Review Date September 2027

Calculation Policy

September 2025

This policy supports the White Rose maths scheme used throughout the school. Progression within each area of calculation is in line with the programme of study in the 2014 National Curriculum. This calculation policy should be used to support children to develop a deep understanding of number and calculation. This policy has been designed to teach children through the use of concrete, pictorial and abstract representations. Where appropriate, sentence stems and key questions are included alongside the key representations.

- Concrete representation— a pupil is first introduced to an idea or skill by acting it out with real objects. This is a 'hands on' component using real objects and is a foundation for conceptual understanding.
- Pictorial representation – a pupil has sufficiently understood the 'hands on' experiences performed and can now relate them to representations, such as a diagram or picture of the problem.
- Abstract representation—a pupil is now capable of representing problems by using mathematical notation, for example 12 x 2 = 24.

It is important that conceptual understanding, supported by the use of representation, is secure for all procedures. Reinforcement is achieved by going back and forth between these representations.

Arithmetical Proficiency

Pupils should **secure mental strategies. Key number facts** should be learnt to automaticity to help avoid cognitive overload in working memory and enable pupils to focus on new learning. They are taught the strategy of counting forwards and backwards in ones and tens first before other strategies are introduced. To further support children in developing their fluency with their mental strategies, we use Fluency Bee, a program developed by White Rose, which recaps key counting and mental strategies and allows children to become fluent in this area.

Mathematics Mastery

At the centre of the mastery approach to the teaching of mathematics is the belief that all children have the potential to succeed and that all children can learn and enjoy maths. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling challenging and varied problems. Similarly, with calculation strategies, children must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations. This policy outlines the different calculation strategies that should be taught and used in Year 1 to Year 6 in line with the requirements of the 2014 Primary National Curriculum.

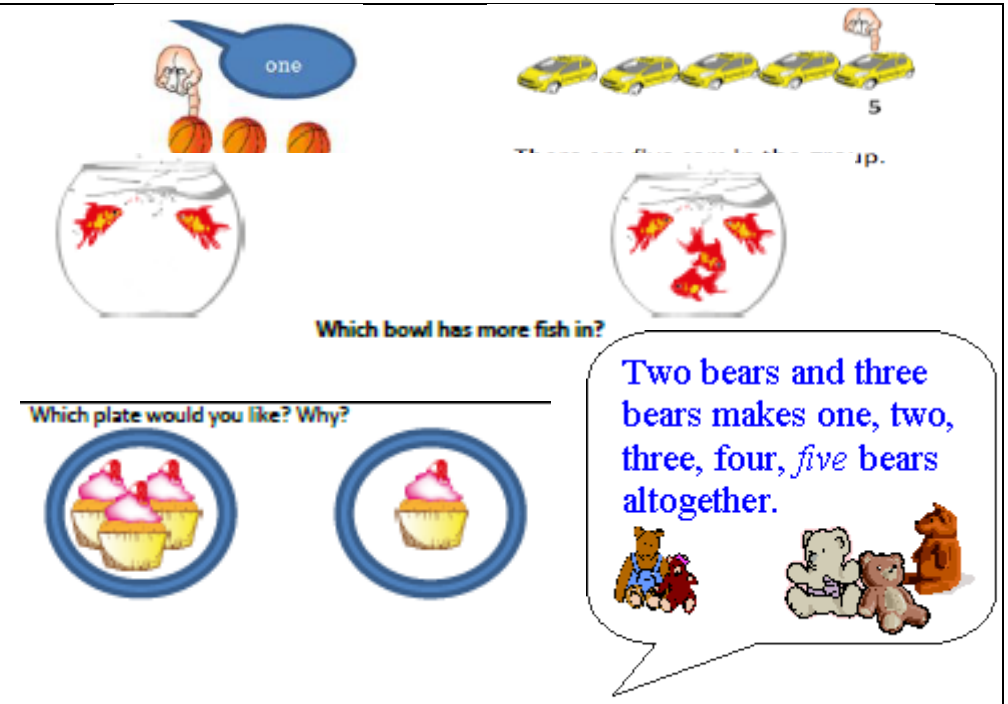
How to use this policy

This mathematics policy is a guide for all staff at Abbot's Hall and has been adapted from work by the NCETM. All teachers plan from the scheme of work provided by White Rose Maths Hub and are required to base their planning around their year group's modules and not to move onto a higher year group's scheme work. These modules use the Singapore Maths Methods and are affiliated to the workings of the 2014 Maths Programme of Study. Teachers can use any teaching resources that they wish to use and

the policy does not recommend one set of resources over another, rather that, a variety of resources are used. For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The principle of the concrete-pictorial-abstract (CPA) approach is for children to have a true understanding of a mathematical concept, they need to master all three phases within a year group's scheme of work.

DEVELOPING UNDERSTANDING OF NUMBER

Early Years Foundation Stage **40-60 months**	**Representations**
• Recognise some numerals of personal significance • Recognise numerals 1 to 5 • Count up to 3 or objects by saying one number name for each item • Count actions or objects which cannot be moved • Count objects to 10, and begin to count beyond 10 • Count up to 6 objects from a larger group • Select the correct numeral to represent 1 to 5, then 1 to 10 objects • Count an irregular arrangement of up to 10 objects • Estimate how many objects they can see and check by counting them • Use the language of 'more' and 'fewer' to compare two sets of objects • Find the total number of items in two groups by counting all of them • Say the number that is one more than a given number • Find one more or one less from a group of up to five objects, then ten objects • In practical activities and discussions, begin to use the vocabulary involved in adding and subtracting • Record, using marks that they can interpret and explain • Begin to identify mathematical problems based on own interests and fascinations **<u>Early Learning Goal</u>** **Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or**	

back to find the answer. They solve problems, including doubling, halving and sharing.	

DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION

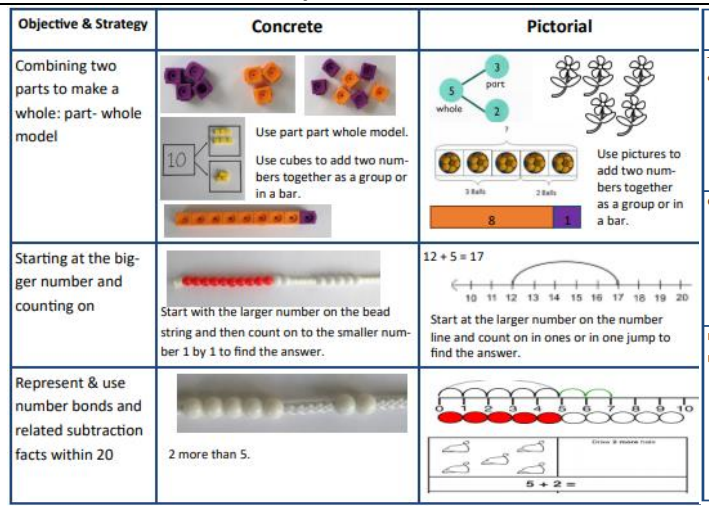
Year 1

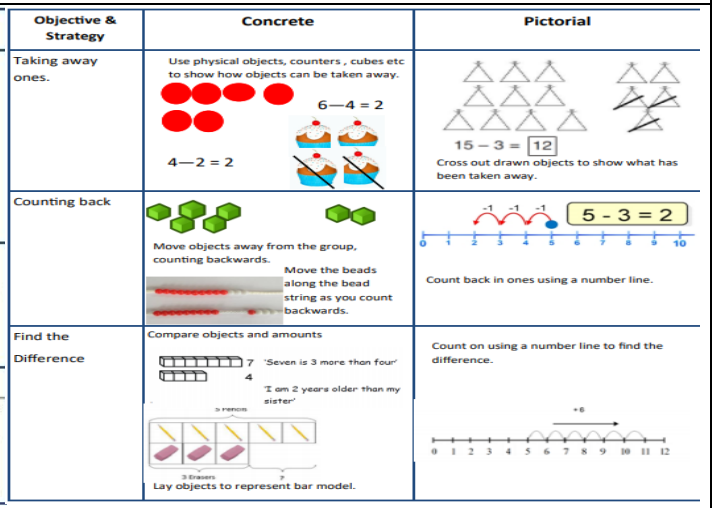
Objectives

- read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including 0
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as

  7 = ? – 9

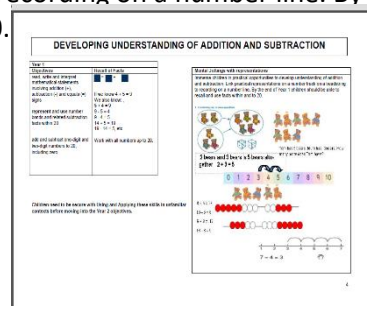
Concrete and Pictorial representations





Mental Jottings with representations (Abstract)

Immerse children in practical opportunities to develop understanding of addition and subtraction. Link practical representations, on a number track or beadstring, to recording on a number line. By the end of Year 1 children should be able to recall and use facts within and to 20.



Recall of facts

If we know 4 + 5 = 9
we also know:
5 + 4 = 9
9 - 5 = 4
9 – 4 =5
14 + 5 = 19
19 – 14 = 5 etc.

Work with all numbers up to 20

Children need to be secure with using and applying these skills in unfamiliar contexts before moving into the Year 2 objectives.

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils memorize and reason with number bonds to 10 and 20 in several forms (for example, 9 + 7 = 16; 16 − 7 = 9; 7 = 16 − 9). They should realise the effect of adding or subtracting 0. This establishes addition and subtraction as related operations.
- Pupils combine and increase numbers, counting forwards and backwards.
- They discuss and solve problems in familiar practical contexts, including using quantities. Problems should include the terms: put together, add, altogether, total, take away, distance between, difference between, more than and less than, so that pupils develop the concept of addition and subtraction and are enabled to use these operations flexibly.

Year 2

Objectives

- 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
- 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 1s
  - a two-digit number and 10s
  - 2 two-digit numbers
  - adding 3 one-digit numbers
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems

Written Methods with representations (Concrete, Pictorial and Abstract)

Continue use of empty number line to show jumps up and back (keep the first number whole and split the second number into tens and units). Include over jumping.

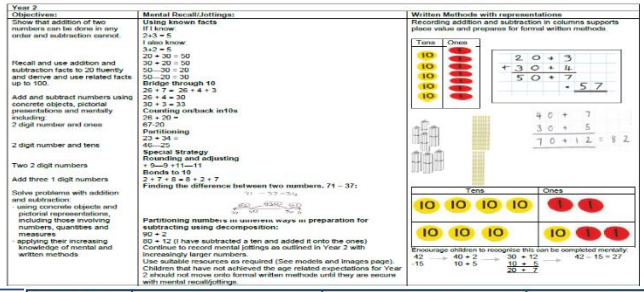
Find the difference using cubes/counters, and model counting up.

Recording addition and subtraction in columns supports place value and prepares for formal written methods.

Use the expanded column method:

24 + 36 becomes

20 and 4
+ 30 and 6
50 and 10 = 60



Objective & Strategy	Concrete	Pictorial	Abstract
Use known number facts Part part whole	Children explore ways of making numbers within 20		
Using known facts	Use of dienes to represent numbers	Children draw representations of H,T and O	3 + 4 = 7 leads to 30 + 40 = 70 leads to 300 + 400 = 700
Bar model	3 + 4 = 7	7 + 3 = 10	23 + 25 = 48
Add a two digit number and ones	17 + 5 = 22 Use ten frame to make 'magic ten Children explore the pattern. 17 + 5 = 22 27 + 5 = 32	Use part part whole and number line to model.	17 + 5 = 22 Explore related facts 17 + 5 = 22 5 + 17 = 22 22 – 17 = 5 22 – 5 = 17
Add a 2 digit number and tens	25 + 10 = 35 Explore that the ones digit does not change	27 + 30	27 + 10 = 37 27 + 20 = 47 27 + □ = 57
Add two 2-digit numbers	Model using dienes , place value counters and numicon	Use number line and bridge ten using part whole if necessary.	25 + 47 20 + 5 40 + 7 20 + 40 = 60 5 + 7 = 12 60 + 12 = 72
Add three 1-digit numbers	Combine to make 10 first if possible, or bridge 1o then add third digit	Regroup and draw representation.	4 + 7 + 6 = 10 + 7 = 17 Combine the two numbers that make/ bridge ten then add on the third.

Objective & Strategy	Concrete	Pictorial	Abstract
Regroup a ten into ten ones	Use a PV chart to show how to change a ten into ten ones, use the term 'take and make'	20 – 4 =	20—4 = 16
Partitioning to subtract without regrouping. 'Friendly numbers'	34—13 = 21 Use Dienes to show how to partition the number when subtracting without regrouping.	Children draw representations of Dienes and cross off. 43—21 = 22	43—21 = 22

Mental Recall/Jottings

Using known facts

If I know:
2 + 3 = 5
I also know:
3 + 2 = 5
20 + 30 = 50
30 + 20 = 50
50 – 30 = 20 and so on

Bridge through 10

26 + 7 = 26 + 4 + 3
26 + 4 = 30
30 + 3 = 33

Counting on/back in 10s

26 + 20 =
67 – 20 =

Partitioning

23 + 34 =
46 – 25 =

Rounding and adjusting

+ 9 or + 11
-9 or -11

Bonds to 10

2 + 7 + 8 = 8 + 2 + 7

Continue to record mental jottings with increasingly large numbers.

