Christ Church Primary School's Calculation Policy

About the policy

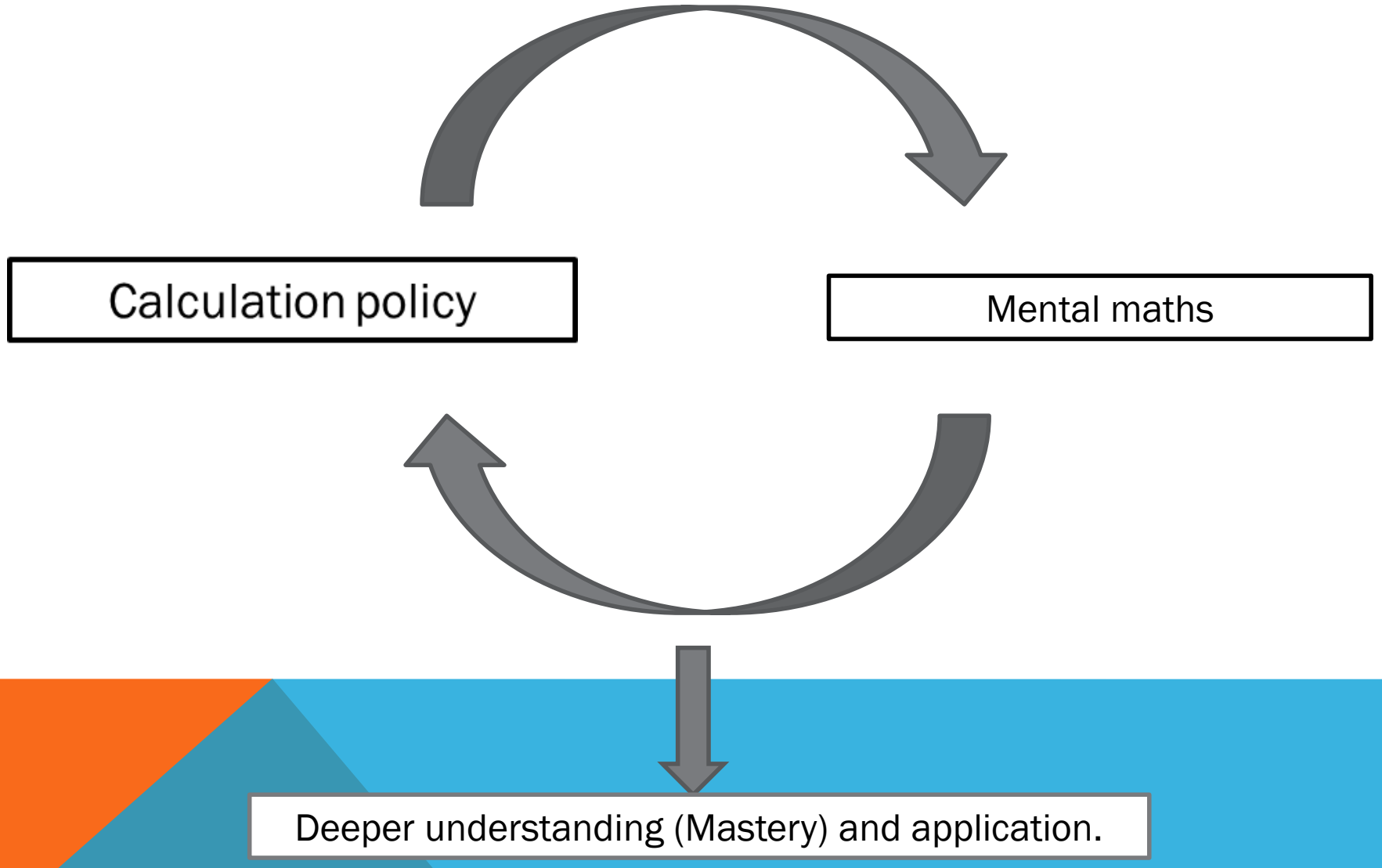
The calculation policy shows how best to teach the specific calculation in the chosen year group. It shows the methods to be taught as the children progress from the EYFS to Year 6. If a child is excelling in a particular area, then you may want to look at the methods used in the next year. Subsequently, if there are gaps in the children's understanding, then you can look at the methods in the year group previous to where they are.

Ensure that children are aware of how to use and where to find the practical equipment to support these methods. These may be supplied on the table or elsewhere but it is important that the children have access to practical equipment (list of the equipment and location can be found at the back of this policy).

The written methods should be supported by daily mental maths sessions, weekly number club activities and the children should be given the chance to apply these methods in a range of problem solving activities and practical situations.

Alongside the guidance and examples of written methods are expectations for year groups in relation to addition, subtraction, multiplication and division. Encompassing all of these should be a solid knowledge of place value and number work. If you would like to see the progression maps for place value and number (and other areas of maths) log on to www.ncetm.org.uk and search for progression maps.

HOW IT ALL LINKS



The approach

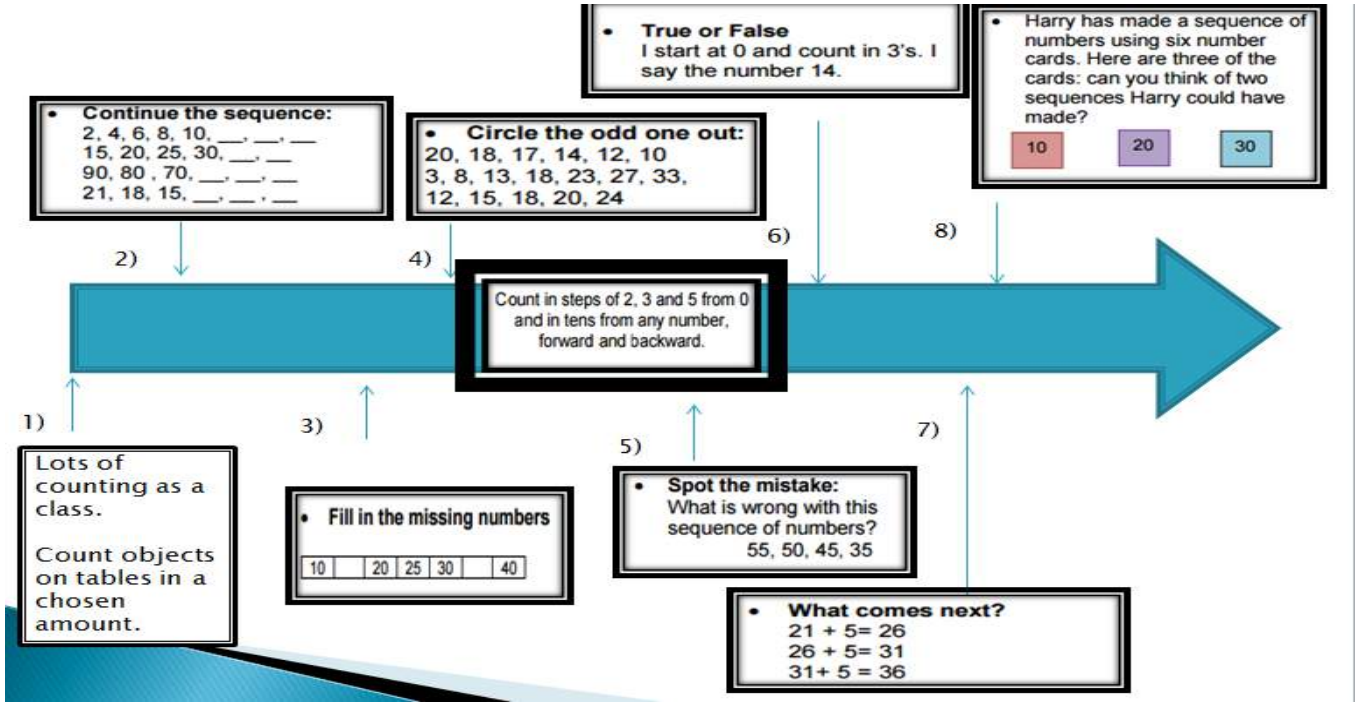
3 Forms of Knowledge
Factual – I know that
Procedural – I know how
Conceptual – I know why

Mastery teaching encourages a deep understanding of a year group's objectives.

- **Teachers reinforce an expectation that all pupils are capable of achieving high standards in mathematics.**
- **The large majority of pupils progress through the curriculum content at the same pace. Differentiation is achieved by emphasising deep knowledge and through individual support and intervention.**
- **Teaching is underpinned by methodical curriculum design and supported by carefully crafted lessons and resources to foster deep conceptual and procedural knowledge.**
- **Practice and consolidation play a central role. Carefully designed variation within this builds fluency and understanding of underlying mathematical concepts in tandem.**
- **Teachers use precise questioning in class to test conceptual and procedural knowledge, and assess pupils regularly to identify those requiring intervention so that all pupils keep up.**

Example

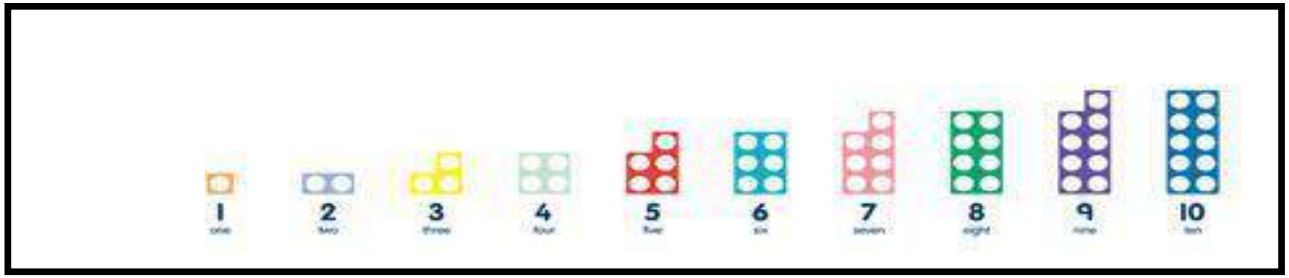
Choose an objective. Start with lots of practical work to gain fluency in that chosen area. Gradually vary the work in different ways so that children are subtly deepening their understanding of the specific concept. Push their learning into mastery with children saying why and how things happen.



