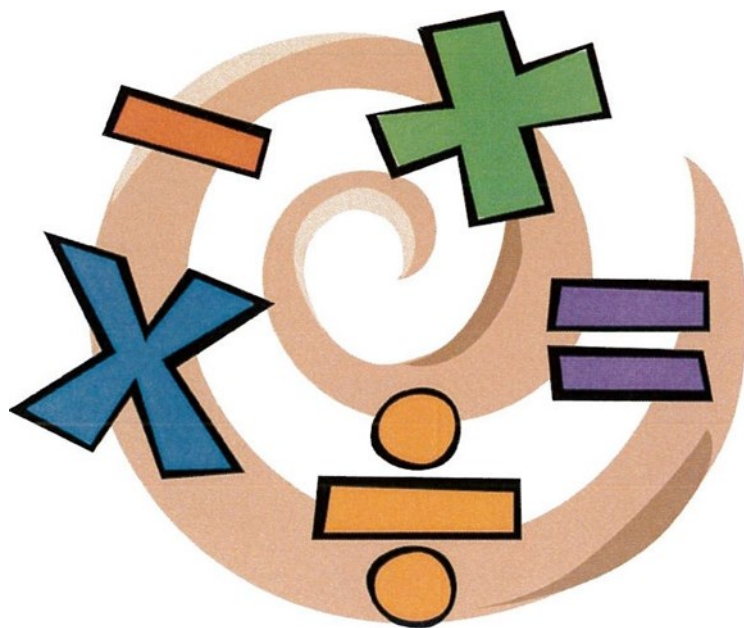




How do we
calculate in
Years 5/6?



How do we calculate?

This document is designed to help you to support your child with their learning in Mathematics lessons.

The four operations for calculation - addition, subtraction, multiplication and division (+ , - , x and ÷) are explained here in the context of how your child will be calculating during the present school year.

If you have any questions or would like further advice please see your child's class teacher or Mrs Dennis (the mathematics coordinator).

Addition +

Year 5

Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, 'carry', expanded, compact, thousands, hundreds, digits, inverse & decimal places, decimal point, tenths, hundredths, thousandths

Key skills for addition at Y5:

- Add numbers mentally with increasingly large numbers, using and practising a range of mental strategies ie. add the nearest multiple of 10, 100, 100 and adjust; use near doubles, inverse, partitioning and re-combining; using number bonds.
- Use rounding to check answers and accuracy.
- Solve multi-step problems in contexts, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000.
- Add numbers with more than 4 digits using formal written method of columnar addition.

Add numbers with more than 4 digits including money, measures and decimals with different numbers of decimal places.

$$\begin{array}{r} \text{£ } 23.59 \\ + \text{£ } 7.55 \\ \hline \text{£ } 31.14 \end{array}$$

The decimal point should be aligned in the same way as the other place value columns, and must be in the same column in the answer.

$$\begin{array}{r} 23481 \\ + 1362 \\ \hline 24843 \end{array}$$

Numbers should exceed 4 digits.

$$\begin{array}{r} 19.01 \\ 3.65 \\ + 0.70 \\ \hline 23.36 \end{array}$$

Pupils should be able to add more than two values, carefully aligning place value columns

Say 6 tenths add 7 tenths to reinforce place value

Empty decimal places can be filled with zero to show the place value in each column.

Children should:

- Understand the place value of **tenths and hundredths** and use this to align numbers with different numbers of decimal places.