Use suitable resources as required.

Children that are not secure with mental recall/jottings should not move onto formal written methods.

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils extend their understanding of the language of addition and subtraction to include sum and difference.
- Pupils practise addition and subtraction to 20 to become increasingly fluent in deriving facts such as using 3 + 7 = 10; 10 − 7 = 3 and 7 = 10 − 3 to calculate 30 + 70 = 100; 100 − 70 = 30 and 70 = 100 − 30. They check their calculations, including by adding to check subtraction and adding numbers in a different order to check addition (for example, 5 + 2 + 1 = 1 + 5 + 2 = 1 + 2 + 5). This establishes commutativity and associativity of addition. Recording addition and subtraction in columns supports place value and prepares for formal written methods with larger numbers.

Year 3

Objectives

- Add and subtract numbers mentally:
  - a three-digit number and 1s
  - a three-digit number and 10s
  - a three-digit number and 100s

- Add and subtract numbers with up to 3 digits using formal written methods of columnar addition and subtraction.

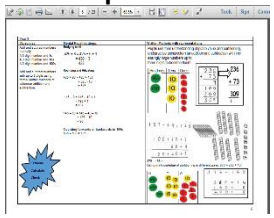
- Estimate the answer to a calculation and use inverse operations to check answers.

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

Written Methods with representations (Concrete, Pictorial and Abstract)

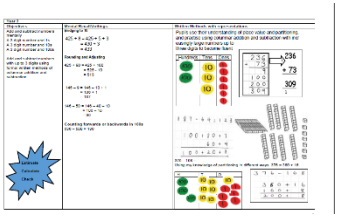
Pupils use their understanding of place value and partitioning using columnar addition and subtraction with increasingly large numbers up to 3 digits to become fluent.

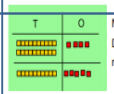
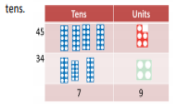
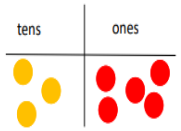
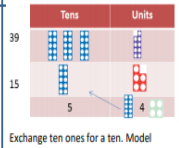
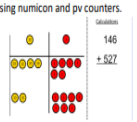
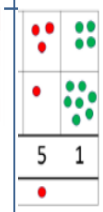
Use the expanded column methods:

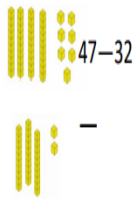
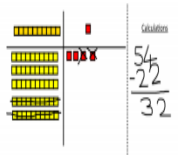
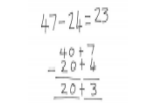
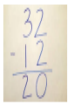
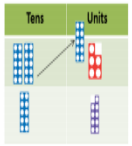
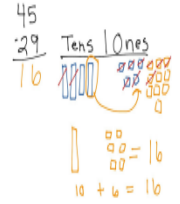
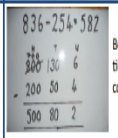
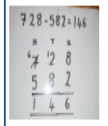


Use knowledge of partitioning in different ways:

e.g. 376 – 168
376 = 360 + 16



Objective & Strategy	Concrete	Pictorial	Abstract
Column Addition—no regrouping (friendly numbers) Add two or three 2 or 3-digit numbers.	 Model using Dienes or numicon Add together the ones first, then the tens.   Move to using place value counters	Children move to drawing the counters using a tens and one frame. 	2 2 3 + 1 1 4 3 3 7 Add the ones first, then the tens, then the hundreds.
Column Addition with regrouping.	 Exchange ten ones for a ten. Model using numicon and pv counters. 	 Children can draw a representation of the grid to further support their understanding, carrying the ten underneath the line	20 + 5 40 + 8 60 + 13 = 73 Start by partitioning the numbers before formal column to show the exchange. 536 + 85 621 11

Objective & Strategy	Concrete	Pictorial	Abstract
Column subtraction without regrouping (friendly numbers)	 47–32 – Use base 10 or Numicon to model	 Darw representations to support understanding	 Intermediate step may be needed to lead to clear subtraction understanding. 
Column subtraction with regrouping	 Begin with base 10 or Numicon. Move to pv counters, modelling the exchange of a ten into ten ones. Use the phrase 'take and make' for exchange.	 Children may draw base ten or PV counters and cross off.	 Begin by partitioning into pv columns  Then move to formal method.

Mental Recall/Jottings

Bridging to 10
425 + 8 = 425 + 5 + 3
= 430 + 3
= 433

Rounding and adjusting
425 + 90 = 425 + 100
= 525 -10
= 515

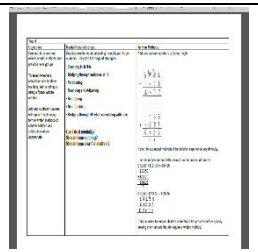
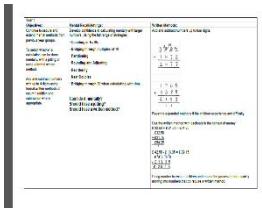
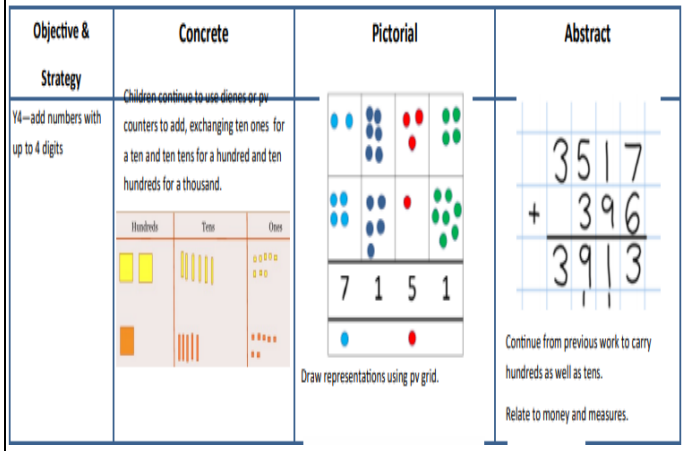
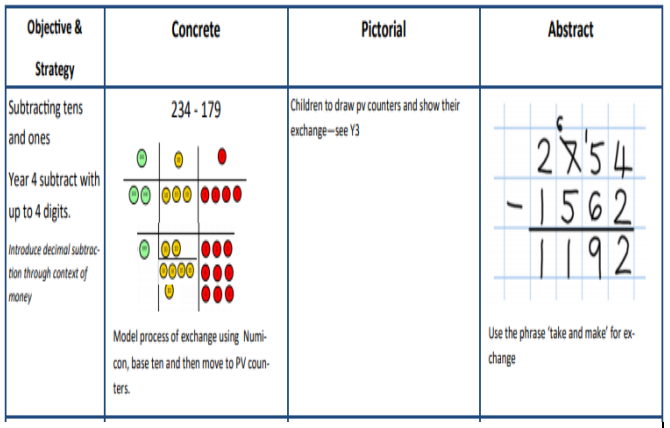
146 – 9 = 146 – 10 + 1
= 136 + 1
= 137

