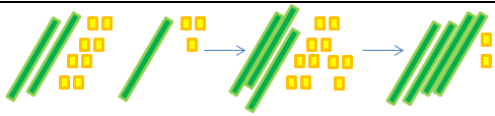
$$12 \div 4 = 3$$

Repetition of sentence with different vocabulary:

"12 divided by 4 equals 3"

"12 shared by 4 is 3"

"12 grouped into 4s is 3"

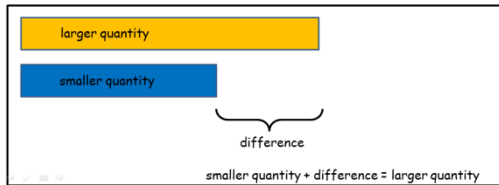
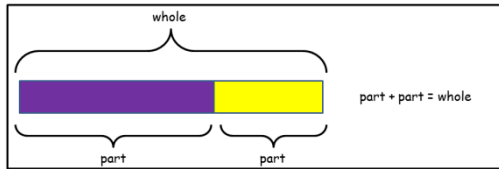


solve problems with addition:

- using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- applying increasing knowledge of mental and written methods

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

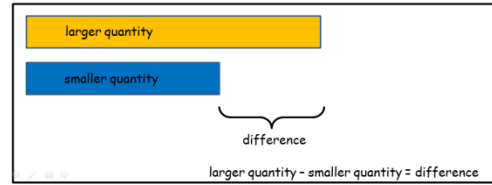
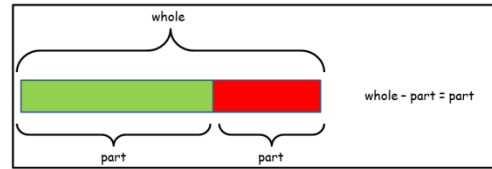


solve problems with subtraction:

- using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- applying increasing knowledge of mental and written methods

Use all the models and images mentioned above. Discuss which is most effective and why.

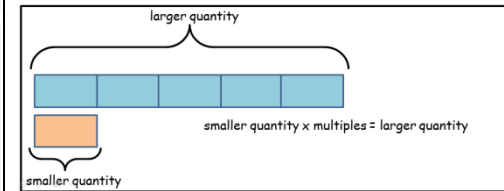
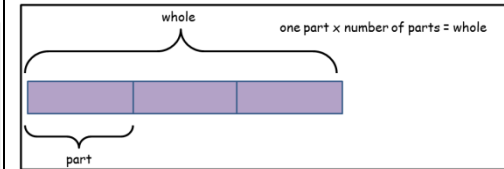
Singapore Bar Method



solve problems involving multiplication, using materials, arrays, repeated addition, mental methods, and multiplication facts, including problems in contexts

Use all the models and images mentioned above. Discuss which is most effective and why.

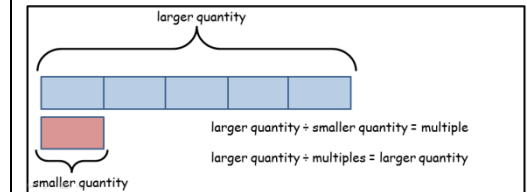
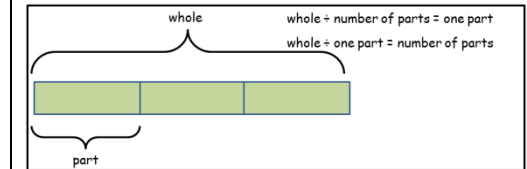
Singapore Bar Method



solve problems involving division, using materials, arrays, repeated addition, mental methods, and division facts, including problems in contexts

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method



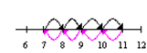
recognise and use the inverse relationship between addition and subtraction and use this to solve missing number problems

Missing numbers placed in all possible places.

$$\begin{aligned} 7 - 3 &= \square & \square &= 4 + 3 \\ 7 - \square &= 4 & 7 &= \square + 3 \\ \square - 3 &= 4 & 7 &= 4 + \square \\ \square - \nabla &= 4 & 7 &= \square + \nabla \end{aligned}$$

Number lines

$$7 + 4 = 11 \quad 11 - 4 = 7$$



As Year 1 and extend to

$$\begin{aligned} 14 + 5 &= 10 + \square \\ 17 - 5 &= 14 - \square \end{aligned}$$

and three numbers

$$\begin{aligned} 32 + \square + \square &= 100 \\ 35 &= 46 - \square - 7 \end{aligned}$$

recognise and use the inverse relationship between multiplication and division and use this to solve missing number problems

$$3 \times 5 = 15$$



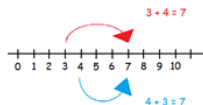
$$15 \div 3 = 5$$

$$5 \times 3 = 15$$

$$15 \div 5 = 3$$

show that addition of two numbers can be done in any order (commutative)

On a number line



$$26 + 12 = 38$$

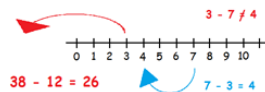


$$12 + 26 = 38$$

On a hundred square

show that subtraction of two numbers cannot be done in any order

On a number line



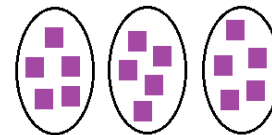
$$12 - 38 \neq 26$$

$$38 - 12 = 26$$

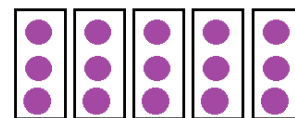


On a hundred square

show that multiplication of two numbers can be done in any order (commutative)

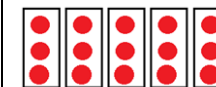


$$5 \times 3 = 15$$

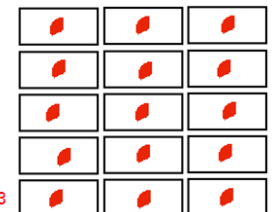


$$3 \times 5 = 15$$


show that division of one number by another cannot be done in any order



$$15 \div 5 = 3$$

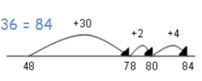
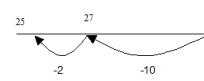


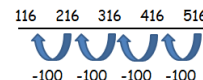
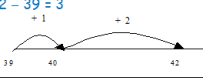
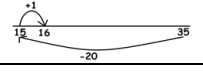
$$5 \div 15 \neq 3$$