Key vocabulary: add, more, plus, and, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, units, partition, plus, addition, column, tens boundary, hundreds boundary, increase, vertical, 'carry', expanded, compact, thousands, hundreds, digits, inverse & decimal places, decimal point, tenths, hundredths, thousandths

Key skills for addition at Y6:

- Perform mental calculations, including with mixed operations and large numbers, using and practising a range of mental strategies.
- Solve multi-step problems in context, deciding which operations and methods to use and why.
- Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit.
- Round any whole number to a required degree of accuracy.
- Pupils understand how to add mentally with larger numbers and calculations of increasing complexity

Add several numbers of increasing complexity

$$\begin{array}{r}
 23.361 \\
 9.080 \\
 59.770 \\
 + 1.300 \\
 \hline
 93.511 \\
 \hline
 212
 \end{array}$$

Adding several numbers with different numbers of decimal places (including money and measures)

- Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row.
- Zeros could be added into any empty decimal places, to show there is no value to add.

Empty decimal places can be filled with zero to show the place value in each column.

$$\begin{array}{r}
 81,059 \\
 3,668 \\
 15,301 \\
 + 20,551 \\
 \hline
 120,579 \\
 \hline
 1111
 \end{array}$$

Adding several numbers with more than 4 digits.



Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is _? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal

Key skills for subtraction at Y5:

- Subtract numbers mentally with increasingly large numbers .
- Use rounding and estimation to check answers to calculations and determine, in a range of contexts, levels of accuracy .
- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers to at least 1 million and determine the value of each digit.
- Count forwards or backwards in steps of powers of 10 for any given number up to 1 million.
- Interpret negative numbers in context, counting forwards and backwards with positive and negative integers through 0.
- Round any number up to 1 million to the nearest 10, 100, 1000, 10 000 and 100 000.

Video Clip: [Moving to the compact column method of subtraction](#) (youtube)

Subtract with at least 4-digit numbers including money, measures and decimals.

Compact Column Subtraction (with 'exchanging')

	2	8	1	0	5	6
-		2	1	2	8	
	2	8	9	2	8	

Children who are still not secure with number facts and place value will need to remain on the partitioned column method until ready for the compact method.

Subtracting with larger integers

	6	7	2	8	5	0
-		3	7	2	5	
	6	7	9	6	5	

Subtract with decimal values, including mixtures of integers and decimals, aligning the decimal point.

See 'moving to the compact method' video

Create lots of opportunities for subtracting and finding differences with money and measures

Add a 'zero' to any empty decimal places to aid understanding of what to subtract in that column.



Key vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer / less than, most, least, count back, how many left, how much less is_? difference, count on, strategy, partition, tens, units exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point, decimal

.Key skills for subtraction at Y6:

- Solve addition and subtraction multi-step problems in context, deciding which operations and methods to use and why.
- Read, write, order and compare numbers up to 10 million and determine the value of each digit
- Round any whole number to a required degree of accuracy
- Use negative numbers in context, and calculate intervals across zero.
- Children need to utilise and consider a range of mental subtraction strategies, jottings and written methods before choosing how to calculate.

See previous videos for introducing the compact column method.

Subtracting with increasingly large and more complex numbers and decimal values.

$$\begin{array}{r} \cancel{9}^{\text{th}} \cancel{5}^{\text{th}} \cancel{10}^{\text{th}}, 699 \\ - \quad 89,949 \\ \hline 60,750 \end{array}$$

Using the compact column method to subtract more complex integers

$$\begin{array}{r} \cancel{9}^{\text{th}} \cancel{10}^{\text{th}} 5 \cdot \cancel{4}^{\text{th}} 19 \text{ kg} \\ - \quad 36 \cdot 08 \text{ kg} \\ \hline 69 \cdot 339 \text{ kg} \end{array}$$

Using the compact column method to subtract money and measures, including decimals with different numbers of decimal places.

Empty decimal places can be filled with **zero** to show place value in each column.

Pupils should be able to apply their knowledge of a range of mental strategies, mental recall skills, and informal and formal written methods when selecting **the most appropriate method** to work out subtraction problems.



Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times, as big as, once, twice, three times ..., partition, grid method, multiple, product, tens, units, value, inverse, square, factor, integer, decimal, short/long multiplication, 'carry'

Key skills for multiplication at Y5:

- Identify multiples and factors, using knowledge of multiplication tables to 12x12.
- Solve problems where larger numbers are decomposed into their factors
- Multiply and divide integers and decimals by 10,
- 100 and 1000
- Recognise and use square and cube numbers and their notation
- Solve problems involving combinations of operations, choosing and using calculations and methods appropriately

Video clips:

[Moving from grid method to a compact method](#)

[Reinforcing rapid times table recall:](#)

[Demonstration of long multiplication](#)

Multiply up to 4-digits by 1 or 2-digits

Introduce column multiplication

- Introduce by comparing a grid method calculation to a short multiplication method, to see how the steps are related, but notice how there are less steps involved in the column method (see video).
- Children need to be taught to approximate first, e.g. for 72×38 , they will use rounding: 72×38 is approximately $70 \times 40 = 2800$, and use the approximation to check the reasonableness of their answer against.

Short multiplication for multiplying by a single digit

x	300	20	7
4	1200	80	28

Pupils could be asked to work out a given calculation using the grid, and then compare it to your" column method. What are the similarities and differences? Unpick the steps and show how it reduces the steps.

Introduce long multiplication for multiplying by 2 digits

x	10	8
10	100	80
3	30	24

		1	8
	×	1	3
		5	4
	1	8	0
	2	3	4

18 x 3 on the 1st row ($8 \times 3 = 24$, carrying the 2 for twenty, then 1×3)
18x10 on the 2nd row. Put a zero in units first, then say 8×1 and 1×1

This grid could be used to introduce long multiplication, as the relationship can be seen in the answers in each row.

Moving towards more complex numbers

	1	2	3	4	
x			1	6	
	7	4	0	4	(1234 x 6)
1	2	3	4	0	(1234 x 10)
	1	9	7	4	4

	3	6	5	2	
x				8	
	<hr/>				
2	9	2	1	6	
	5	4	1		
	<hr/>				



Key vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, column, row, commutative, sets of, equal groups, times, as big as, once, twice, three times ..., partition, grid method, multiple, product, tens, units, value, inverse, square, factor, integer, decimal, short/long multiplication, 'carry', tenths, hundredths, decimal

Key skills for multiplication at Y6:

- Recall multiplication facts for all times tables up to 12×12 (as Y4 and Y5).
- Multiply multi-digit numbers, up to 4-digit \times 2-digit using long multiplication.
- Perform mental calculations with mixed operations and large numbers.
- Solve multi-step problems in a range of contexts, choosing appropriate combinations of operations and methods.
- Estimate answers using round and approximation and determine levels of accuracy.
- Round any integer to a required degree of accuracy.

Video clips:

[Moving from grid method to a compact method](#) (youtube)

[Reinforcing rapid times table recall](#): (youtube)

[Demonstration of long multiplication](#) (SLEP)

Short and long multiplication as in Y5

Long and short multiplication

$$\begin{array}{r} 1234 \\ \times 16 \\ \hline 7404 \\ 12340 \\ \hline 19744 \end{array} \quad \begin{array}{l} (1234 \times 6) \\ (1234 \times 10) \end{array}$$

$$\begin{array}{r} 3652 \\ \times 8 \\ \hline 29216 \\ 541 \end{array}$$

Multiply decimals with up to 2 decimal points by a single digit.

Remind children that the single digit belongs in the units column

$$\begin{array}{r} 3.19 \\ \times 8 \\ \hline 25.52 \\ 1 \quad 7 \end{array}$$

Line up the decimal points in the question and the answer

This works well for multiplying money (£, p) and other measures.

Children will be able to:

- Use rounding and place value to make approximations before calculating and use these to check answers against.
- Use short multiplication (see Y5) to multiply numbers with **more than 4-digits by a single digit**; to multiply money and measures, and to **multiply decimals with up to 2d.p. by a single digit**.
- Use long multiplication (see Y5) to multiply numbers with **at least 4 digits by a 2-digit number**.