Counting forwards or backwards in 100s
636 – 500 = 136

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100.
- Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to 3 digits to become fluent.

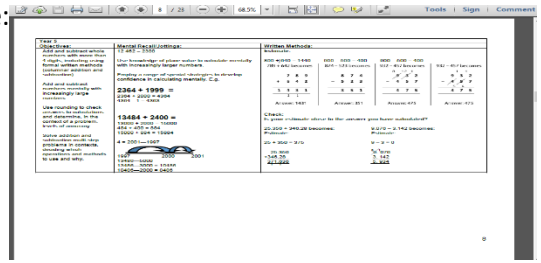
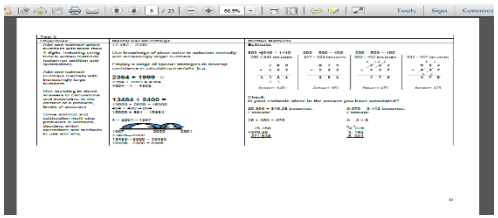
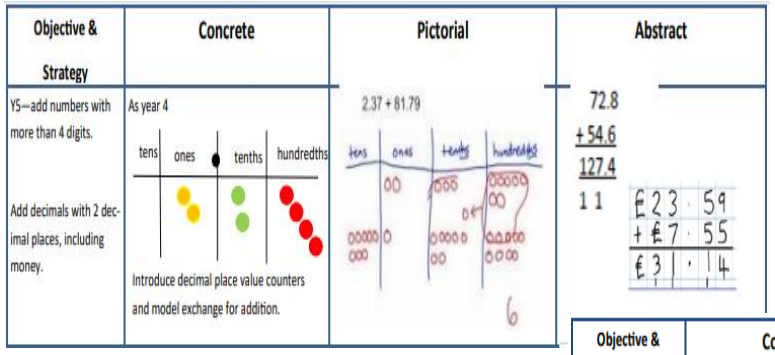
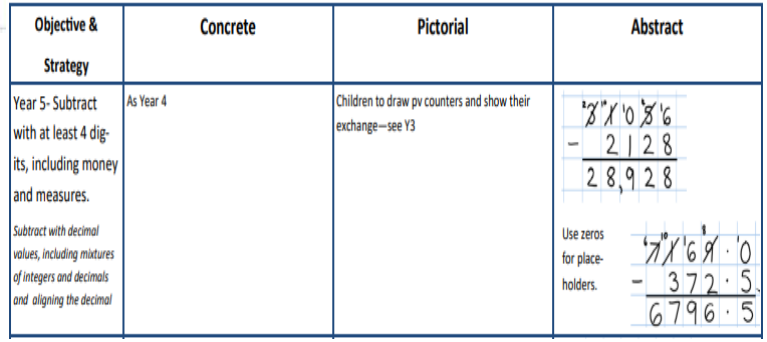
Year 4

Objectives	Written Methods with representations (Concrete, Pictorial and Abstract)	Mental Recall/Jottings
• Continue to secure and extend mental methods from previous year groups. • To select whether a calculation can be done mentally, with a jotting or using a formal written method. • To add and subtract numbers with up to 4 digits using formal written methods of column addition and subtraction where appropriate. • To estimate and use inverse operations to check answers to a calculation. • Solve addition and subtraction two-step problems in contexts, deciding which operations to use and why.	Add and subtract numbers up to 4 digits:  Revert to expanded methods if the children need support. Use the written methods with decimals in the context of money:    	Develop confidence at calculating mentally with larger numbers. Using the full range of strategies: ○ **Counting in 1s/10s** ○ **Bridging through multiples of 10** ○ **Partitioning** ○ **Rounding and adjusting** ○ **Reordering** ○ **Near doubles** ○ **Bridging through 60 when calculating with time.** **Can I do it mentally?** **Should I use a jotting?** **Should I use a written method?**

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency.

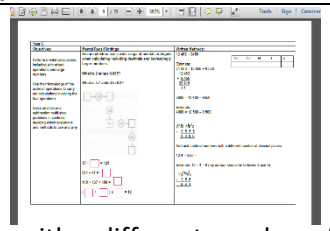
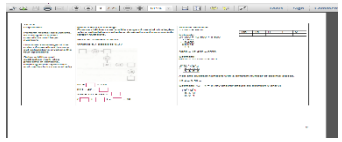
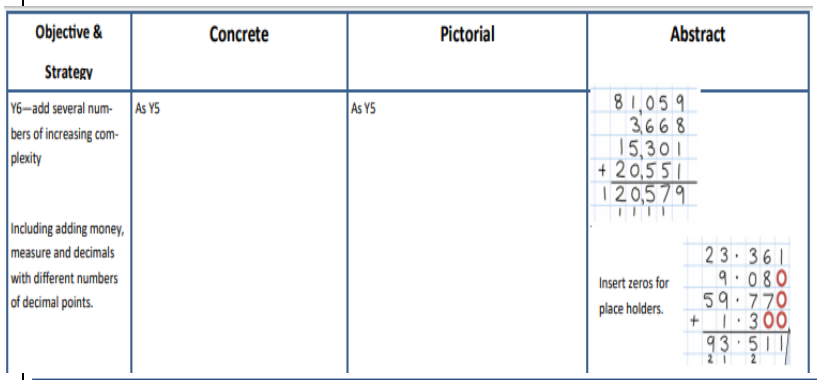
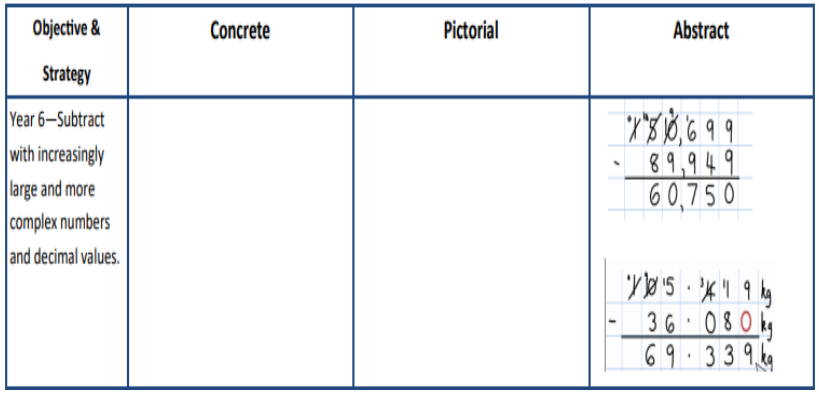
Year 5