<p>check their calculations, including adding numbers in a different order to check addition (for example, $5 + 2 + 1 = 1 + 5 + 2 = 1 + 2 + 5$) - establishing commutativity and associativity of addition</p> <p>See models and images above.</p>	<p>check their calculations, including by adding to check subtraction</p> <p>See models and images above.</p>		
<p>recognise and use the inverse relationship between addition and subtraction and use this to check calculations</p> <p>See models and images above.</p>	<p>recognise and use the inverse relationship between addition and subtraction and use this to check calculations</p> <p>See models and images above.</p>	<p>use commutativity and inverse relations to develop multiplicative reasoning (for example, $4 \times 5 = 20$ and $20 \div 5 = 4$)</p> <p>Arrays – related facts</p> <p>$3 \times 5 = 15$ $5 \times 3 = 15$</p>  <p>$15 \div 3 = 5$ $15 \div 5 = 3$</p>	
<p>extend their understanding of the language of addition to include sum</p> <p>+ , add, more, plus, make, sum, total, altogether, score, double, near double, one more, two more... ten more, How many more to make...? How many more is... than...? How much more is...? Repetition of facts with different vocabulary: "What is 2 add 5?" "What is 2 more than 5?" "What is 2 plus 5?" What is the total of 2 and 5?" etc</p> <p>= equals, sign, is the same as</p>	<p>extend their understanding of the language of subtraction to include difference</p> <p>- subtract, subtraction, take (away), minus, leave, how many are left/left over? one less, two less... ten less... one hundred less, how many fewer is... than...? how much less is...? difference between, half, halve, tens boundary $13 + 5 = 8$ Repetition of sentence with different vocabulary: "13 subtract 5 equals 8" "5 less than 13 is 8" "13 take away 5 equals 8" "The difference between 13 and 5 is 8" etc</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe multiplication</p> <p>count on (from, to), count back (from, to), count in ones, twos, threes, fours, fives... count in tens, lots of, groups of, x, times, multiply, multiplied by, multiple of, once, twice, three times... ten times... times as (big, long, wide... and so on), repeated addition, array, row, column, double, halve</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe division</p> <p>Array, row, column, halve, share, share equally, one each, two each, three each... group in pairs, threes... tens, equal groups of, ÷, divide, divided by, divided into, left, left over</p> <p>= equals, sign, is the same as</p>




Year 3

Number – addition and subtraction

<p>add numbers mentally, including:</p> <ul style="list-style-type: none"> a three-digit number and ones a three-digit number and tens a three-digit number and hundreds 	<p>Adding near numbers and adjusting</p> <p>$433 + 90 = 433 + 100 - 10$ $= 533 - 10$ $= 523$</p>
<p>Counting on</p> <p>$115 + 2$</p> <p>"Put 115 in your head, 116, 117."</p>	<p>Count on by splitting units to make next multiple of ten/hundred</p> <p>$360 + 80 = 360 + 40 + 40$ $= 400 + 40$ $= 440$</p>
<p>Partition number and recombine</p> <p>$127 + 90 = 100 + 20 + 7 + 90$ $= 100 + 110 + 7$ $= 100 + 117$ $= 217$</p>	<p>Count on by partitioning the second number only</p> <p>$36 + 93 = 93 + 30 + 6$ $= 123 + 6$ $= 129$</p>
<p>• two two-digit numbers (including answer crossing 100)</p> <p>Counting on with number lines</p> <p>$48 + 36 = 84$</p> 	<p>Partition both numbers and recombine</p> <p>$27 + 82 = 20 + 7 + 80 + 2$ $= 100 + 9$ $= 109$</p>
<p>Add the nearest multiple of 10, then adjust</p> <p>$63 + 59$ is the same as $63 + 60 - 1$</p>	<p>Use known number facts and place value to subtract (partition second number only)</p> <p>$37 - 12 = 37 - 10 - 2$ $= 27 - 2$ $= 25$</p> 

<p>subtract numbers mentally, including:</p> <ul style="list-style-type: none"> a three-digit number and ones a three-digit number and tens a three-digit number and hundreds 	<p>Use unprepared numbered lines to subtract, by counting back:</p> <p>$516 - 400 = 116$</p> 
<p>Counting back: $263 - 5$</p> <p>"Put 263 in your head, 262, 261, 260, 259, 258."</p> <p>Subtract mentally a 'near multiple of 10' to or from a two-digit number:</p> <p>$678 - 90 = 678 - 100 + 10$</p>	<p>Find a small difference by counting up</p> <p>$42 - 39 = 3$</p> 
<p>Subtract mentally a number near 10 to or from a two-digit number</p> <p>$35 - 19 = 35 - 20 + 1$</p> 	

Number – multiplication and division

<p>recall and use multiplication facts for the 3, 4 and 8 multiplication tables</p> <p>Play games, chant, test etc to increase speed of recalling facts. Make models and images to display facts. Investigate patterns within tables.</p>	<p>recall and use division facts for the 3, 4 and 8 multiplication tables</p> <p>Play games, chant, test etc to increase speed of recalling facts. Make models and images to display facts. Investigate patterns within tables.</p>
<p>understand and use mental methods using commutativity and associativity (for example, $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$)</p> <p>Use a variety of resources (including a calculator) to investigate order of multiplication. Make models and images to display facts.</p>	
<p>understand and use mental methods using multiplication facts (e.g. using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts (e.g. $30 \times 2 = 60$, $60 \div 3 = 20$ and $20 = 60 \div 3$)</p> <p>$30 \times 5 = 150$ $50 \times 3 = 150$ $150 \div 5 = 30$ $150 \div 3 = 50$</p> <p>$3 \times 5 = 15$  $15 \div 3 = 5$</p> <p>$3 \times 50 = 150$  $150 \div 30 = 5$</p> <p>$5 \times 3 = 15$  $15 \div 5 = 3$</p> <p>$5 \times 30 = 150$ $50 \times 30 = 1500$ $30 \times 50 = 1500$ $150 \div 50 = 3$</p>	

add numbers with up to three digits, using formal written methods of columnar addition (See Appendix 1)

Extend mental method of partitioning and recombining. $158 + 72 = 100 + (50 + 70) + (8 + 2)$ $= 100 + 120 + 10$ $= 230$	Vertical expansion 367 $+185$ <hr/> 12 140 400 552
----------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------

Column addition 367 $+185$ <hr/> 552 11	Including money $£ 2.50$ $+ £ 1.75$ <hr/> $£ 4.25$ 1
-----------------------------------------------------------	--------------------------------------------------------------------

Use base 10 (diennes) or place value counters to support understanding of carrying and to ensure conceptual understanding of place value.

If children are experiencing persistent difficulties, they could use the partitioned column method with carrying (using Diennes for support):

$200 + 40 + 6$
$70 + 6$
$300 + 20 + 2$
$100 \quad 10$

subtract numbers with up to three digits, using formal written methods of columnar subtraction (See Appendix 1)

Use base 10 (diennes) as a practical method to introduce exchanging

$31 - 18 = 13$

When pupil(s) are confident in doing this practically and verbalizing the calculation, begin to record using partitioned column method:

20	1
$30 + 1$	
$-10 + 8$	
<hr/>	
$10 + 3$	

When secure with exchanging, use partitioned column method to solve calculations involving 3 digit numbers. Repeating the practical stage if necessary.