Addition – EYFS

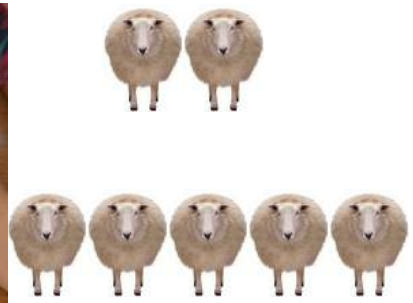
Learning numbers and understanding them

Children count and can recite numbers to twenty. They also understand the amount of objects that a number relates to e.g. The 4-ness of 4.

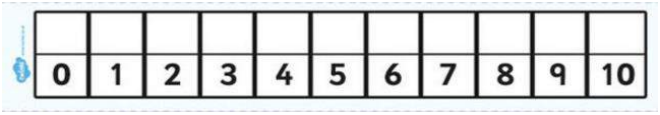


Counting 2 groups

Children find the total number in 2 groups by counting all of them. Adding together two 1-digit numbers. Once secure in practical, children then move to showing the calculation in pictures or jottings and then writing the number sentence. Children may also use a number track.



2 + 5 = 7



Guidance

See the development matters document for guidance on addition at the different age ranges.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Recites numbers in order to 10.

Knows that a group of things changes in quantity when something is added or taken away.

Knows that numbers identify how many objects are in a set.

Separates a group of three or four objects in different ways, beginning to recognise that the total is still the same.

Uses the language of 'more' and 'fewer' to compare two sets of objects.

Finds the total number of items in two groups by counting all of them.

Says the number that is one more than a given number.

Finds one more or one less from a group of up to five objects, then ten objects.

In practical activities and discussion, beginning to use the vocabulary involved in adding and subtracting.

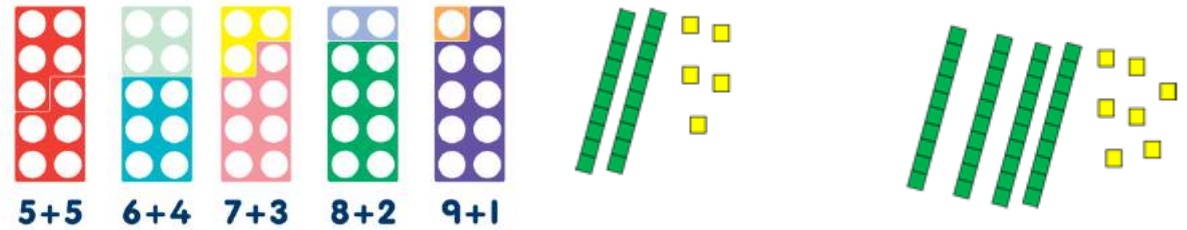
Record using marks that they can interpret and explain.

They add and subtract two single-digit numbers and count on or back to find the answer.

New vocabulary - add, plus, altogether, 1...2...3...10 more, equals, double, how many? and count forwards

Addition Stage 1

Children carry on to understand what makes a number and they use practical equipment within lessons to help with number work.



Children carry out addition on a number track to support mental working out. They move through the stages of a number line.

Number Track

6 + 2 = 8

Number line

6 8

Guidance

Number track

Start from the biggest number and place the counter. Children then count on using the smaller amount.

Once secure children stay on the track but do the jumps using a pencil/pen to make marks. (Supports moving to a number line)

Number line

Children start at the biggest number and count on the smallest using jumps.

They may move on to working on a blank number line if secure on a numbered line.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Represent and use number bonds and related subtraction facts within 20.

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

Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs.

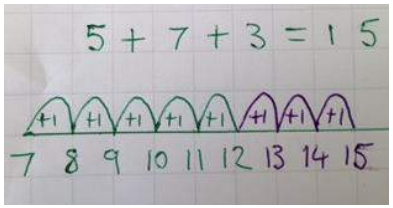
Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ☐ - 9

New vocabulary - total, sum, near double

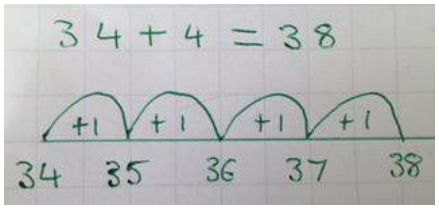
Addition Stage 2

Number line – To support mental operations

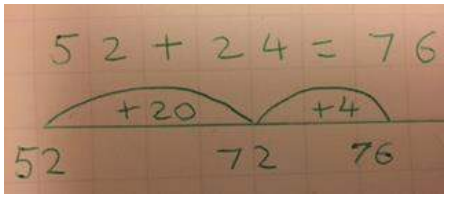
O + O + O =



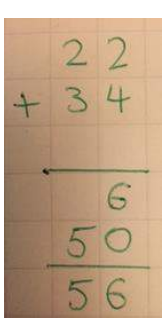
TO + O =

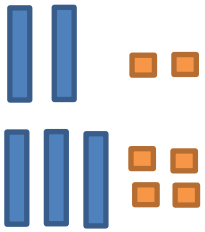


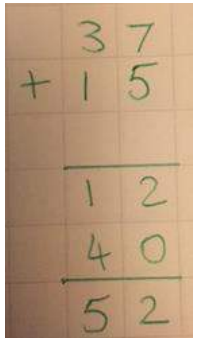
TO + TO =

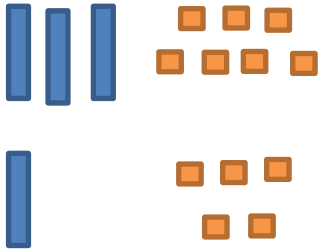


Expanded Column Method – Formal method









Guidance

Number line

Children may start the year with marked number lines but move to unmarked number lines when secure(Biggest number first). The number line helps to support mental methods and helps the children to become fluent in number.

Children start with Ones+Ones+Ones e.g. 5+7+3 =

They then move on to Tens and ones + ones e.g. 34+4 =

Finally children do tens and ones + tens and ones e.g. 52 + 24=

Column method

When children become secure with partitioning and place value, they can begin to do the expanded column method with practical support.

Calculations will be supported by daily mental maths activities.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

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

Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens ; two two-digit numbers ; adding three one-digit numbers.

Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.

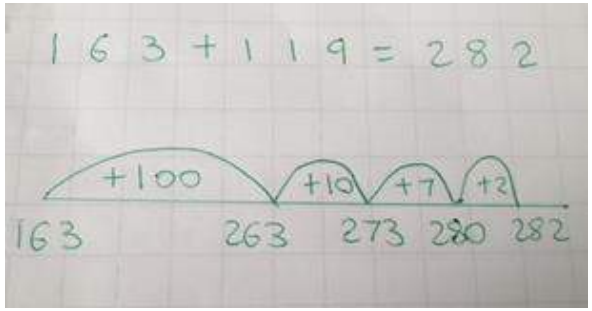
Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Solve problems with addition and subtraction: Using concrete objects and pictorial representations, including those involving numbers, quantities and measures. Applying their increasing knowledge of mental and written methods. *(solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change)*

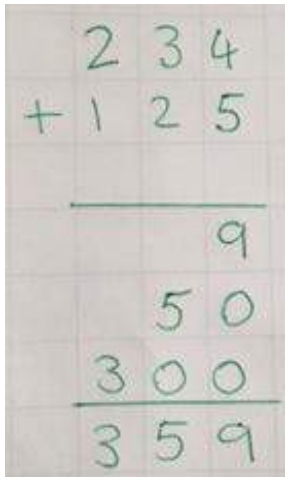
New vocabulary - Addition and recap all regularly

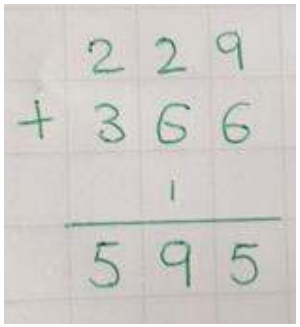
Addition Stage 3

Blank number line – Support mental methods



Column Method – Formal written method.





Guidance

Number Line
Children add hundreds tens and ones starting at the biggest number. Children practise bridging the multiples of ten.

Column method – *(Use practical resources to support calculations but gradually remove this support when secure)*
Children explore the expanded method of addition adding the ones then the tens then the hundreds. Once secure with the place value, children can move to the compact method for column addition. Leave a space to show carrying.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.

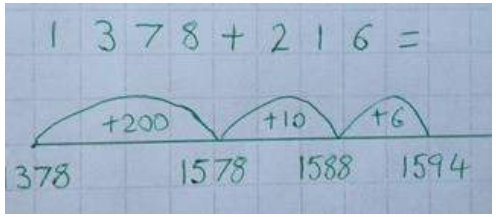
Estimate the answer to a calculation and use inverse operations to check answers.