Objectives	Written Methods with representations (Concrete, Pictorial and Abstract)	Mental Recall/Jottings
• Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). • Add and subtract numbers mentally with increasingly large numbers. • Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy. • Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	Estimate:  **Check:** **Is your estimate close to the answer you have calculated?**    	Use knowledge of place value to calculate mentally with increasingly large numbers. E.g. 12 462 – 2300 = Employ a range of strategies to develop confidence in calculating mentally: **2362 + 1999 =** 2364 + 2000 = 4364 4364 – 1 = 4363 **13484 + 2400 =** 13000 + 2000 = 15000 484 + 400 = 884 15000 + 884 = 15884

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils practise using the formal written methods of columnar addition and subtraction with increasingly large numbers to aid fluency.
- They practise mental calculations with increasingly large numbers to aid fluency (for example, 12,462 – 2,300 = 10,162).

Year 6

Objectives	Written Methods with representations (Concrete, Pictorial and Abstract)	Mental Recall/Jottings
• 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. • Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why. • Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.	12 462 + 8456 Estimate: 21 000 = 12 500 + 8 500  Add and subtract numbers with a different number of decimal places E.g. 12.4 – 3.56 = Estimate: 12 – 4 = 8 (my answer should be between 8 and 9).    	**Ensure children use a wide range of mental strategies when calculating including decimals and increasingly larg numbers.** **E.g. What is 2 minus 0.005?** **What is 5.7 added to 3?**

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils practise addition and subtraction for larger numbers, using the formal written methods of columnar addition and subtraction.
- They undertake mental calculations with increasingly large numbers and more complex calculations.
- Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50, etc, but not to a specified number of significant figures.
- Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9.

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION

Year 1

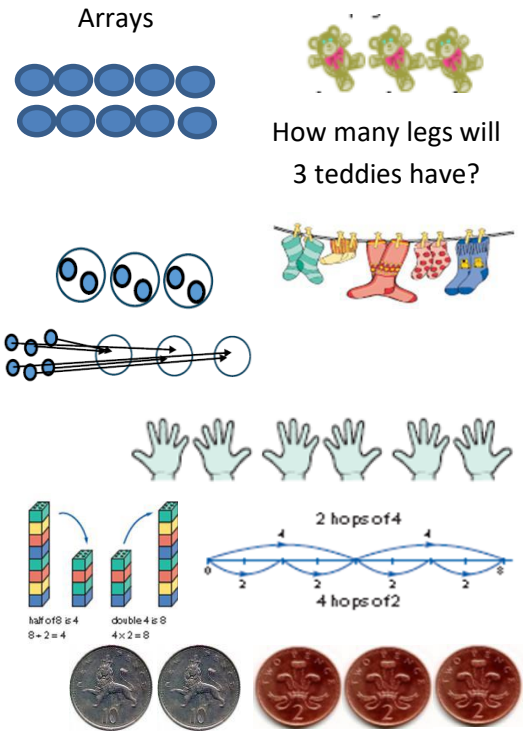
Objectives

- 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

Written Methods with representations (Concrete, Pictorial and Abstract)

Objective & Strategy	Concrete	Pictorial	Abstract
Doubling	Use practical activities using manipulatives including cubes and Numicon to demonstrate doubling	Draw pictures to show how to double numbers Double 4 is 8	Partition a number and then double each part before recombining it back together. 16 10 (×2) 6 (×2) 20 + 12 = 32
Counting in multiples	Count the groups as children are skip counting, children may use their fingers as they are skip counting.	Children make representations to show counting in multiples.	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30
Making equal groups and counting the total	Use manipulatives to create equal groups.	Draw to show 2 x 3 = 6 Draw and make representations	2 x 4 = 8
Understanding arrays	Use objects laid out in arrays to find the answers to 2 lots 5, 3 lots of 2 etc.	Draw representations of arrays to show understanding	3 x 2 = 6 2 x 5 = 10

Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing *Use Gordon ITPs for modelling*	I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities. 8 shared between 2 is 4 Sharing: 12 shared between 3 is 4	12 shared between 3 is 4



Jottings

Use of visual models to support counting in 2, 5 and 10

Ensure children begin to see the patterns of counting in 2, 5 and 10

Double and halve numbers

Children do not need to record number sentences using the symbols.

Develop the vocabulary by encouraging children to explain wh they are doing

NOTES AND GUIDANCE (NON-STATUTORY)

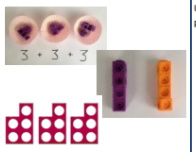
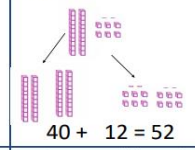
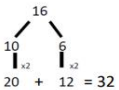
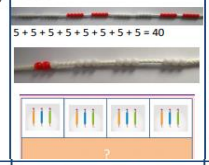
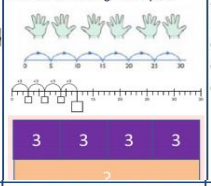
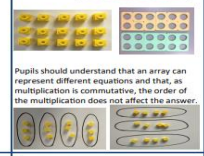
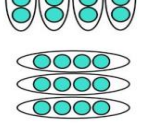
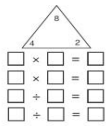
- Through grouping and sharing small quantities, pupils begin to understand multiplication and division; doubling numbers and quantities; and finding simple fractions of objects numbers and quantities
- They should make connections between arrays, number patterns and counting in twos, fives and tens

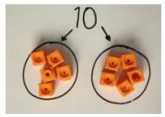
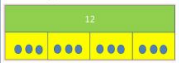
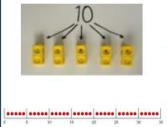
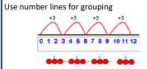
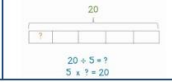
Year 2