Introduce Column Subtraction without decomposition:

458
$- 232$
<hr/>
226

develop reliable written methods for multiplication, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication

Start by reinforcing mental methods of partitioning:

$15 \times 2 = 30$

$13 \times 3 = (10 \times 3) + (3 \times 3)$
 $= 30 + 9$
 $= 39$

Grid Method

1. Introduce the grid method by linking it to arrays initially (using counters):
2. Use base 10 (diennes) with grid method to support understanding of place value:
3. Use the grid method:

$12 \times 3 = 36$

x	3	
10	30	
2	6	
		36

x	3	
10	30	
2	6	
		36

develop reliable written methods for division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short division

Use counters and a number line to support pupils understanding, Number lines

How many 3's make 18?

Hoops and dots
 $16 \div 2 = 8$

Move on to calculations that leave remainders and/or require tables knowledge:
1) $16 \div 3 = 5r1$

When pupils have had experience with and demonstrated understanding of grouping for division, begin to look at short division with no remainders in the final answer.

Use counters/Diennes to support understanding.

3	2
3	9
9	6

solve problems, including missing number problems, using number facts, place value, and more complex addition

Missing numbers should be placed in all possible places:

$3 + 4 = \square$	$\square = 4 + 3$
$3 + \square = 7$	$7 = \square + 4$
$4 + \square = 7$	$7 = 3 + \square$
$\square + 7 = 7$	$7 = \square + 7$

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

larger quantity + difference = larger quantity

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

Missing numbers should be placed in all possible places:

$16 - 9 = \square$	$\square = 16 - 9$
$16 - \square = 7$	$7 = \square - 9$
$\square - 9 = 7$	$7 = 16 - \square$
$\square - 7 = 7$	$7 = \square - 7$

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

larger quantity - smaller quantity = difference

solve problems, including missing number problems, involving multiplication, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects

solve simple problems in contexts, deciding which of the four operations to use and why

Missing numbers placed in all possible places.

$7 \times 2 = \square$	$\square = 2 \times 7$
$7 \times \square = 14$	$14 = \square \times 7$
$\square \times 2 = 14$	$14 = 2 \times \square$
$\square \times 7 = 14$	$14 = \square \times 7$

Extend to
 $2 \times 6 = 3 \times \square$
and using three numbers
 $10 \times \square \times \square = 60$ $12 = 2 \times \square \times 2$

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

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

solve simple problems in contexts, deciding which of the four operations to use and why

Missing numbers placed in all possible places.

$6 \div 2 = \square$	$\square = 6 \div 2$
$6 \div \square = 3$	$3 = 6 \div \square$
$\square \div 2 = 3$	$3 = \square \div 2$
$\square \div 3 = 3$	$3 = \square \div 3$

Extend to
 $12 \div 6 = 8 \div \square$
and using three numbers
 $10 \div 5 \div \square = 1$ $3 = 12 \div \square \div 2$

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

<p>estimate the answer to a calculation and use inverse operations to check answers</p> <p>Estimate answers before solving any calculation. Once inverse operation has been learnt use as a method for checking.</p>	<p>estimate the answer to a calculation and use inverse operations to check answers</p> <p>Estimate answers before solving any calculation. Once inverse operation has been learnt use as a method for checking.</p>	<p>write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods</p> <p>See models and images above.</p>	<p>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</p> <p>See models and images above.</p>
<p>use a variety of language to describe addition</p> <p>+, add, addition, more, plus, make, sum, total, altogether, score, double, near double, one more, two more... ten more... one hundred more, how many more to make...? how many more is... than...? how much more is...?</p> <p>= equals, sign, is the same as</p> <p>tens boundary, hundreds boundary</p>	<p>use a variety of language to describe subtraction</p> <p>- subtract, subtraction, take (away), minus, leave, how many are left/left over? one less, two less... ten less... one hundred less, how many fewer is... than...? how much less is...? difference between, half, halve</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe multiplication</p> <p>count, count (up) to, count on (from, to), count back (from, to), count in ones, wos, threes, fours, fives... count in tens, hundreds, lots of, groups of, 0, times, multiply, multiplication, multiplied by, multiple of, product, once, twice, three times... ten times...times as (big, long, wide... and so on), repeated addition, array, row, column</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe division</p> <p>Array, row, column, halve, share, share equally, one each, two each, three each... group in pairs, threes... tens, equal groups of, ÷, divide, division, divided by, divided into, left, left over, remainder</p> <p>= equals, sign, is the same as</p>

Year 4		Number - addition and subtraction		Number - multiplication and division																						
<p>add numbers mentally, including:</p> <ul style="list-style-type: none"> a four-digit number and ones a four-digit number and tens a four-digit number and hundreds a four-digit number and thousands 	<p>subtract numbers mentally, including:</p> <ul style="list-style-type: none"> a four-digit number and ones a four-digit number and tens a four-digit number and hundreds a four-digit number and thousands 	<p>recall multiplication facts for multiplication tables up to 12 x 12</p> <p>Play games, chant, test etc to increase speed of recalling facts. Make models and images to display facts. Investigate patterns within tables.</p>	<p>recall division facts for multiplication tables up to 12 x 12</p> <p>Play games, chant, test etc to increase speed of recalling facts. Make models and images to display facts. Investigate patterns within tables.</p>	<p>Counting on</p> <p>3115 + 2</p> <p>"Put 3115 in your head, 3116, 3117."</p>	<p>Adding near numbers and adjusting</p> <p>7433 + 90 = 7433 + 100 - 10 = 7533 - 10 = 7523</p>	<p>Use unprepared numbered lines to subtract, by counting back:</p> <p>1516 - 400 = 1116</p> <p>1116 1216 1316 1416 1516</p> <p>-100 -100 -100 -100</p>	<p>Use place value, known and derived facts to multiply mentally, including: multiplying by 0 and 1; multiplying together three numbers</p> <p>practise and extend mental methods to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6)</p>	<p>Use place value, known and derived facts to divide mentally, including: dividing by 1</p> <p>practise and extend mental methods to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6)</p>	<p>Partition number and recombine</p> <p>5127 + 2000 = 5000 + 100 + 20 + 7 + 2000 = 7000 + 100 + 20 + 7 = 7127</p>	<p>Count on by splitting units to make next multiple of ten/hundred</p> <p>2360 + 500 = 2360 + 400 + 40 + 60 = 2400 + 400 + 60 = 2860</p>	<p>three and two-digit numbers</p> <p>Partition both numbers into hundreds, tens and ones and recombine</p> <p>358 + 73 = 300 + 50 + 8 + 70 + 3 = 300 + 120 + 11 = 420 + 11 = 431</p>	<p>Partition second number only into hundreds, tens and ones and recombine</p> <p>358 + 73 = 358 + 70 + 3 = 428 + 3 = 431</p>	<p>Use known number facts and place value to subtract (partition second number only)</p> <p>437 - 12 = 437 - 10 - 2 = 427 - 2 = 425</p>	<p>Find a small difference by counting up</p> <p>6003 - 5998 = 5 + 3 +2</p> <p>5998 6000 6003</p>	<p>Use knowledge of multiplication facts and place value to derive related facts.</p> <p>30 x 5 = 150 50 x 3 = 150 150 + 5 = 30 150 ÷ 3 = 50</p> <p>3 x 5 = 15 3 x 5 = 15 15 + 3 = 5</p> <p>3 x 50 = 150 5 x 3 = 15 150 + 30 = 5</p> <p>5 x 30 = 150 50 x 30 = 1500 30 x 50 = 1500 150 + 50 = 3</p>	<p>Use knowledge of multiplication facts and place value to derive related facts.</p> <p>30 x 5 = 150 50 x 3 = 150 150 + 5 = 30 150 ÷ 3 = 50</p> <p>3 x 5 = 15 3 x 5 = 15 15 + 3 = 5</p> <p>3 x 50 = 150 5 x 3 = 15 150 + 30 = 5</p> <p>5 x 30 = 150 50 x 30 = 1500 30 x 50 = 1500 150 + 50 = 3</p>	<p>Partitioning with number lines</p> <p>358 428 431</p> <p>+70 +3</p>	<p>Add the nearest multiple of 10 or 100, then adjust</p> <p>458 + 79 = 458 + 80 - 1</p>	<p>Partition</p> <p>18 x 9 = (10 x 9) + (8 x 9) = 90 + 72 = 162</p>	<p>Partitioning/Chunking</p> <p>77 ÷ 5 = (50 ÷ 5) + (25 ÷ 5) + (remainder 2) = 10 + 5 + (remainder 2) = 15 remainder 2</p>	<p>recognise and use commutativity in mental calculations</p> <p>write statements about the equality of expressions (for example, use the distributive law 39 x 7 = 30 x 7 + 9 x 7 and associative law (2 x 3) x 4 = 2 x (3 x 4))</p>	<p>recognise and use factor pairs in mental calculations</p> <p>Use a variety of resources (including a calculator) to investigate factor pairs. Make models and images to display facts.</p>	<p>add numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate (see Appendix 1)</p> <p>Column addition</p> <p>2358 + 373 ----- 2731</p>	<p>subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate (see Appendix 1)</p> <p>Revision of partitioned column method from Year 3. Moving on to numbers with 4 digits: (use Diennes to support when required.)</p>	<p>multiply two-digit and three-digit numbers by a one-digit number using formal written layout (see Appendix 1)</p> <p>Grid method</p> <p>231 x 7 is approximately 200 x 10 = 2000</p>	<p>divide numbers up to 3 digit by a one-digit number using the formal written method of short division and begin to interpret remainders.</p> <p>Short division with no remainders in the final answer, use place value counters/Diennes where support is required.</p>