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

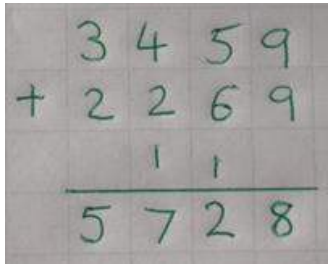
New vocabulary -

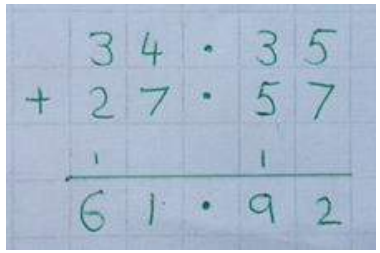
Addition Stage 4

Blank number line – To support mental methods



Column Method – Formal written method





Guidance

Number Line

Children add hundreds tens and ones starting at the biggest number. Children practise bridge multiples of 10 when needed but start to do this mentally rather than on the number line.

Column method – *(Use practical resources to support calculations but gradually remove this support when secure)*

Children solve addition problems using the compact column method. They leave a gap to show carrying. Children start to explore adding with decimals including putting it into the context of money.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.

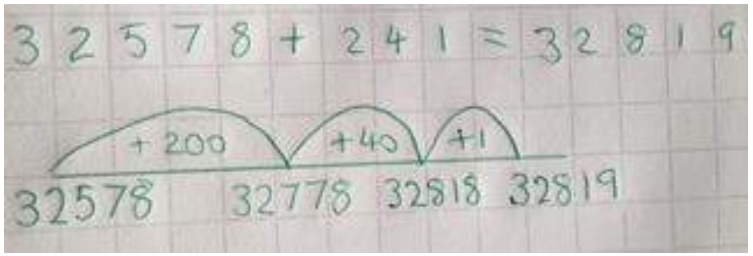
Estimate and use inverse operations to check answers to a calculation.

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

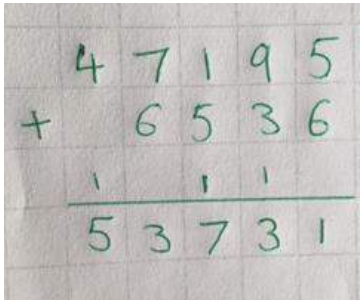
New vocabulary - (recapping all and applying other words to mean add)

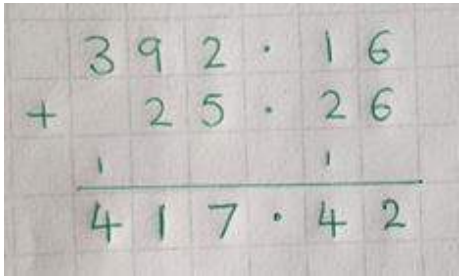
Addition Stage 5

Blank number line – To support mental methods



Column Method – Formal written method





Guidance

Number Line
Children start at the biggest number and add the various partitioned numbers. They bridge mentally and when crossing boundaries. (could involve decimals as well)

Column method
Children solve addition problems using the compact column method. They leave a gap to show carrying. Children also add with decimals including putting it into the context of money.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Add and subtract numbers mentally with increasingly large numbers.

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)

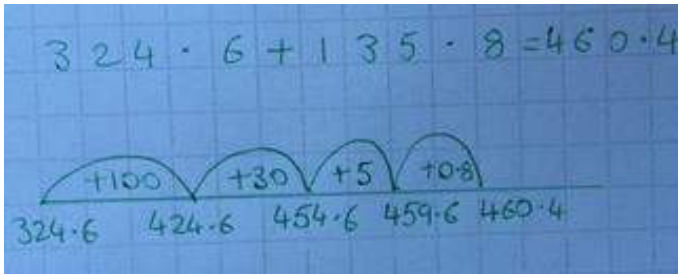
Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.

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

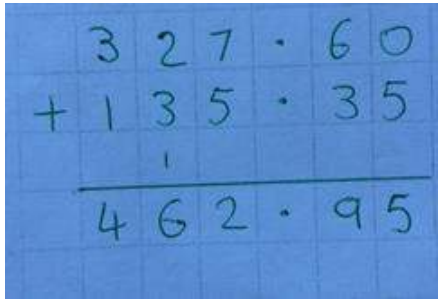
New vocabulary - (recapping all and applying other words to mean add)

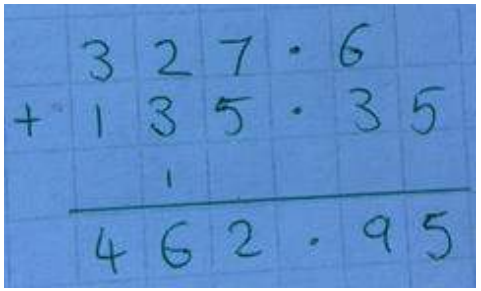
Addition Stage 6

Blank number line – To support mental methods



Column Method – Formal written method





Guidance

Number Line
Children start at the biggest number and add the various partitioned numbers. They bridge mentally and when crossing boundaries. (Could involve decimals as well)

Column method
Children solve addition problems using the compact column method using numbers up to and beyond 1 million. They leave a gap to show carrying. Children add with decimals including those with differing place values. At first children can add zeros to support the calculation but then this support is removed when ready.

Continue to develop pupils' understanding of addition with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Perform mental calculations, including with mixed operations and large numbers.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

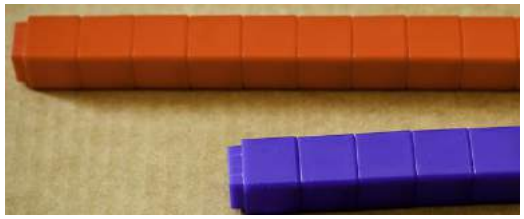
Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
(Solve problems involving addition, subtraction, multiplication and division.)

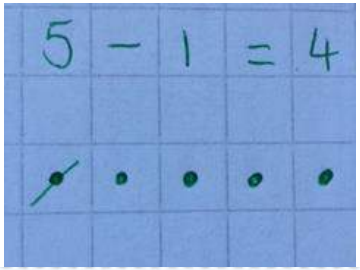
New vocabulary - (recapping all and applying other words to mean add)

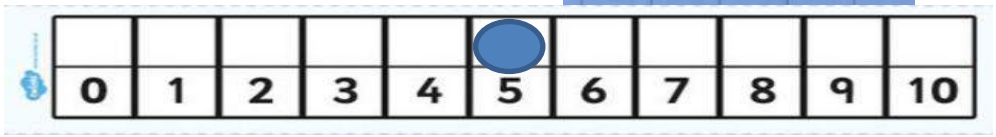
Subtraction EYFS

Finding the difference



Take away





Guidance

See the development matters document for guidance on subtraction at the different age ranges.

Difference

Children start to explore finding the difference by comparing two amounts and seeing which is more and which is less. They then move on to exploring how many more and how many less it is.

Take away

Children can take away two 1-digit numbers by starting with an amount and then taking another chosen amount away. Start using concrete apparatus, then move to pictorial and number tracks.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and dienes

Year expectations

Recites numbers in order to 10.

Knows that a group of things changes in quantity when something is added or taken away.

Knows that numbers identify how many objects are in a set.

Uses the language of 'more' and 'fewer' to compare two sets of objects.

Finds one more or one less from a group of up to five objects, then ten objects.

In practical activities and discussion, beginning to use the vocabulary involved in adding and subtracting.

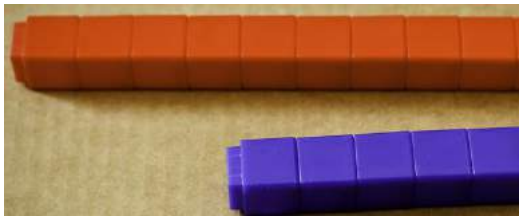
Record using marks that they can interpret and explain.

They add and subtract two single-digit numbers and count on or back to find the answer.

New vocabulary - Take/Take away, one...two...ten less, how many less is? Fewer, count back, how many left, difference.

Subtraction Stage 1

Difference

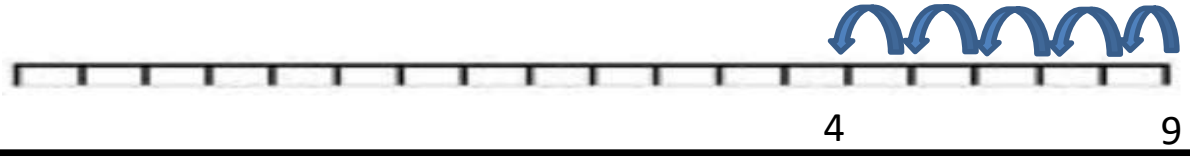


16 – 9 = 7

Take away

9-5=

Can you count back 5? Take away 5.



Guidance

Difference

The difference is done practically but is then moved on to a number track or number line. To find the difference, count from the smallest to the biggest.

Take away

Begin on a number track. Start on the first number and count back the necessary amount. Practise doing the jumps in preparation to moving to a number line.

Move to a marked number line and complete with jumps..

Move to a blank number line with partitions. Start on the right hand side and count back in the necessary jumps.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Represent and use number bonds and related subtraction facts within 20.

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

Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs.