Objectives

- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

Written Methods with representations (Concrete, Pictorial and Abstract)

Objective & Strategy	Concrete	Pictorial	Abstract
Repeated addition	 Use different objects to add equal groups	Use pictorial including number lines to solve prob There are 3 sweets in one bag. How many sweets are in 5 bags altogether? 	Write addition sentences to describe objects and pictures. 
Doubling	Model doubling using dienes and PV counters.  40 + 12 = 52	Draw pictures and representations to show how to double numbers	Partition a number and then double each part before recombining it back together.  20 + 12 = 32
Counting in multiples of 2, 3, 4, 5, 10 from 0 (repeated addition)	Count the groups as children are skip counting, children may use their fingers as they are skip counting. Use bar models.  5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 40	Number lines, counting sticks and bar models should be used to show representation of counting in multiples. 	Count in multiples of a number aloud. Write sequences with multiples of numbers. 0, 2, 4, 6, 8, 10 0, 3, 6, 9, 12, 15 0, 5, 10, 15, 20, 25 , 30 4 × 3 = ☐
Multiplication is commutative	Create arrays using counters and cubes and Numicon.   Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.	Use representations of arrays to show different calculations and explore commutativity. 	12 = 3 × 4 12 = 4 × 3 Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Using the Inverse *This should be taught alongside division, so pupils learn how they work alongside each other.* Using related multiplication and division facts			2 × 4 = 8 4 × 2 = 8 8 ÷ 2 = 4 8 ÷ 4 = 2 8 = 2 × 4 8 = 4 × 2 2 = 8 ÷ 4 4 = 8 ÷ 2 Show all 8 related fact family sentences.

Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing	 I have 10 cubes, can you share them equally in 2 groups?	Children use pictures or shapes to share quantities.  Children use bar modelling to show and support understanding.  12 ÷ 4 = 3	12 ÷ 3 = 4
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding. 	Use number lines for grouping  12 ÷ 3 = 4 Think of one way to work out the number of groups you are dividing by and work out how many would be within each group.  20 ÷ 5 = ? 5 x ? = 20	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

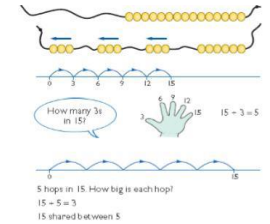
Examples

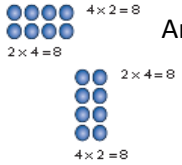
2 x 5 = 10
5 x 2 = 10

10 ÷ 5 = 2
10 ÷ 2 = 5
Use knowledge of doubling
10 x 2 = 20
20 ÷ 2 = 10

Repeated addition

Range of materials and contexts





Arrays

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils use a variety of language to describe multiplication and division.
- Pupils are introduced to the multiplication tables. They practise to become fluent in the 2, 5 and 10 multiplication tables and connect them to each other. They connect the 10 multiplication table to place value, and the 5 multiplication table to the divisions on the clock face. They begin to use other multiplication tables and recall multiplication facts, including using related division facts to perform written and mental calculations.
- Pupils work with a range of materials and contexts in which multiplication and division relate to grouping and sharing of discrete and continuous quantities, to arrays and repeated addition. They begin to relate those to fractions and measures (for example, 40 ÷ 2 = 20, 20 is half of 40). They use commutativity and inverse relations to develop multiplicative reasoning (for example 4 x 5 = 20 and 20 ÷ 5 = 4).

Year 3

Objective	Written Methods with representations (Concrete, Pictorial and Abstract)	Mental recall/jottings

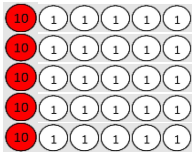
- Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- 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

Objective & Strategy	Concrete	Pictorial	Abstract
Grid method	Show the links with arrays to first introduce the grid method 4 rows of 10 4 rows of 3 Move onto base ten to move towards a more compact method. 4 rows of 13 Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows Fill each row with 126 Add up each column, starting with the ones making any exchanges needed Then you have your answer.	Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below. 24 x 3 = 72 Bar model are used to explore missing numbers 4 x ☐ = 20 20 4	Start with multiplying by one digit numbers and showing the clear addition alongside the grid. × 30 5 7 210 35 210 + 35 = 245 Moving forward, multiply by a 2 digit number showing the different rows within the grid method. 10 8 10 100 80 3 30 24

Objective & Strategy	Concrete	Pictorial	Abstract
Division with arrays	Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	Draw an array and use lines to split the array into groups to make multiplication and division sentences	Find the inverse of multiplication and division sentences by creating eight linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7 28 = 7 x 4 28 = 4 x 7 4 = 28 ÷ 7 7 = 28 ÷ 4

Priority should be given to the Grid Method and ensuring children are confident with this before moving onto Short Multiplication.

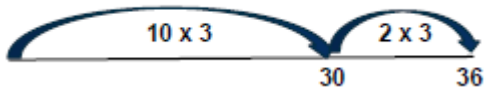
Progress from mental to written methods 5 x 15



x	10	5
5	50	25

15 × 5 = 50 + 25 = 75

36 ÷ 3 =



12 remainder 0

Short multiplication and division rely on mental methods –children should be given short multiplication and division involving 2/3/4/5/6/10 times tables when confident

Short multiplication

24 × 6 becomes

2 4
× 6
1 4 4
2

Answer: 144

Short division

98 ÷ 7 becomes

1 4
7 | 9 8
2

Answer: 14

3 x 2 = 6
6 ÷ 3 = 2
2 = 6 ÷ 3

30 x 2 = 60
60 ÷ 3 = 20
20 = 60 ÷ 3

There are 5 biscuits in each packet.
There are 4 packets.
How many biscuits are there altogether?

NOTES AND GUIDANCE (NON-STATUTORY)

- Pupils continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency. Through doubling, they may connect the 2, 4 and 8 multiplication tables.
- Pupils develop efficient mental methods, for example using commutativity and associativity (for example 4 x 12 x 5 = 4 x 5 x 12 = 20 x 12 = 240) and multiplication and division facts (for example, using 3 x 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (for example, 30 x 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).
- Pupils develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one- digit numbers and progressing to the formal written method of short multiplication and division.
- Pupils solve simple problems in contexts, deciding which of the four operations to use and why. These include measuring and scaling contexts, (for example, four times as high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example 3 hats and 4 coats, how many outfits?; 12 sweets shared between 4 children; 4 cakes shared between 8 children).