To ensure conceptual understanding, it is essential that place value is reinforced by frequently. Discussing the actual value of each digit, e.g. the 5 digit represents 5 hundreds.

Use base 10 (Diennes) or place value counters to support understanding of carrying and to ensure conceptual understanding of place value (see year 2 and 3 for how to use these manipulatives).

Including decimals

$$\begin{array}{r} 72.8 \\ + 54.6 \\ \hline 127.4 \\ \hline 1 \end{array}$$

To ensure conceptual understanding, it is essential that place value is reinforced by frequently discussing the actual value of each digit, e.g. the 2 digit represents 2 tens.

Use money to support understanding.

$$\begin{array}{r} 2754 - 1562 = 1192 \\ \hline 2000 + 700 + 50 + 4 \\ - 1000 + 500 + 60 + 2 \\ \hline 1000 + 100 + 90 + 2 \end{array}$$

Column Subtraction without decomposition

$$\begin{array}{r} 458 \\ - 232 \\ \hline 226 \end{array}$$

Column Subtraction with decomposition

Once pupils are confident in exchanging and have a clear understanding of place value, move towards the formal compact column method: (use Diennes to support when required.)

$$\begin{array}{r} 2\overset{6}{\cancel{7}}54 \\ - 1562 \\ \hline 1192 \end{array}$$

$231 \times 7 = 1617$

x	7	
200	1400	
30	210	+
1	7	
	1617	

move onto formal method of short multiplication when proficient

$$\begin{array}{r} 452 \\ \times 3 \\ \hline 1356 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 037 \\ 5 \overline{) 1835} \\ \underline{51} \\ 325 \\ \underline{310} \\ 15 \end{array} \quad \begin{array}{r} 218 \\ 4 \overline{) 872} \\ \underline{8} \\ 72 \\ \underline{68} \\ 42 \\ \underline{40} \\ 2 \end{array}$$

Remainders

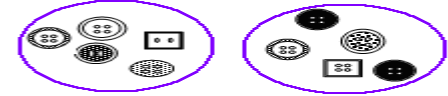
Begin to interpret remainders by looking at word problems to give context and small numbers to start with.

Cars carry 5 people. 12 people are going on a trip. How many cars will they need?



$12 \div 5 = 2 \text{ r } 2$ So they would need 3 cars.

5 buttons are packed in a bag. How many full bags would there be if there were 12 buttons?

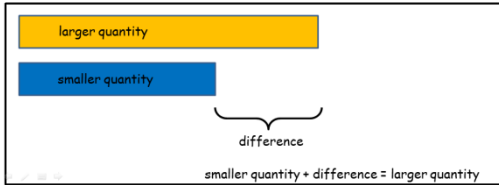
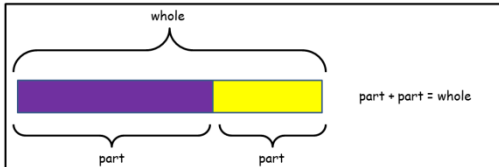


$12 \div 5 = 2 \text{ r } 2$. So there are 2 full bags.

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

Use all the models and images mentioned above. Discuss which is most effective and why.

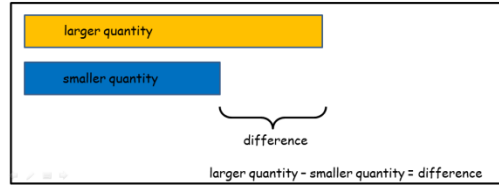
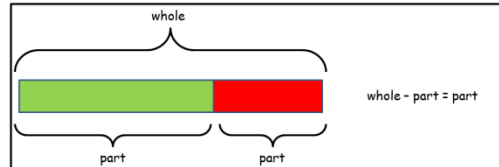
Singapore Bar Method



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

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

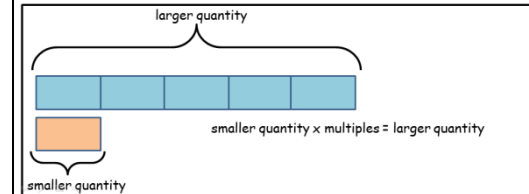
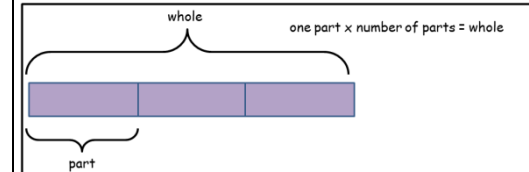


solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers

Use all the models and images mentioned above. Discuss which is most effective and why.