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

New vocabulary - subtract, minus, how much less,

Subtraction Stage 2

Difference

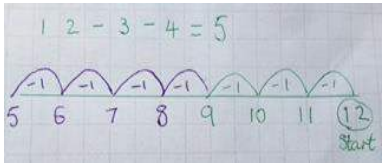
16 – 9 = 7

55-27= 28

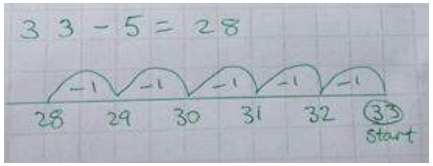
Take away

Number line

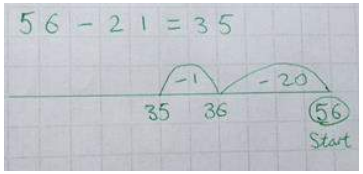
O - O - O =



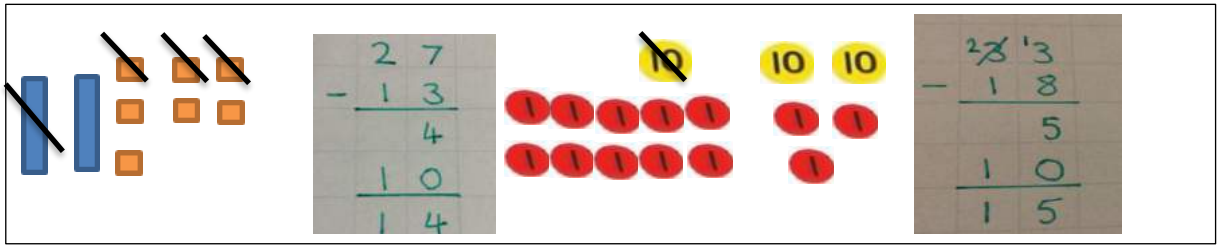
TO - O =



TO - TO =



Extended Column Method



Guidance

Difference

Children find the difference by counting on from the smallest number to the biggest number, bridging the ten when necessary. Count the jumps to find your answer. Marked number line moving to unmarked.

The number line can then be used for other operations e.g. 27+?=55 or 55-?=27

Take away – Number line

Start on the right hand side with the first number. Subtract the other number/numbers to give the answer. Children may bridge when ready and also count in bigger jumps e.g -3 instead of -1-1-1.

Take away – Column method

Pupils use practical apparatus to explore subtraction. Children then begin to use written column methods of subtraction in the expanded form by partitioning both numbers, taking away and then regrouping. They also begin to look at exchanging (with practical support) if ready.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

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

Add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens ; two two-digit numbers ; adding three one-digit numbers.

Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.

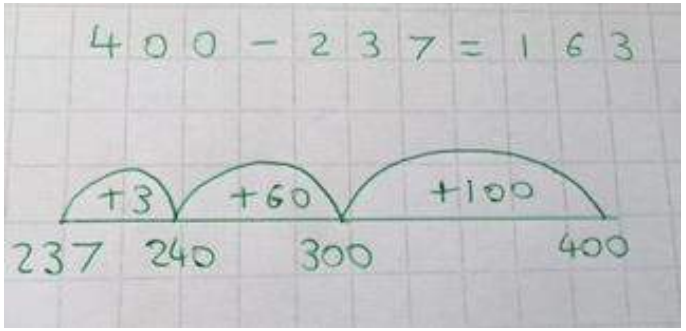
Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Solve problems with addition and subtraction: Using concrete objects and pictorial representations, including those involving numbers, quantities and measures. Applying their increasing knowledge of mental and written methods.
(solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change)

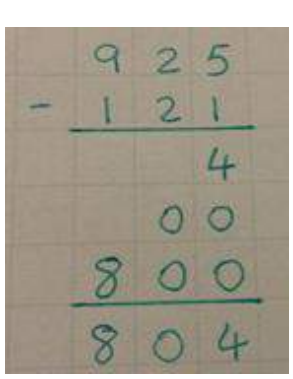
New vocabulary - Taken from, subtraction

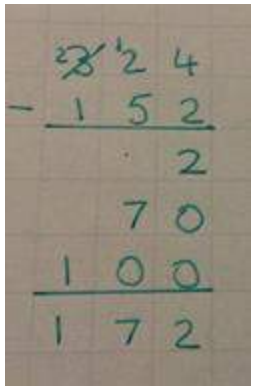
Subtraction Stage 3

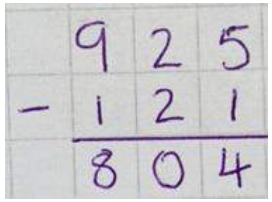
Difference – Supports mental calculations

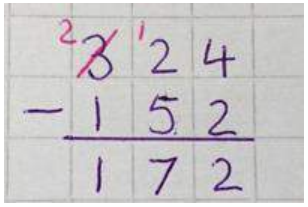


Take away – Formal written method









Guidance

Difference

Find the difference to subtractions involving 3-digits by counting from the smallest to the biggest, bridging the ten and hundred when needed. Children count the value of the jumps to find the difference.

Take away

Children carry on with the expanded method involving 3-digits and become more used to problems that involve an exchange. They move on to the compact method once secure. Ensure at all times that practical equipment is available to keep an understanding of place value.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.

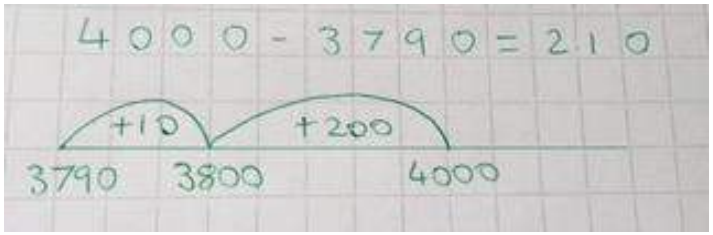
Estimate the answer to a calculation and use inverse operations to check answers.

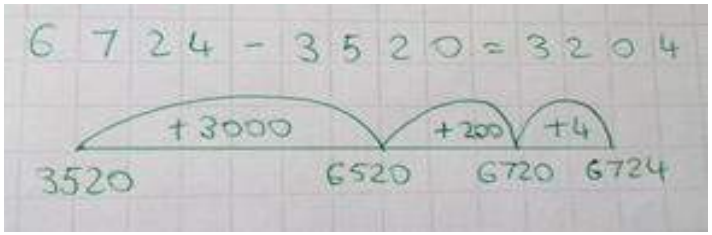
Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.

New vocabulary - decrease, inverse

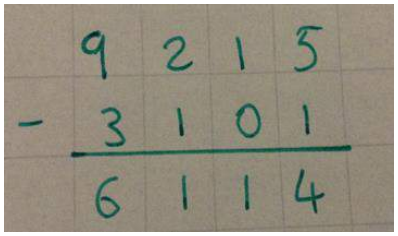
Subtraction Stage 4

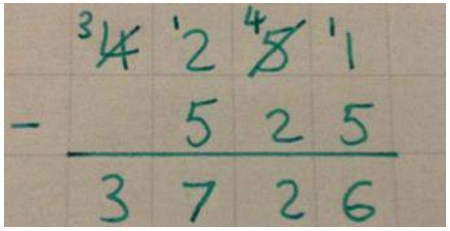
Difference – Supports mental calculations

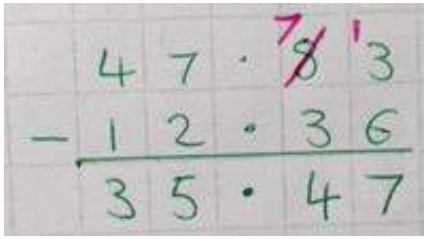




Take away – Formal written method







Guidance

Difference

Pupils begin to calculate numbers including thousands mentally using a number line for support. Jumps may bridge when needed (1000s). Children may select more efficient jumps to get from the smallest to the biggest if bridging is not appropriate.

Take away

Move to the compact column method if children have displayed a firm grasp of place value in year 3. Children also explore subtraction with decimals (Can be used in the context of money). Pupils are encouraged to check answers using the inverse.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.

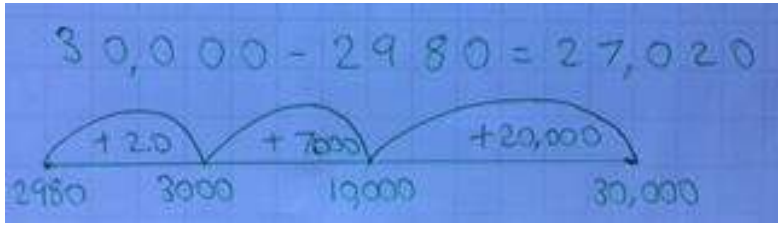
Estimate and use inverse operations to check answers to a calculation.

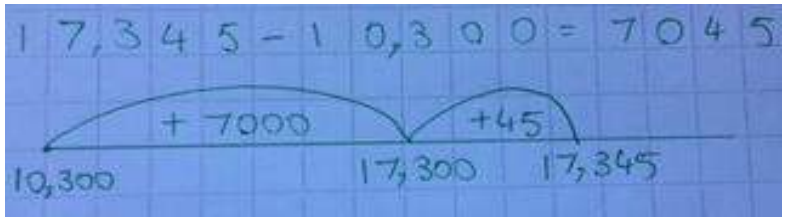
Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.