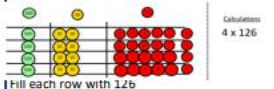
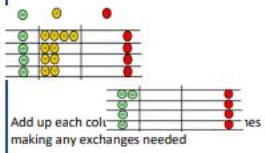
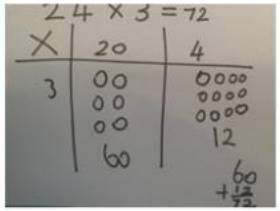
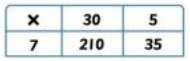
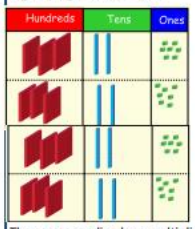
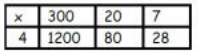
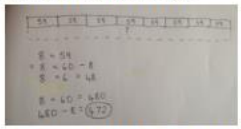
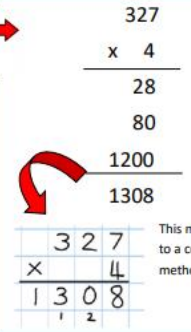
Year 4

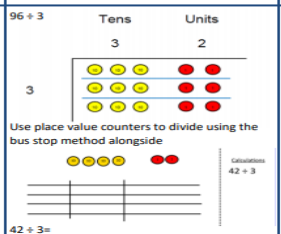
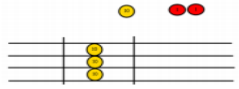
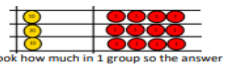
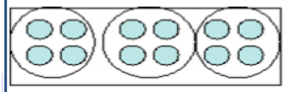
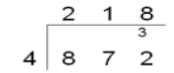
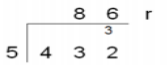
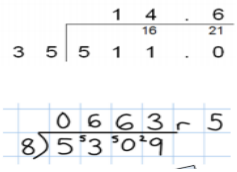
Objective	Written Methods with representations (Concrete, Pictorial and Abstract)	Mental recall/jottings

Objective

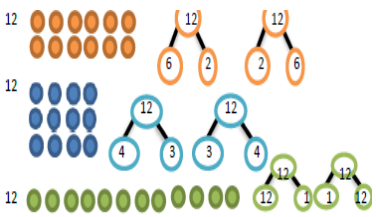
- Recall multiplication and division facts for multiplication tables up to 12 × 12
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- Recognise and use factor pairs and commutativity in mental calculations
- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- 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

Written Methods with representations (Concrete, Pictorial and Abstract)

Objective & Strategy	Concrete	Pictorial	Abstract
Grid method recap from year 3 for 2 digits x 1 digit Move to multiplying 3 digit numbers by 1 digit. (year 4 expectation)	Use place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows  Fill each row with 126  Add up each column making any exchanges needed	Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below. 	Start with multiplying by one digit numbers and showing the clear addition alongside the grid.  210 + 35 = 245
Column multiplication	Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. 321 x 2 = 642  It is important at this stage that they always multiply the ones first. The corresponding long multiplication is modelled alongside	 The grid method my be used to show how this relates to a formal written method.  Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.	 This may lead to a compact method.

Objective & Strategy	Concrete	Pictorial	Abstract
Divide at least 3 digit numbers by 1 digit. Short Division	 Use place value counters to divide using the bus stop method alongside Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.  We exchange this ten for ten ones and then share the ones equally among the groups.  We look how much in 1 group so the answer is 14.	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder.  Finally move into decimal places to divide the total accurately. 

Factor pairs



Short multiplication

342 × 7 becomes

	3	4	2
×			7
2	3	9	4
	2	1	

Answer: 2394

Short division

432 ÷ 5 becomes

		8	6	r 2
			3	
5	4	3	2	

Answer: 86 remainder 2

'If 24 is a multiple of 6 then 6 is a factor of 24'. We can say 6 'goes into' 24 four times'.

Scaling is the process modelled by multiplication in which a given quantity is increased by a scale factor.

Scaling by a factor of less than 1 (halving) reduces the size of the quantity.

Eg: John earns £125 a week- his brother earns three times as much = 125 x3

I purchased 25 tickets at £12 per ticket. = 25 x 12

A box of drinks has 24 cans. Each can costs 45p each. = 24 x 45

NOTES AND GUIDANCE (NON-STATUTORY)

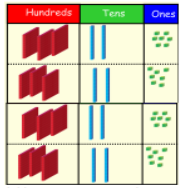
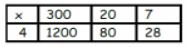
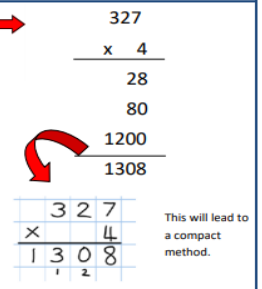
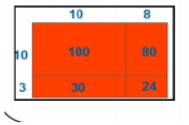
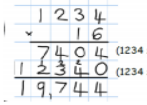
- Pupils continue to practise recalling and using multiplication tables and related division facts to aid fluency.
- Pupils practice mental methods and extend this to three-digit numbers to derive facts (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6)
- Pupils practise to become fluent in the formal written methods of short multiplication, and short division with exact answers.
- Pupils write statements about the equality of expressions (for example, use the distributive law 37 x 9 = 30 x 9 + 7 x 9 and associative law (2 x 3) x 4 = 2 x (3 x 4)). They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations for example 2 x 6 x 5 = 10 x 6)
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the number of choices of a meal on a menu, or three cakes shared equally between 10 children

Year 5

Objectives

- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- Establish whether a number up to 100 is prime and recall prime numbers up to 19
- 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
- Multiply and divide numbers mentally drawing upon known facts
- 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
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- Recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³)

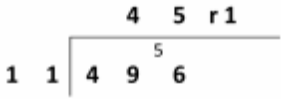
Written Methods with representations (Concrete, Pictorial and Abstract)

Objective & Strategy	Concrete	Pictorial	Abstract
Column Multiplication for 3 and 4 digits x 1 digit.	 It is important at this stage that they always multiply the ones first. Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. 321 x 2 = 642		 This will lead to a compact method.
Column multiplication	Manipulatives may still be used with the corresponding long multiplication modelled alongside.	 Continue to use bar modelling to support problem solving	 18 x 3 on the first row (8 x 3 =24, carrying the 2 for 20, then 1 x 3) 18 x 10 on the 2nd row. Show multiplying by 10 by putting zero in units first 

Objective & Strategy	Concrete	Pictorial	Abstract
Divide at least 3 digit numbers by 1 digit. Short Division	See Year 4	See Year 4	See Year 4

Short division

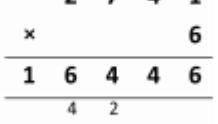
496 ÷ 11 becomes



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

Short multiplication

2741 × 6 becomes

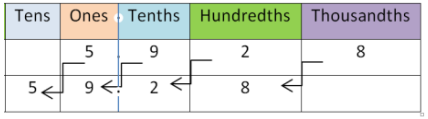


Answer: 16 446

Long Multiplication

Mental and written methods

5.298 x 10 = 59.28

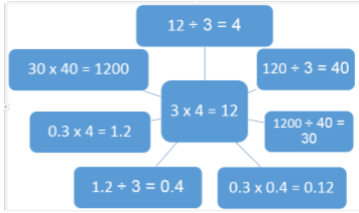


What are the common factors of 8 and 12?