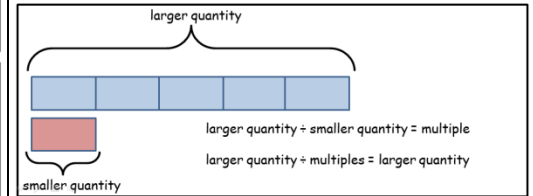
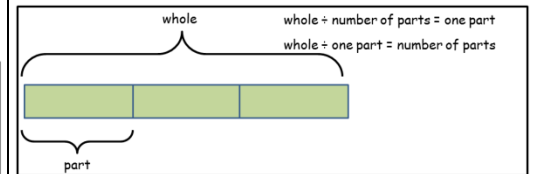
Singapore Bar Method



solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method



estimate and use inverse operations to check answers to a calculation

Estimate answers before solving any calculation. Once inverse operation has been learnt use as a method for checking.

use a variety of language to describe addition

+ add, addition, more, plus, increase, sum, total, altogether, score, double, near double, how many more to make...? tens boundary, hundreds boundary, inverse = equals, sign, is the same as

estimate and use inverse operations to check answers to a calculation

Estimate answers before solving any calculation. Once inverse operation has been learnt use as a method for checking.

use a variety of language to describe subtraction

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

estimate and use inverse operations to check answers to a calculation

Estimate answers before solving any calculation. Once inverse operation has been learnt use as a method for checking.

use a variety of language to describe multiplication

times, multiply, multiplication, multiplied by, multiple of, product once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array, row, column, double, inverse = equals, sign, is the same as

estimate and use inverse operations to check answers to a calculation

Estimate answers before solving any calculation. Once inverse operation has been learnt use as a method for checking.

use a variety of language to describe division

Array, row, column, halve, share, share equally, one each, two each, three each... group in pairs, threes... tens. equal groups of, divide, division, divided by, divided into, remainder, factor, quotient, divisible by, inverse = equals, sign, is the same as

Year 5

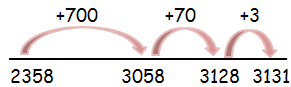
Number – addition and subtraction

add numbers mentally with increasingly large numbers (e.g. 12 462 – 2300 = 10 162)

Partition both numbers and recombine

$$\begin{aligned} 2358 + 773 \\ = 2000 + 300 + 50 + 8 + 700 + 70 + 3 \\ = 2000 + 1000 + 120 + 11 \\ = 3000 + 100 + 30 + 1 \\ = 3131 \end{aligned}$$

Partitioning with number lines



Partition second number only into hundreds, tens and ones and recombine

$$\begin{aligned} 2358 + 773 &= 2358 + 700 + 70 + 3 \\ &= 3058 + 70 + 3 \\ &= 3128 + 3 \\ &= 3131 \end{aligned}$$

Add the nearest multiple of 10 or 100, then adjust

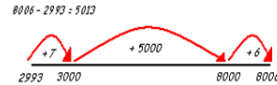
$$458 + 79 = 458 + 80 - 1$$

subtract numbers mentally with increasingly large numbers (e.g. 12 462 – 2300 = 10 162)

Subtract the nearest multiple of 10 or 100, then adjust

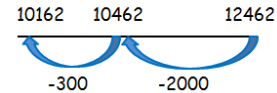
$$\begin{aligned} 458 - 79 &= 458 - 80 + 1 \\ &= 378 + 1 \\ &= 379 \end{aligned}$$

Find a difference by counting up



Use known number facts and place value to subtract (partition second number only)

$$\begin{aligned} 12\ 462 - 2300 \\ = 12\ 462 - 2000 - 300 \\ = 10\ 462 - 300 \\ = 10\ 162 \end{aligned}$$



Number – multiplication and division

multiply numbers mentally drawing upon known facts

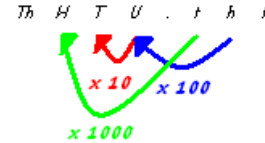
Partition

$$\begin{aligned} 47 \times 6 &= (40 \times 6) + (7 \times 6) \\ &= (240) + (42) \\ &= 282 \end{aligned}$$

Double and halve

$$25 \times 16 = 50 \times 8 = 100 \times 4 = 200 \times 2 = 400$$

multiply whole numbers and those involving decimals by 10, 100 and 1000
Place Value

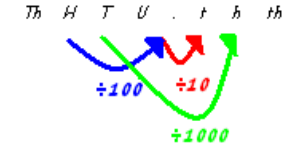


divide numbers mentally drawing upon known facts

Partitioning

$$\begin{aligned} 72 \div 3 &= (60 \div 3) + (12 \div 3) \\ &= 20 + 4 \\ &= 24 \end{aligned}$$

divide whole numbers and those involving decimals by 10, 100 and 1000
Place Value



identify multiples, (and use them to construct equivalence statements, e.g. 4 x 35 = 2 x 2 x 35; 3 x 270 = 3 x 3 x 9 x 10 = 9² x 10)

Use a variety of resources (including a calculator) to investigate multiples. Make models and images to display facts.

identify factors, including finding all factor pairs of a number, and common factors of two numbers (and use them to construct equivalence statements, e.g. 4 x 35 = 2 x 2 x 35; 3 x 270 = 3 x 3 x 9 x 10 = 9² x 10)

Use a variety of resources (including a calculator) to investigate factors. Make models and images to display facts.

recall prime numbers up to 19
establish whether a number up to 100 is prime

Play games, chant, test etc to increase speed of recalling facts.
Make models and images to display facts.
Investigate patterns within primes.

recall prime numbers up to 19
establish whether a number up to 100 is prime

Play games, chant, test etc to increase speed of recalling facts.
Make models and images to display facts.
Investigate patterns within primes.

recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³)

Use a variety of resources (including a calculator) to investigate square and cubed numbers. Make models and images to display facts.
Investigate the patterns within squared and cubed numbers.

add numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction - see Appendix 1)

Column addition

$$\begin{array}{r} 124.90 \\ + 117.25 \\ \hline 242.15 \\ 11 \end{array} \quad \text{(add in a zero to keep the place value)}$$

To ensure conceptual understanding, it is essential that place value is reinforced by frequently. Discuss the value of each digit. Use base 10 (Diennes) to support understanding of exchanging and to ensure conceptual understanding of place value. Where there is an 'empty' space in a decimal column, pupils should insert a zero to show the value. Children should be made aware that it is essential to align the columns carefully.

$$\begin{array}{r} \text{Pupils should be able to add more than 2 numbers using the compact column method.} \\ 3.25 \\ + 4.13 \\ \hline 0.76 \\ 8.14 \\ \hline 11 \end{array}$$

subtract numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction - see Appendix 1)

Revision of **formal compact column method** extending to calculations involving numbers with more than 4 digits (use Diennes to support understanding of decomposition and place value).