New vocabulary - (recapping all and applying other words to mean subtract e.g. ate)

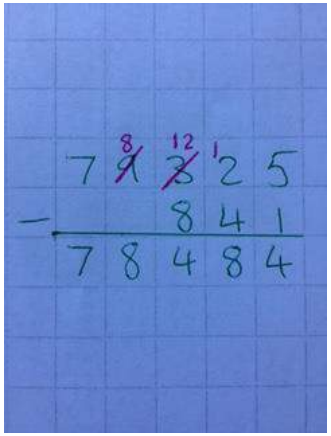
Subtraction Stage 5

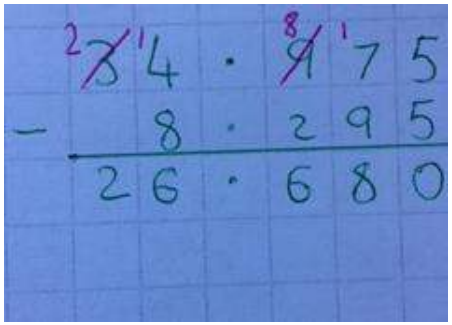
Difference – Supports mental calculations





Take away – Formal written method





Guidance

Difference

Pupils to calculate difference with increasingly bigger numbers mentally, supported with a number line. Jumps may bridge when needed. (10,000s) Children may select more efficient jumps to get from the smallest to the biggest if bridging is not appropriate.

Take away

Pupils use the column method to solve increasingly more complex calculations involving many exchanges and solve subtractions with more than 4 digits. Pupils subtract decimals with more than one decimal place and with differing numbers of digits. Pupils are encouraged to check answers using the inverse.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Add and subtract numbers mentally with increasingly large numbers.

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)

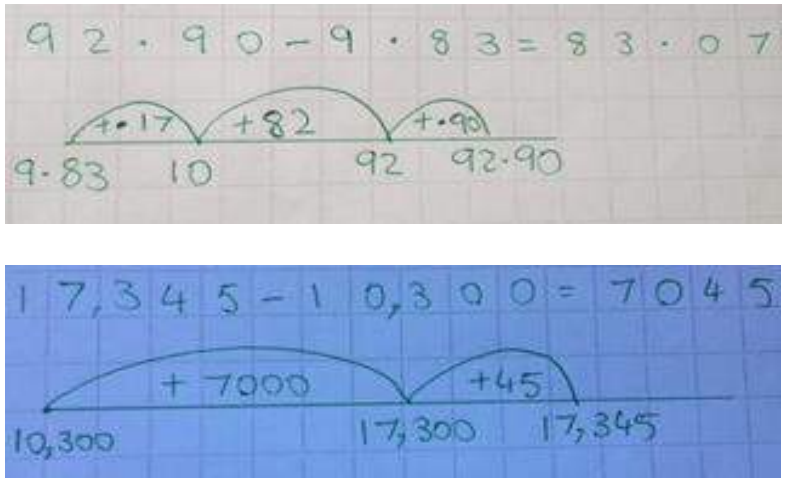
Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.

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

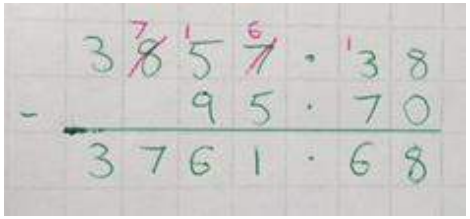
New vocabulary - (recapping all and applying other words to mean subtract e.g. ate)

Subtraction Stage 6

Difference – Supports mental calculations



Take away – Formal written method



Guidance

Difference

Pupils to calculate difference with increasingly bigger numbers mentally, supported with a number line. Jumps may bridge when needed. Children may select more efficient jumps to get from the smallest to the biggest if bridging is not appropriate.

Take away

Pupils use the column method to solve increasingly more complex calculations involving many exchanges and solve subtractions with any number of digits. Pupils subtract decimals with more than one decimal place and with differing numbers of digits. Zeros may be added to keep the decimal place value but then these should be removed. Pupils are encouraged to check answers using the inverse.

Continue to develop pupils' understanding of subtraction with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Perform mental calculations, including with mixed operations and large numbers.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
(Solve problems involving addition, subtraction, multiplication and division.)

New vocabulary - (recapping all and applying other words to mean subtract e.g. ate)

Multiplication EYFS

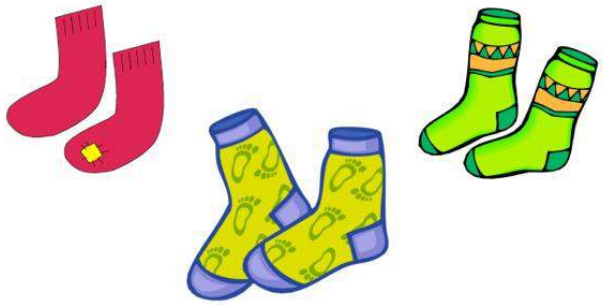
Counting on number tracks or number squares

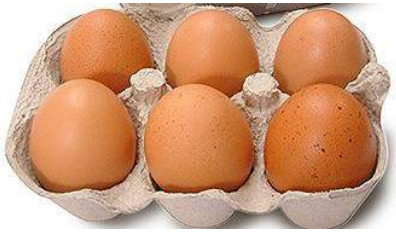
Jumping along number tracks/number squares to support stories, songs, activities etc.

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
51	52	53	54	55	56	57	58	59	60
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

Practical drawings or objects

Grouping/counting in equal sized groups including doubles.





Guidance

Use rhymes, songs and stories involving counting on and counting back in ones, twos, fives and tens.

Use a 100 square to show number patterns

Help children to understand that five fingers on each hand make a total of ten fingers altogether, or that two rows of three eggs in the box make six eggs altogether.

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

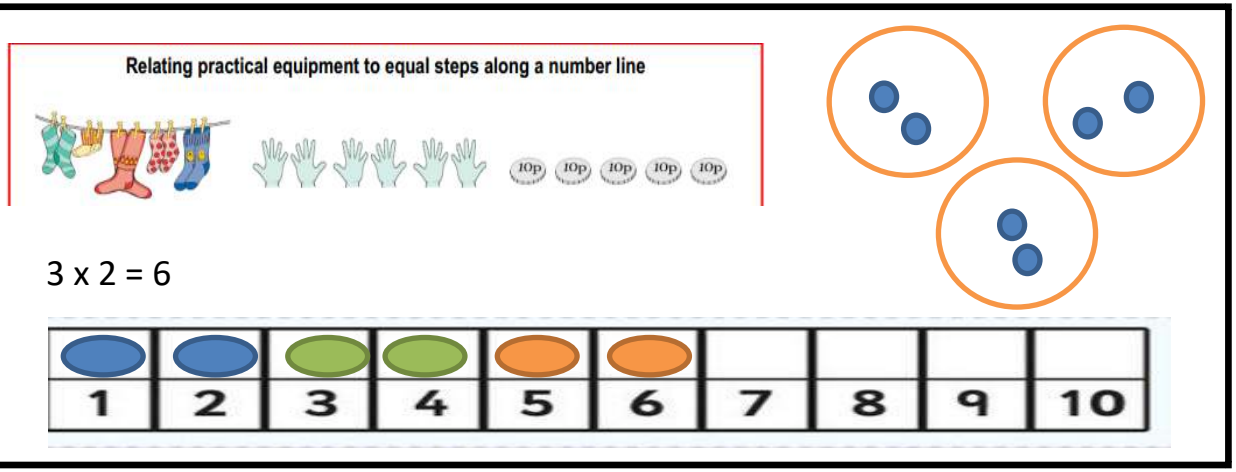
Year expectations

They solve problems, including doubling, halving and sharing.

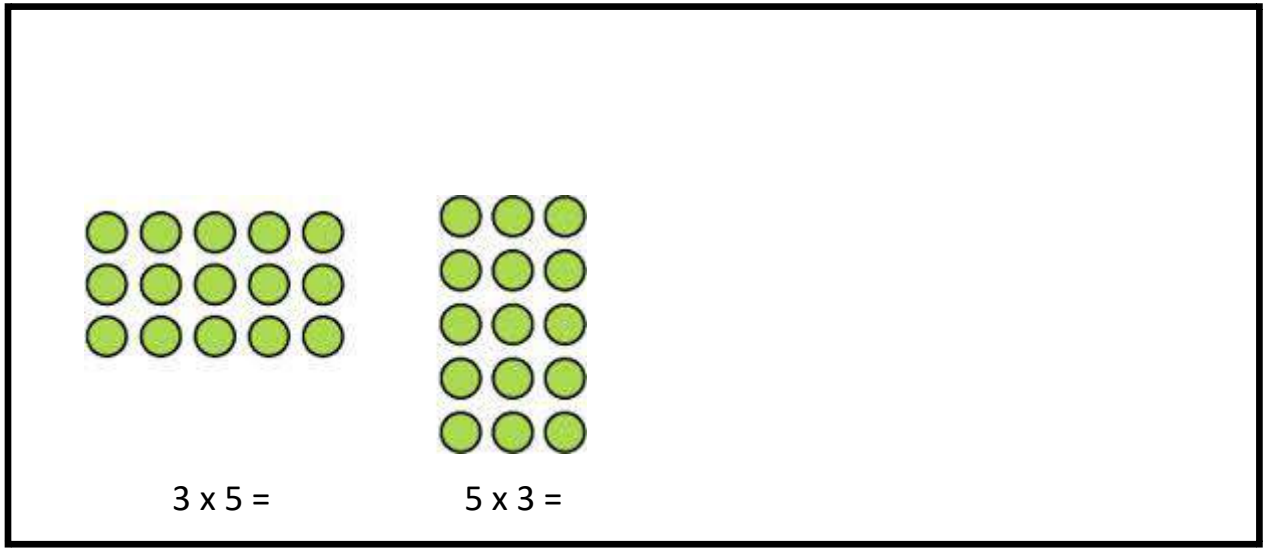
New vocabulary - lots of, double, count in...