8 = 1 x 8 12 = 1 x 12
8 = 2 x 4 12 = 2 x 6
12 = 3 x 4

The factors of 8 are: 1, 2, 4, and 8
The factors of 12 are: 1, 2, 3, 4, 6, and 12
The common factors of 8 & 12 are 1, 2 and 4.

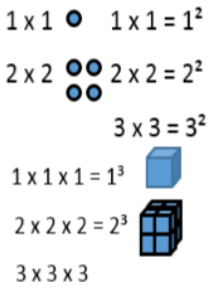
Using known facts



Square and cube numbers

$1^2 = 1 \times 1 = 1$
$2^2 = 2 \times 2 = 4$
$3^2 = 3 \times 3 = 9$
$4^2 = 4 \times 4 = 16$
$5^2 = 5 \times 5 = 25$ etc

$1^3 = 1 \times 1 \times 1 = 1$
$2^3 = 2 \times 2 \times 2 = 8$
$3^3 = 3 \times 3 \times 3 = 27$
$4^3 = 4 \times 4 \times 4 = 64$
$5^3 = 5 \times 5 \times 5 = 125$...etc.



Distributivity can be expressed as:

If: a=12, b=5, c=2

12 (5 + 2) = 12 x 7 = 84

=

(12 x 5) + (12 x 2) = 60 + 24 = 84

$a(b+c) = ab+ac$

• Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes • Solve problems involving multiplication and division, and a combination of these, including understanding the meaning of the equals sign • Solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates		

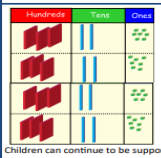
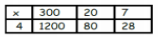
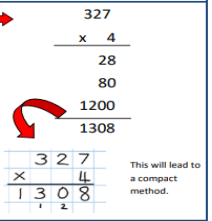
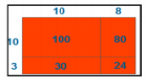
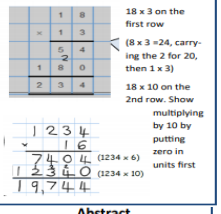
NOTES AND GUIDANCE (NON-STATUTORY)

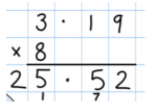
- Pupils practise and extend their use of the formal written methods of short multiplication and short division (see Mathematics Appendix 1). They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations.
- They use and understand the terms factor, multiple and prime, square and cube numbers.
- Pupils interpret non-integer answers to division by expressing results in different ways according to the context, including with remainders, as fractions, as decimals or by rounding (for example, 98 ÷ 4 = 4 98 = 24 r 2 = 24 2 1 = 24.5 ≈ 25).
- Pupils use multiplication and division as inverses to support the introduction of ratio in year 6, 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.
- Distributivity can be expressed as a(b + c) = ab + ac.
- They understand the terms factor, multiple and prime, square and cube numbers and use them to construct equivalence statements (for example, 4 x 35 = 2 x 2 x 35; 3 x 270 = 3 x 3 x 9 x 10 = 92 x 10).
- Pupils use and explain the equals sign to indicate equivalence, including in missing number problems (for example, 13 + 24 = 12 + 25; 33 = 5 x□).

Year 6

Objective

- Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- Perform mental calculations, including with mixed operations and large numbers
- Identify common factors, common multiples and prime numbers
- Use his/her knowledge of the order of operations to carry out calculations involving the four operations

Objective & Strategy	Concrete	Pictorial	Abstract
Column Multiplication for 3 and 4 digits x 1 digit.	 It is important at this stage that they always multiply the ones first. Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. 321 x 2 = 642		 This will lead to a compact method.
Column multiplication	Manipulatives may still be used with the corresponding long multiplication modelled alongside.	 Continue to use bar modelling to support problem solving	 18 x 3 on the first row (8 x 3 =24, carrying the 2 for 20, then 1 x 3) 18 x 10 on the 2nd row. Show multiplying by 10 by putting zero in units first

Objective & Strategy	Concrete	Pictorial	Abstract
Multiplying decimals up to 2 decimal places by a single digit.			Remind children that the single digit belongs in the units column. Line up the decimal points in the question and the answer. 

Objective & Strategy	Concrete	Pictorial	Abstract
Divide at least 3 digit numbers by 1 digit. Short Division	See Year 4	See Year 4	See Year 4

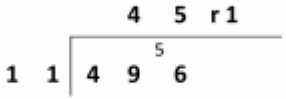
Short multiplication

2741 × 6 becomes

Answer: 16 446

Short division

496 ÷ 11 becomes



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

Mental and written methods

Calculate: 3 x (7 - 3)
In this question, we have a bracket, a subtraction and a multiplication.
BIDMAS tells us that brackets come first, So we calculate:
3 x (7 - 3) = 3 x 4
= 12

Brackets
Order
Division
Multiplication
Addition
Subtraction

• Solve problems involving multiplication and division • Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy	<u>Long Multiplication</u>  **Long division** 432 ÷ 15 becomes 2 8 r 12 1 5 | 4 3 2 3 0 0 1 3 2 1 2 0 1 2 Answer: 28 remainder 12 432 ÷ 15 becomes 2 8 1 5 | 4 3 2 3 0 0 15×20 1 3 2 1 2 0 15×8 1 2 $\frac{12}{15} = \frac{4}{5}$ Answer: $28\frac{4}{5}$ 432 ÷ 15 becomes 2 8·8 1 5 | 4 3 2·0 3 0 1 3 2 1 2 0 1 2 0 1 2 0 0 Answer: 28·8	

Notes and guidance (non-statutory):

- Pupils practise multiplication and division for larger numbers, using formal written methods of short and long multiplication, and short and long division
- They undertake mental calculations with increasingly large numbers and more complex calculations
- Pupils continue to use their multiplication tables to calculate mathematical statements in order to maintain their fluency.
- Pupils explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9
- Common factors can be related to finding equivalent fractions.