$$\begin{array}{r} \cancel{2} \cancel{0} \cancel{0} \cancel{0} \cancel{6} \\ - \quad 2 \quad 1 \quad 2 \quad 8 \\ \hline 2 \quad 8 \quad 9 \quad 2 \quad 8 \end{array}$$

When confident in using **formal compact column method** with integers and decimals involving money (always 2 decimal places), extend to subtraction with mixtures of integers and decimals. A clear understanding of place value is essential. Align the decimal point and use '**place holders**', if needed.

$$\begin{array}{r} - \quad \cancel{2} \cancel{6} \quad 1 \\ 263.0 \\ \underline{26.5} \\ 236.5 \end{array} \quad \text{Use Diennes or place value counters (add counters with 0.1) to support understanding of decomposition and place value.}$$

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

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 (as fractions, as decimals or by rounding (for example, 98 ÷ 4 = 98/4 = 24 r 2 = 24 ½ = 24.5 ≈ 25))

Review formal method of short multiplication (for multiplying by one digit numbers) when proficient

$$\begin{array}{r} 452 \\ \times 3 \\ \hline 1356 \end{array}$$

$$\begin{array}{r} 1243 \\ \times 8 \\ \hline 9624 \end{array}$$

Start with grid method when multiplying by 2 digit numbers
72 x 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

$$\begin{array}{r} 2160 \\ + 576 \\ \hline 2736 \\ 1 \end{array}$$

Move onto formal long multiplication

$$\begin{array}{r} 34 \\ \times 13 \\ \hline 102 \\ 340 \\ \hline 442 \end{array}$$

Then formal multiplication with more complex numbers:

$$\begin{array}{r} 1234 \\ \times 16 \\ \hline 7404 \\ 12340 \\ \hline 19744 \end{array}$$

Bus shelter method (short division)

$$\begin{array}{r} 86r2 \\ 5 \overline{) 432} \\ \underline{40} \\ 32 \\ \underline{30} \\ 20 \\ \underline{18} \\ 20 \\ \underline{18} \\ 2 \end{array}$$

Pupils should consider whether remainders should be left as a remainder, rounded to the nearest whole or converted into a decimal or fraction.

$$\begin{array}{r} 114.25 \\ 4 \overline{) 457.00} \\ \underline{45} \\ 7 \\ \underline{68} \\ 9 \\ \underline{91} \\ 4 \\ \underline{40} \\ 00 \end{array}$$

Introduce long division (dividing by single digits)

256 ÷ 7 lies between 210 ÷ 7 = 30 and 280 ÷ 7 = 40

$$\begin{array}{r} 256 \\ - 70 \\ \hline 186 \\ - 140 \\ \hline 46 \\ - 42 \\ \hline 4 \end{array}$$

(10 groups) or (10 x 7)
(20 groups) or (20 x 7)
(6 groups) or (6 x 7)
(36 groups) or (36)

Answer: 36 remainder 4

solve addition multi-step problems in contexts, deciding which operations and methods to use and why

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

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

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

use and explain the equals sign to indicate equivalence, including missing number problems (e.g. 13+24 = 12+25; 33 = 5 x [])
express distributivity, for example as a(b + c) = ab + ac

Use all of the models and images above to investigate a range of statements, ensuring the equals sign is in different positions. Allow time for discussion and reasoning. Display solutions and reasoning. Also use errors or misconceptions as a starting point.

use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy

Estimate answers before solving any calculation.
Check against estimate after calculating (and use inverse check).

use a variety of language to describe addition

+ add, addition, more, plus, increase, sum, total, altogether, score, double, near double, how many more to make...? tens boundary, hundreds boundary, units

use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy

Estimate answers before solving any calculation.
Check against estimate after calculating (and use inverse check).

use a variety of language to describe subtraction

- subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is...

Solve problems that use multiplication and division as inverses, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as kilometres and metres

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

use and explain the equals sign to indicate equivalence, including missing number problems (e.g. 13+24 = 12+25; 33 = 5 x [])
express distributivity, for example as a(b + c) = ab + ac

Use all of the models and images above to investigate a range of statements, ensuring the equals sign is in different positions. Allow time for discussion and reasoning. Display solutions and reasoning. Also use errors or misconceptions as a starting point.

use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy

Estimate answers before solving any calculation.
Check against estimate after calculating (and use inverse check).

use a variety of language to describe multiplication

know and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers

Solve problems that use multiplication and division as inverses, for example, by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1000 in converting between units such as kilometres and metres

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method

use and explain the equals sign to indicate equivalence, including missing number problems (e.g. 13+24 = 12+25; 33 = 5 x [])

Use all of the models and images above to investigate a range of statements, ensuring the equals sign is in different positions. Allow time for discussion and reasoning. Display solutions and reasoning. Also use errors or misconceptions as a starting point.

use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy

Estimate answers before solving any calculation.
Check against estimate after calculating (and use inverse check).

use a variety of language to describe division

Array, row, column, halve, share, share equally one each, two each, three each... group in pairs, threes... tens, equal groups of, divide, division, divided by, divided

boundary, tenths boundary, inverse = equals, sign, is the same as	than...? how much more/less is...? tens boundary, hundreds boundary, units boundary, tenths boundary, inverse = equals, sign, is the same as	lots of, groups of, times, multiply, multiplication, multiplied by, multiple of, product, once, twice, three times... ten times... times as (big, long, wide... and so on), repeated addition, array, row, column, double,, inverse, prime, equals, sign, is the same as	into, remainder, factor, quotient, divisible by, inverse, Prime, factors equals, sign, is the same as
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Year 6

Number – addition and subtraction

perform mental calculations, including with mixed operations and large numbers (*and decimals*)

Partition both numbers into hundreds, tens, ones and decimal fractions and recombine

$$\begin{aligned} 35.8 + 7.3 &= 30 + 5 + 0.8 + 7 + 0.3 \\ &= 30 + 12 + 1.1 \\ &= 42 + 1.1 \\ &= 43.1 \end{aligned}$$

Partition second number only into hundreds, tens, ones and decimal fractions and recombine

$$\begin{aligned} 35.8 + 7.3 &= 35.8 + 7 + 0.3 \\ &= 42.8 + 0.3 \\ &= 43.1 \end{aligned}$$

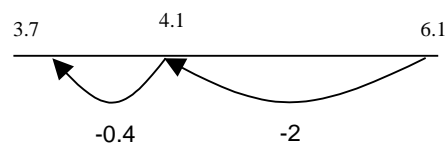
Add the nearest whole number then adjust

$$\begin{aligned} 52 + 11.9 &= 52 + 12 - 0.1 \\ &= 64 - 0.1 \\ &= 63.9 \end{aligned}$$

perform mental calculations, including with mixed operations and large numbers (*and decimals*)

Use known number facts and place value to subtract

$$6.1 - 2.4 = 3.7$$



Subtract the nearest whole number then adjust

$$\begin{aligned} 52 - 11.9 &= 52 - 12 + 0.1 \\ &= 40 + 0.1 \\ &= 40.1 \end{aligned}$$