Multiplication Stage 1

Pictorial and Number track



Array



Guidance

Pictorial and Number track

This helps children to visualise the multiplication problem with practical equipment and is the starting point for grouping. 3 x 2 = 6. In the cases shown this is 3 lots of 2 but show children both ways to introduce to the commutative law of multiplication.

Array

Children set it out in the array to visualise the multiplication problem. In the example shown 3 x 5 = means 3 lots of 5 =. It's important to show both ways to introduce children to commutative law.

(3 in this case is the multiplier, what you are multiplying it by, the verb)

(5 in this case is the multiplicand, the number, the noun)

(Both are factors and the answer is the product)

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

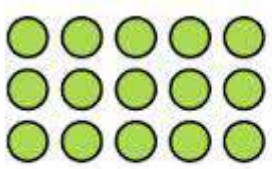
Count in multiples of twos, fives and tens.

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

New vocabulary - array, times, row

Multiplication Stage 2

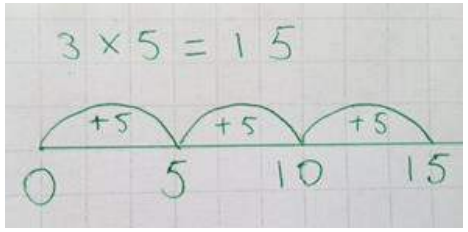
Array

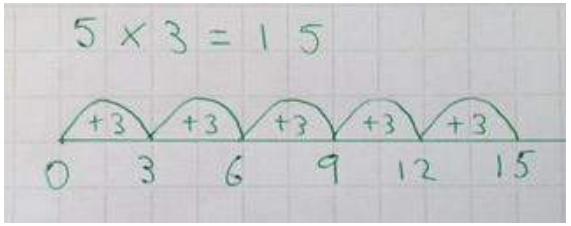


3x5 =

5x3 =

Number line





Guidance

Array

Children set it out in the array to visualise the multiplication problem. In the example shown 3 x 5 = means 3 lots of 5 =. It's important to show both ways to introduce children to commutative law.

(3 in this case is the multiplier, what you are multiplying it by, the verb)

(5 in this case is the multiplicand, the number, the noun)

(both are factors and the answer is the product)

Number line

In the case of 3 x 5 = start at zero and count on 3 lots of 5 (repeated addition). Ensure both ways are used to show children the commutative law. Children can then be asked to choose the most efficient way to multiply thinking about amount of jumps and the easier times tables.

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward.

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

Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.

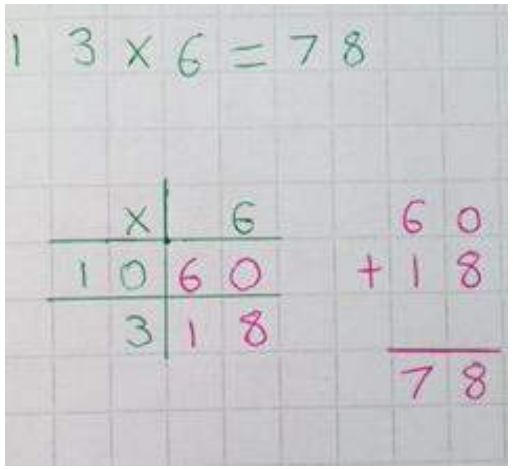
Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs.

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

New vocabulary - groups of, repeated addition, multiply, multiple of, multiplication,

Multiplication Stage 3

Grid



Guidance

Children need to have a secure knowledge of multiplication methods from the previous years and a secure knowledge of how to solve times tables mentally.

Grid

Children represent the problem with the multiplicand at the top and the multiplier down the side. When there is a two digit number, this is partitioned.

Arrays to be used to show how it looks visually when teaching but not to be used as a method as numbers get bigger (not efficient).

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count from 0 in multiples of 4, 8, 50 and 100.

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.

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.

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.

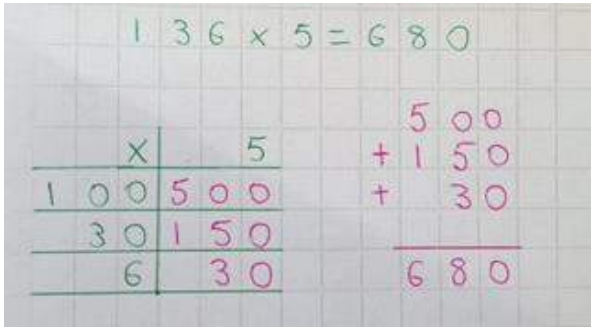
Estimate the answer to a calculation and use inverse operations to check answers.

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

New vocabulary - product

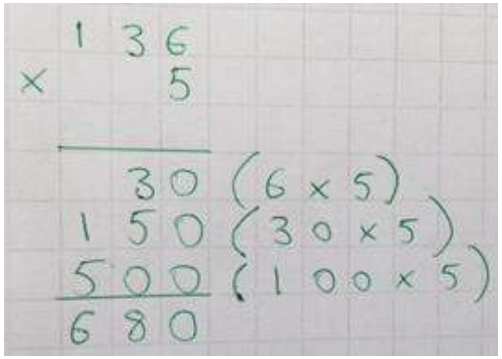
Multiplication Stage 4

Grid method

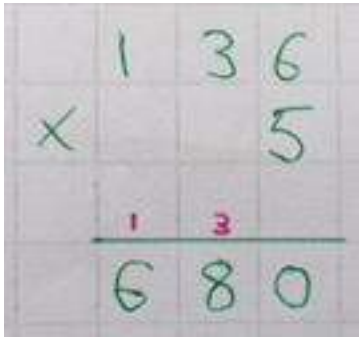


Column method

Expanded



Compact



Guidance

Children need to have a secure knowledge of multiplication methods from the previous years and a secure knowledge of how to solve times tables mentally. Children move on to problems involving 3-digit times 1 digit. They may also experience problems involving decimals.

Grid

Children represent the problem with the multiplicand at the top and the multiplier down the side. When there is a two or three digit number, this is partitioned.

Column method

The grid method is then transformed into the expanded column method. The two/three digit number is partitioned and each calculation is shown in brackets at the side (This could be withdrawn once secure with the place value). When ready, children can move to the compact method. Leave a space to allow for carrying.

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

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

Recall multiplication and division facts for multiplication tables up to 12 × 12.

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.

Recognise and use factor pairs and commutativity in mental calculations.

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.

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

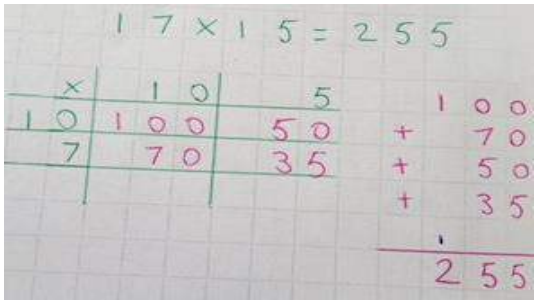
Solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

New vocabulary - Area, factor, factor pairs, square, multiplicand, multiplier

Multiplication Stage 5

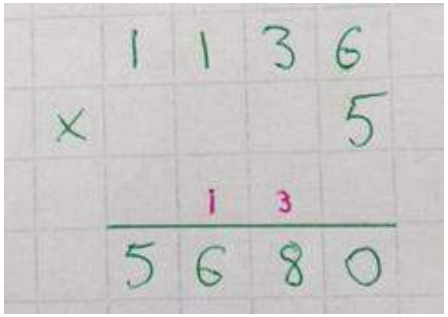
Grid method

Grid method for 2-digit times by 2-digit

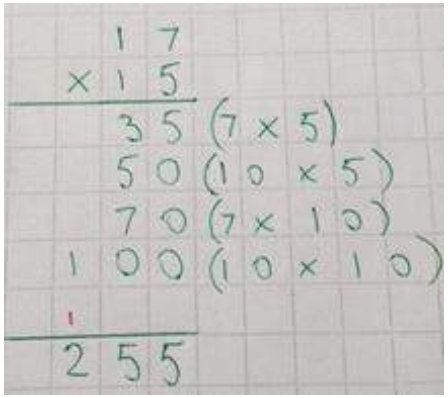


Column method

Compact for 4-digit times by 1-digit



Expanded for 2-digit times by 2-digit



Guidance

Children start to answer problems which include 2-digit times 2-digit and 4-digit times 1-digit.

Grid

They represent the problem with the multiplicand at the top and the multiplier down the side. When there is a two or three digit number, this is partitioned. Problems may also include decimals.

The grid method is not a formal method but it provides a link to working in the column method.

Column method

Children can carry on the compact method for 4-digit x 1-digit, remembering to leave space for the carrying. When they use this method for 2-digit x 2-digit, children go back to the expanded way, putting each calculation in brackets at the side (with time these brackets to help support the calculation can be removed).

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000.

Multiply and divide numbers mentally drawing upon known facts.

Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.

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.

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Establish whether a number up to 100 is prime and recall prime numbers up to 19.

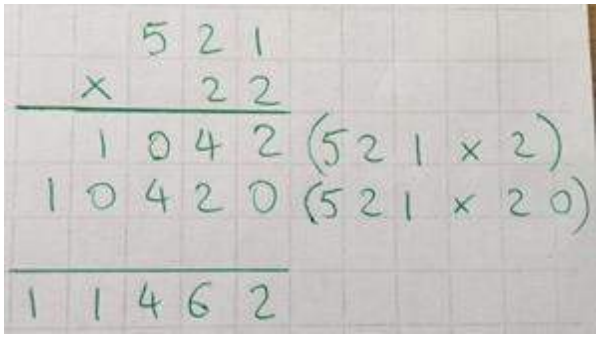
Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}).