Number – multiplication and division

perform mental calculations, including with mixed operations and large numbers (*and decimals*)

Partitioning

$$\begin{aligned} 4.7 \times 6 &= (4 \times 6) + (0.7 \times 6) \\ &= (24) + (4.2) \\ &= 28.2 \end{aligned}$$

Double and halve

$$\begin{aligned} 4.25 \times 32 &= 8.5 \times 16 \\ &= 17 \times 8 \\ &= 34 \times 4 \\ &= 68 \times 2 \\ &= 136 \end{aligned}$$

perform mental calculations, including with mixed operations and large numbers (*and decimals*)

Partitioning

$$\begin{aligned} 7.2 \div 3 &= (6 \div 3) = (1.2 \div 3) \\ &= 2 + 0.4 \\ &= 2.4 \end{aligned}$$

identify common factors, common multiples and prime numbers

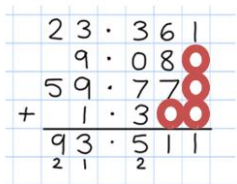
Use a variety of resources (including a calculator) to investigate common factors, common multiples and prime numbers. Make models and images to display facts. Investigate the patterns within the numbers.

identify common factors, common multiples and prime numbers

Use a variety of resources (including a calculator) to investigate common factors, common multiples and prime numbers. Make models and images to display facts. Investigate the patterns within the numbers.

practise addition for larger numbers, using the formal written methods of columnar addition (see Appendix 1)

Extend the use of compact column method to adding several numbers with mixed decimals.

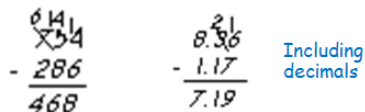


Children should be reminded of the importance of aligning the columns accurately.

Where there is an 'empty' space in a decimal column, pupils could insert a zero to show the value.

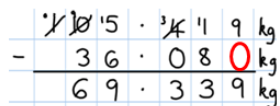
practise subtraction for larger numbers, using the formal written methods of columnar subtraction (see Appendix 1)

Column Subtraction with decomposition



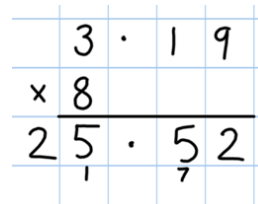
Revision of formal compact column method extending to more complex integers and applying to problem solving using money and measures, including decimals with different numbers of decimal places. Align the decimal point when setting out calculations.

Use 'place holders' to aid understanding of the value in that column.



multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of short and long multiplication (Appendix 1)

Short multiplication and Long multiplication as in Year 5, but apply to numbers with decimals.



Pupils may need reminding that single digits belong in the ones (units) column.

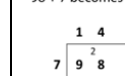
A sound understanding of place value and the formal method itself are required before progressing to decimal multiplication.

divide numbers up to 4 digits by a two-digit whole number using the formal written method of short and long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context (Appendix 1)

Short division

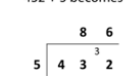
Short division

98 ÷ 7 becomes



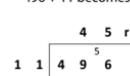
Answer: 14

432 ÷ 5 becomes



Answer: 86 remainder 2

496 ÷ 11 becomes

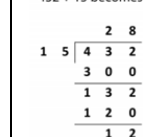


Answer: 45 $\frac{1}{11}$

Long division (for dividing by 2 digits)

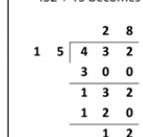
Long division

432 ÷ 15 becomes



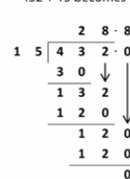
Answer: 28 remainder 12

432 ÷ 15 becomes



Answer: 28 $\frac{8}{5}$

432 ÷ 15 becomes



Answer: 28.8

Remainders

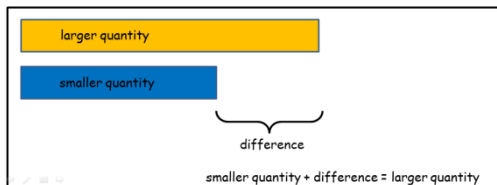
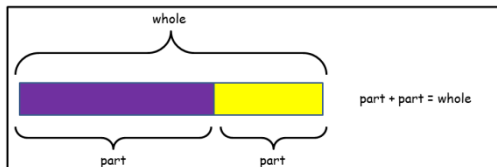
Quotients expressed as fractions or decimal fractions

$$61 \div 4 = 15 \frac{1}{4} \text{ or } 15.25$$

solve addition multi-step problems in contexts, deciding which operations and methods to use and why

Use all the models and images mentioned above. Discuss which is most effective and why.

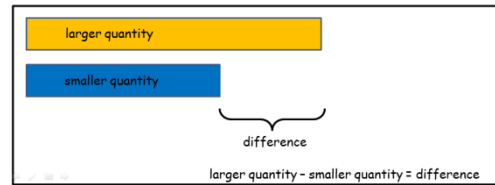
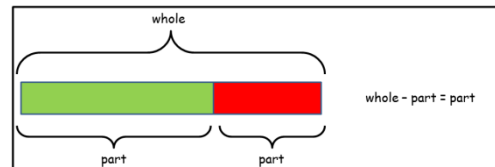
Singapore Bar Method



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

Use all the models and images mentioned above. Discuss which is most effective and why.

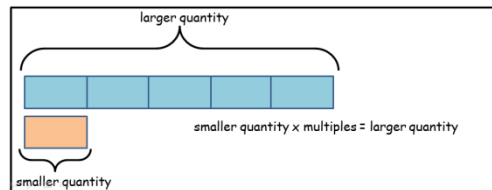
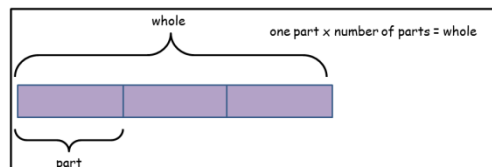
Singapore Bar Method



solve problems involving multiplication

Use all the models and images mentioned above. Discuss which is most effective and why.

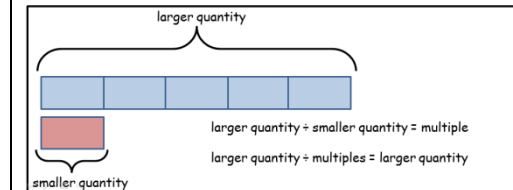
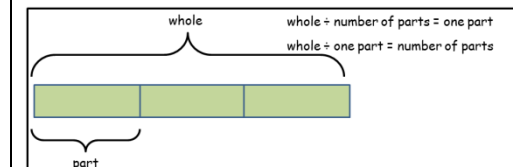
Singapore Bar Method



solve problems involving division

Use all the models and images mentioned above. Discuss which is most effective and why.