Solve problems involving multiplication and division including all operations and vocabulary such as prime number and scaling etc.

New vocabulary - Powers of, cube, prime numbers, prime factors and composite (non-prime) numbers

Multiplication Stage 6

Formal column method



Guidance

Children must be fluent in times tables and have an appreciation for the place value of a number when it's multiplied. E.g. know 300 x 7 would be 2100 using knowledge of 3 x 7 = 21

Formal column method

Multiply multi-digit numbers up to 3 or 4-digit times a 2-digit whole number using the formal written method of long multiplication. To avoid many calculations the most significant stays together and the least significant is partitioned as seen in the example . Children may want to include brackets with each calculation at the side but this can be removed. Problems may also include decimals.

Continue to develop pupils' understanding of multiplication with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Perform mental calculations, including with mixed operations and large numbers.

Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

Identify common factors, common multiples and prime numbers.

Calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm3) and cubic metres (m3), and extending to other units such as mm3 and km3.

Use their knowledge of the order of operations to carry out calculations involving the four operations.
Solve problems involving addition, subtraction, multiplication and division (include scale for problems involving shapes).

New vocabulary - (recapping all and applying other words to mean multiply)

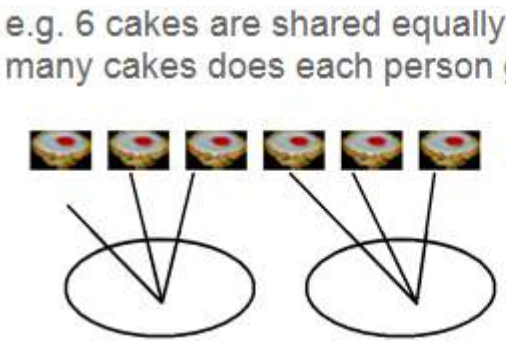
Division EYFS

Practical

Practical situations with objects e.g. use share all the biscuits out so that everyone has the same number. Cut the sandwich in half, how many pieces are there?

Sharing

Draw/present the number of circles (how many you're dividing by) then share out the amount.



Guidance

Use rhymes, songs and stories involving counting on and counting back in ones, twos, fives and tens.

Use a 100 square to show number patterns

Help children to understand that one thing can be shared by number of pieces, e.g. a pizza.

Enable children to note the 'missing set', e.g. 'There are none left' when sharing things out.

Create opportunities for children to separate objects into unequal groups as well as equal groups.

Encourage children to extend problems, e.g. "Suppose there were three people to share the bricks between instead of two".

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

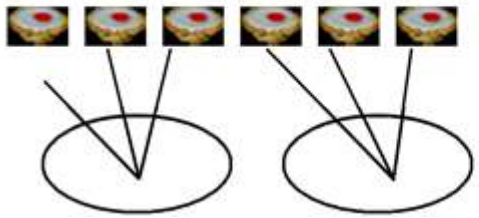
They solve problems, including doubling, halving and sharing.

New vocabulary - Share, share equally, half

Division Stage 1

Sharing

e.g. 6 cakes are shared equally between 2 people. How many cakes does each person get?

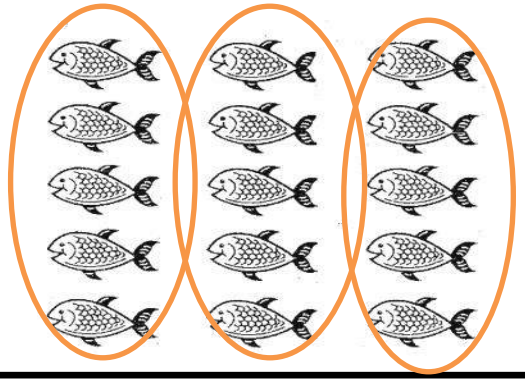


Grouping

12÷2 = asked in the context of…

How many pairs of socks can we make from this pile of socks? Count the pairs.

15÷5 = asked in the context of 'How many groups of 5 can you make?'



Guidance

Sharing

For 6÷2 =, 6 is the dividend and 2 is the divisor. Children draw the amount of hoops they are dividing the number by (in this case 2). They then share the dividend equally into the two hoops.

Start off practically, then move to a written method.

Grouping

Children see how many groups they can make to make the whole. In the case of 15÷5 =, how many groups of 5 make 15?

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count in multiples of twos, fives and tens.

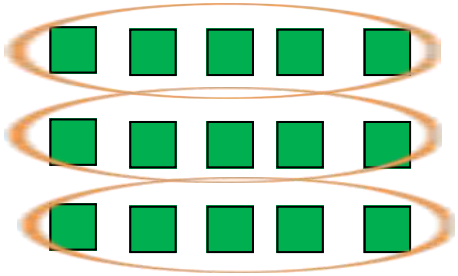
Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

New vocabulary - groups, equal groups

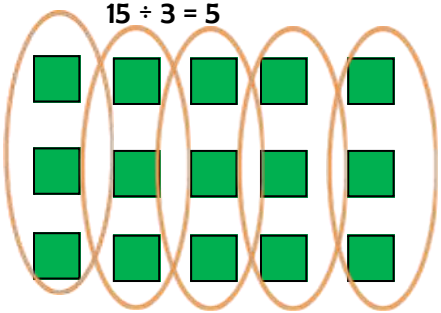
Division Stage 2

Grouping - Arrays

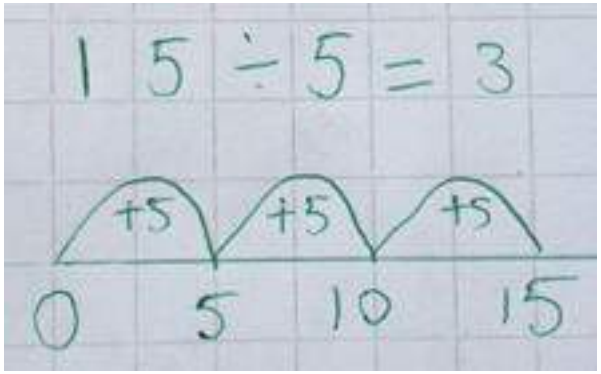
15 ÷ 5 = 3



15 ÷ 3 = 5



Grouping – Number line



Guidance

(*You may want to introduce division by sharing but as a method this becomes impractical as the numbers get bigger).*

Grouping – Array

Children can visualise the division by drawing an array. For 15÷5=, you are seeing how many 5s make 15. Draw the array and ring the 5s. To show the link between division number sentences you can demonstrate 15 ÷ 3 = 5 alongside it.

Grouping – Number line

For 15÷5= you are finding how many 5s go into 15 so start at zero and count in 5s until you reach 15. Your answer is how many jumps you've done.

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward.

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

Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.

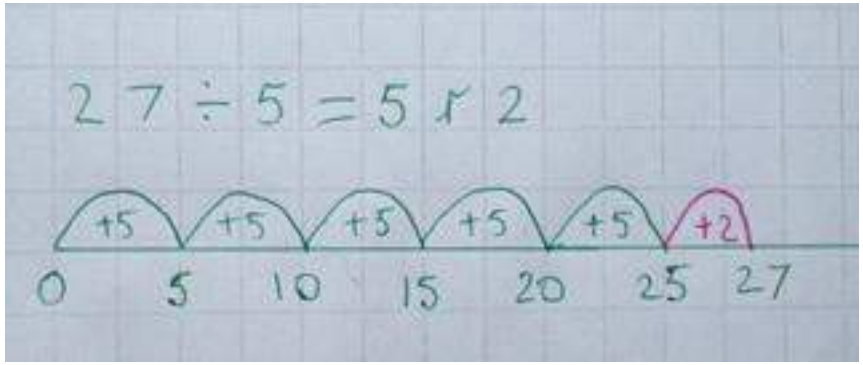
Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs.

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

New vocabulary - each, divide, divided by, divided into, groups of

Division Stage 3

Grouping – Number line (may include remainders)



Guidance

Grouping – Number line

For 27÷5= you are finding how many 5s go into 27 so start at zero and count in 5s until you reach the closest multiple of 5 to 27. However many you have left is your remainder. Your answer is how many jumps you've done and however many you have remaining.

(*You may want to introduce remainders by sharing but as a method this becomes impractical as the numbers get bigger).*

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count from 0 in multiples of 4, 8, 50 and 100.

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.

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.

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.

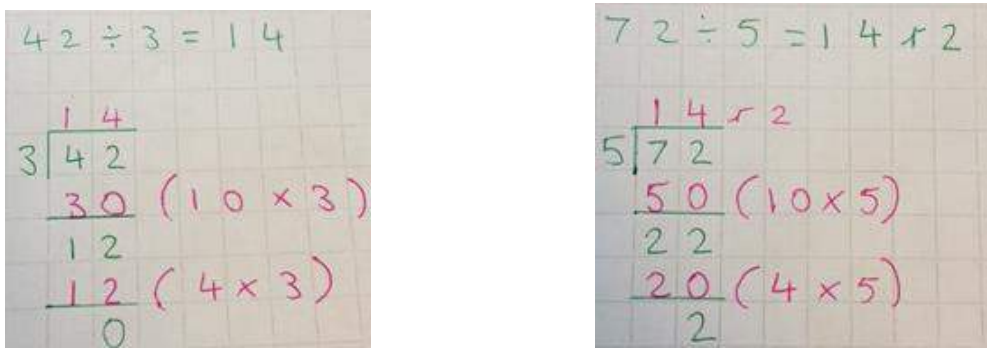
Estimate the answer to a calculation and use inverse operations to check answers.