Singapore Bar Method



<p>round answers to a specified degree of accuracy, e.g. to the nearest 10, 20, 50 etc., but not to a specified number of significant figures</p> <p>Use knowledge of rounding (see fraction Policy) to create estimates.</p>	<p>round answers to a specified degree of accuracy, e.g. to the nearest 10, 20, 50 etc., but not to a specified number of significant figures</p> <p>Use knowledge of rounding (see fraction Policy) to create estimates.</p>	<p>round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., (not to specified number of significant figures)</p> <p>Use knowledge of rounding (see fraction Policy) to create estimates.</p>	<p>round answers to a specified degree of accuracy, e.g. to the nearest 10, 20, 50 etc., but not to a specified number of significant figures</p> <p>Use knowledge of rounding (see fraction Policy) to create estimates.</p>
<p>use their knowledge of the order of operations to carry out calculations involving the four operations explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$</p> <p>Review and investigate the effect of carrying out operations in different orders. Explore the effect. Introduce and use BODMAS to solve calculations.</p>	<p>use their knowledge of the order of operations to carry out calculations involving the four operations explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$</p> <p>Review and investigate the effect of carrying out operations in different orders. Explore the effect. Introduce and use BODMAS to solve calculations.</p>	<p>use their knowledge of the order of operations to carry out calculations involving the four operations explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$</p> <p>Review and investigate the effect of carrying out operations in different orders. Explore the effect. Introduce and use BODMAS to solve calculations.</p>	<p>use their knowledge of the order of operations to carry out calculations involving the four operations explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$</p> <p>Review and investigate the effect of carrying out operations in different orders. Explore the effect. Introduce and use BODMAS to solve calculations.</p>
<p>use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy</p> <p>Estimate answers before solving any calculation. Check against estimate after calculating (and use inverse check).</p>	<p>use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy</p> <p>Estimate answers before solving any calculation. Check against estimate after calculating (and use inverse check).</p>	<p>use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy</p> <p>Estimate answers before solving any calculation. Check against estimate after calculating (and use inverse check).</p>	<p>use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy</p> <p>Estimate answers before solving any calculation. Check against estimate after calculating (and use inverse check).</p>
<p>use a variety of language to describe subtraction</p> <p>+ add, addition, more, plus, increase, sum, total, altogether, score, double, near double, how many more to make...? tens boundary, hundreds boundary, units boundary, tenths boundary, inverse</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe subtraction</p> <p>- subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is... than...? how much more/less is...? tens boundary, hundreds boundary, units boundary, tenths boundary, inverse</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe subtraction</p> <p>x lots of, groups of, times, multiply, multiplication, multiplied by, multiple of, product, once, twice, three times... ten times... times as (big, long, wide... and so on), repeated addition, array, row, column double, inverse</p> <p>= equals, sign, is the same as</p>	<p>use a variety of language to describe subtraction</p> <p>Array, row, column, halve, share, share equally one each, two each, three each... group in pairs, threes... tens, equal groups of, divide, division, divided by, divided into, remainder, factor, quotient, divisible by, inverse</p> <p>= equals, sign, is the same as</p>

Key Vocabulary and Definitions

Reception	<p>Subtract - taking away one number from another/the difference between two numbers/the inverse of addition.</p> <p>Double - double is twice as many.</p> <p>Share - when you share you divide things equally. Sharing is the same as dividing. The symbol for sharing is \div.</p> <p>Halve - if you half something you divide it into equal pieces. Halving a number is the same as dividing it by two.</p>
Year 1	<p>Equal to - two things are equal if they are the same in some way.</p> <p>Numerals - any symbol for a word or number.</p> <p>Digits - there are ten digits. They are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.</p> <p>Bond - A number bond is a mental picture of the relationship between a number and the parts that combine to make it. $2+8=10$.</p> <p>Add - combing two or more numbers together to make a new number called the sum.</p> <p>Multiply - when you multiply you increase something a number of times. Multiplying is the same as multiplication.</p> <p>Multiple - lots of the same number or quantity.</p> <p>Divide - when you share things equally.</p>
Year 2	<p>Greater than < Less than > - these words can be used when comparing two unequal numbers.</p> <p>Empty number line</p> <p>Inverse - if you turn something upside down you have its inverse/inverse means to reverse something/addition and subtraction are inverse operations/multiplication are inverse operations/the inverse undoes the previous calculation.</p> <p>Commutative</p> <p>Difference - the amount one quantity is greater or less than another. You can find the difference by subtracting the smaller number from the larger number.</p> <p>Arrays</p> <p>Multiply - when you multiply you increase something a number of times. Multiplying is the same as multiplication.</p> <p>Multiple - lots of the same number or quantity.</p>
Year 3	<p>Numerator - the top number of a fraction is called the numerator. The numerator tells you how many equal parts there are.</p> <p>Denominator - the bottom number of a fraction. The denominator tells you how many equal parts the quantity or shape has been separated into.</p> <p>Unit fractions</p> <p>Integer - a whole positive or negative number. Zero is also an integer.</p> <p>Remainder - what is left after you share something.</p>
Year 4	<p>Improper fraction - where the numerator is larger than the denominator. An improper fraction is a fraction which is more than one.</p>
Year 5	<p>Power - You read 3 as three to the power of 4. It means $3 \times 3 \times 3 \times 3$. The power shows how many equal numbers have been multiplied together. A number to the power of 2 is said to be squared. A number to the power of 3 is said to be cubed.</p> <p>Rounding - writing a number as an approximate. Numbers are often rounded to the nearest one, nearest two or nearest 100. Rounding often means round up or down to the nearest whole unit.</p> <p>Decimal place - the number of digits after the decimal point. Sometimes numbers are written to the nearest decimal place. 12.56 has two decimal places. 0.228 has 3 decimal places.</p> <p>Factors - A whole number which will divide exactly into another number. 3 is a factor of 21. 7 is a factor of 63. 2 and 7 are both factors of 14.</p> <p>Prime numbers - A number which only has two factors which are one and itself. One is not a prime number because it only has one factor not two.</p> <p>Prime factors - Factors of a number which are also prime numbers are called prime factors.</p> <p>Composite numbers - numbers which are not prime numbers.</p> <p>Square numbers - A square number is the product of two identical whole numbers. $1 \times 1 = 1$, $2 \times 2 = 4$, $3 \times 3 = 9$.</p> <p>Cube numbers - the cube of a number is the number multiplied by itself three times. The cube of four is $4 \times 4 \times 4$.</p> <p>Proper fractions - when the numerator is smaller than the denominator. It is a fraction worth less than 1.</p> <p>Mixed number - a mixed number is a whole number with a fraction.</p> <p>Remainder - a remainder is what is left after you share something.</p>
Year 6	<p>Common factors - A number which divides exactly into two or more other numbers. Factors of 15 are 1, 3, 5, 15. Factors of 40 are 1, 2, 4, 5, 8, 10, 20 and 40. The common factors of 15 and 40 are 1 and 5.</p> <p>Common multiples - a number which is a multiple of two or more other numbers. Multiples of two include 2, 4, 6, 8, 10, 12. Multiples of 3 include, 3, 6, 9, 12, 15. So the common multiples of 2 and 3 are 6 and 12</p>