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

New vocabulary - division, remainder

Division Stage 4

Chunking



Guidance

Children need to have a good knowledge of times tables or have the ability to work out times tables before moving on to chunking.

Chunking

Get as close to the number as you can by thinking about how many multiples of ten you can get rid of. Then think of your other multiples. Keep chunking until you get rid of the number or get as close as you can. Your answer is how many chunks of the divisor you have done. Encourage getting rid of the biggest chunk possible to decrease the amount of calculations needed. Problems may also involve remainders.

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

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

Recall multiplication and division facts for multiplication tables up to 12 × 12.

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.

Recognise and use factor pairs and commutativity in mental calculations.

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.

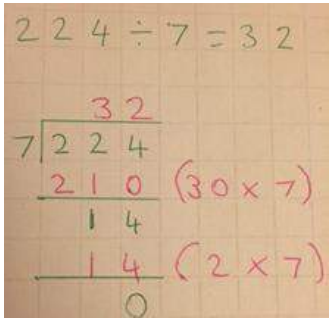
Estimate and use inverse operations to check answers to a calculation.

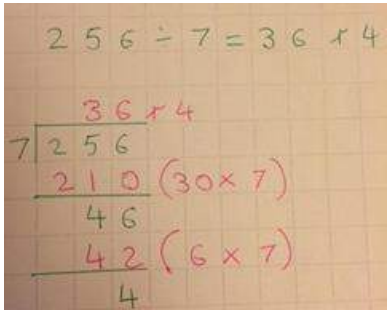
Solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

New vocabulary - divisible by, quotient

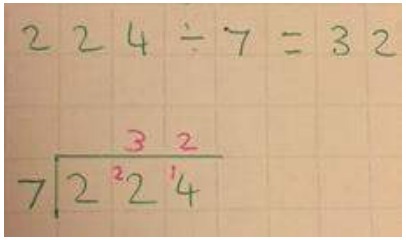
Division Stage 5

Chunking





Short division



Guidance

Children need to have a good knowledge of times tables or have the ability to work out times tables before moving on to chunking.

Chunking

Get as close to the number as you can by thinking about how many multiples of ten you can get rid of. Then think of your other multiples. Keep chunking until you get rid of the number or get as close as you can. Your answer is how many chunks of the divisor you have done. Encourage getting rid of the biggest chunk possible to decrease the amount of calculations needed. Problems may also involve remainders.

Short division

Children see how many times the divisor fits into the most significant digit. However many remain get carried into the next significant digit. This process continues until the dividend has been divided completely or a remainder is left.

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000.

Multiply and divide numbers mentally drawing upon known facts.

Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.

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.

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Establish whether a number up to 100 is prime and recall prime numbers up to 19.

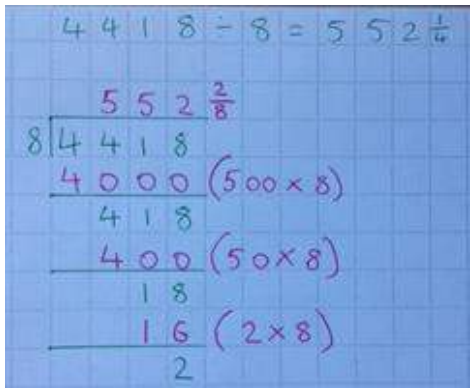
Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}).

Solve problems involving multiplication and division including all operations and vocabulary such as prime number and scaling etc.

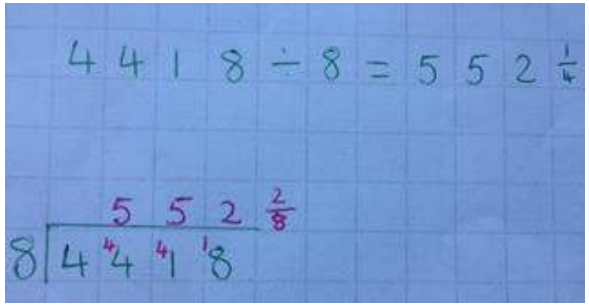
New vocabulary - (recapping all) Prime numbers, prime factors and composite (non-prime) numbers.

Division Stage 6

Chunking (remainder as a fraction)



Short division (remainder as a fraction)



Guidance

Pupils practise division for larger numbers, using the formal written methods of short and long division. Division follows the same path as in year 5. Children may have trickier or bigger calculations and they are to present any remainder as a fraction or other depending on the context of the question.

Chunking

Get as close to the number as you can by thinking about how many multiples of ten you can get rid of. Then think of your other multiples. Keep chunking until you get rid of the number or get as close as you can. Your answer is how many chunks of the divisor you have done. Encourage getting rid of the biggest chunk possible to decrease the amount of calculations needed. Problems may also involve remainders.

Short division

Children see how many times the divisor fits into the most significant digit. However many remain get carried into the next significant digit. This process continues until the dividend has been divided completely or a remainder is left.

Continue to develop pupils' understanding of division with practical activities using concrete apparatus, such as bundles of straws, numicon, counters and diennes.

Year expectations

Perform mental calculations, including with mixed operations and large numbers. Associate a fraction with division and calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. $^{3}/_{8}$)

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

Identify common factors, common multiples and prime numbers.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

Solve problems involving addition, subtraction, multiplication and division (include scale for problems involving shapes).

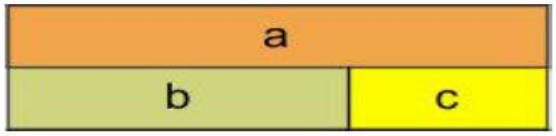
New vocabulary - (recapping all and applying other words to mean division)

Part-Part-Whole and Bar Modelling (Problem solving)

Many problems involving the 4 operations can be separated into parts of the problem and the whole total. This can be visually represented on a bar model. Examples for addition, subtraction, multiplication and division can be seen on the next pages.

Addition and Subtraction

The bar model supports understanding of the relationship between addition and subtraction in that both can be seen within the one representation and viewed as different ways of looking at the same relationships.



This diagram encapsulates all of the following relationships;

$a = b + c$; $a = c + b$; $a - b = c$; $a - c = b$

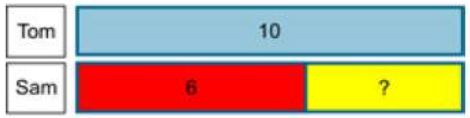
Barry has 12 stickers and Chris has 8 stickers, how many do they have altogether?

Chris has 8 stickers and Barry has 12 stickers, how many do they have altogether?

Altogether Barry and Chris have 20 stickers. If Barry has 12 stickers, how many does Chris have?

Altogether Barry and Chris have 20 stickers. If Chris has 8 stickers, how many does Barry have?

Subtraction
- Comparison or Difference



Tom has 10 pencils and Sam has 6 pencils. How many more does Tom have?

Part-Part-Whole and Bar Modelling (Problem solving)

Multiplication

Notice how each section of the bars in the problem below has a value of 4 and not 1. This many-to-one correspondence, or unitising is important and occurs early, for example in the context of money, where one coin has a value of 2p for example. It is also a useful principle in the modelling of ratio problems.

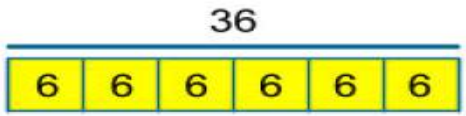
Peter has 4 books
Harry has five times as many books as Peter.
How many books has Harry?

4 × 5 = 20
Harry has 20 books

Division

When using the bar model for division it is the image of sharing rather than grouping which is highlighted in this representation.

Mr Smith had a piece of wood that measured 36 cm.
He cut it into 6 equal pieces.
How long was each piece?

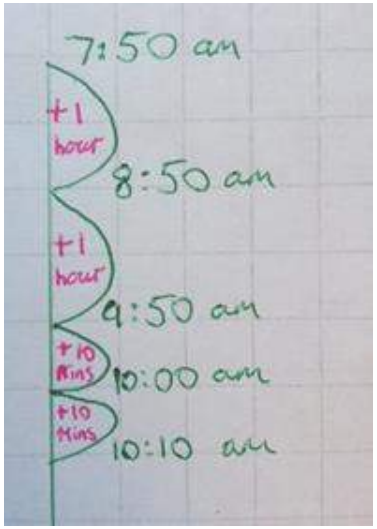


36 ÷ 6 = 6
Each piece is 6 cm

A more in-depth look into bar modelling can be found in the school's bar modelling document.

Intervals of time

It takes Alex 2 hours and 20 minutes to drive to his grandma's house. If he set off at 7:50am what time does he get there?



Guidance

With problems involving time, we usually go to 60 as a bridge therefore when solving these problems the approach is slightly different to remind children to go to 60 and not 100.

Use a vertical number line, make jumps in hours and minutes using the hour as a bridge if needed.

Yearly expectations

Year 1

Tell the time to the hour and half past the hour and draw the hands on a clock face to show these times.

Recognise and use language relating to dates, including days of the week, weeks, months and years.

Year 2

Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times.

Know the number of minutes in an hour and the number of hours in a day.

Year 3

Tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks.

Estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes, hours and o'clock; use vocabulary such as a.m./p.m., morning, afternoon, noon and midnight.

Year 4

Read, write and convert time between analogue and digital 12 and 24-hour clocks.

Solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.

Year 5 & 6

Solve problems involving converting between units of time.