Key vocabulary: share, share equally, one each, two each..., group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime)

Key number skills needed for division at Y5:

- Recall multiplication and division facts for all numbers up to 12×12 (as in Y4).
- Multiply and divide numbers mentally, drawing upon known facts.
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.
- Solve problems involving multiplication and division where larger numbers are decomposed into their factors.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000.
- Use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Work out whether a number up to 100 is prime, and recall prime numbers to 19.
- 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.
- Use multiplication and division as inverses.
- 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 (e.g. $98 \div 4 = 24 \text{ r } 2 = 24\frac{1}{2} = 24.5 \approx 25$).
- Solve problems involving combinations of all four operations, including understanding

Divide up to 4 digits by a single digit, including those **with remainders**.

Short division, including remainder answers

$$\begin{array}{r} 663 \text{ r } 5 \\ 8 \overline{) 5309} \end{array}$$

Short division with remainders: Now that pupils are introduced to examples that give rise to remainder answers, division needs to have a real life problem solving context, where **pupils consider the meaning of the remainder and how to express it**, e.g. as a fraction, a decimal, or as a rounded number or value, depending upon the context of the problem.

The answer to $5309 \div 8$ could be expressed as **663 and five eights, $663 \text{ r } 5$** , as a decimal **or rounded** as appropriate to the problem involved.

Include **money and measure** contexts

See Y6 for how to continue the short division to give a **decimal answer** for children who are confident.

If children are confident and accurate:

- Introduce **long division** for pupils who are ready to divide any number by a 2-digit number (e.g. $2678 \div 19$). This is a Year 6 expectation - see Y6



Key vocabulary: share, share equally, one each, two each..., group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime), common factor

Key number skills needed for division at Y6:

- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- 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. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.

Divide at least 4 digits by both single digit and 2 digit numbers (including decimal numbers and quantities)

Short division, for dividing by a single digit: e.g. $6497 \div 8$

Short division with remainders: Pupils should continue to use this method, but with numbers to at least 4 digits, and

$$\begin{array}{r} 0812.125 \\ 8 \overline{) 6497.000} \end{array}$$

understand how to express remainders as fractions, decimals, whole number remainders, or rounded numbers. Real life problem solving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder.

Calculating a decimal remainder: In this example, rather than expressing the remainder as r 1, a decimal point is added after the

units because there is still a remainder, and the one remainder is carried onto zeros after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved.

Introduce **long division by chunking** for dividing by 2 digits.

- Find out „How many 36s are in 972?“ by subtracting 'chunks' of 36, until zero is reached (or until there is a remainder).

$$\begin{array}{r} 27 \\ 36 \overline{) 972} \\ \underline{- 720} \quad (20 \times 36) \\ 252 \\ \underline{- 180} \quad (5 \times 36) \\ 72 \\ \underline{- 72} \quad (2 \times 36) \\ 0 \end{array}$$

- Teach pupils to write a 'useful list' first at the side that will help them decide what chunks to use, e.g.:

Useful list: $1 \times = 36$

$10 \times = 360$

$100 \times = 3600$

- Introduce the method in a simple way by limiting the choice of chunks to „Can we use 10 lots? Can use 100 lots? As children become confident with the process, encourage more efficient chunks to get to the answer more quickly (e.g. 20x, 5x), and expand on their 'useful' lists.

Where remainders occur, pupils should express them as fractions, decimals or use rounding, depending on the problem.

Must be aligned in place value for subtracting

Continued on next page

Division



Year 6

Key vocabulary: share, share equally, one each, two each..., group, groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse, short division, 'carry', remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime), common factor

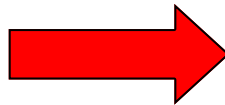
Key number skills needed for division at Y6:

- Recall and use multiplication and division facts for all numbers to 12 x 12 for more complex calculations
- 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. Use short division where appropriate.
- Perform mental calculations, including with mixed operations and large numbers.
- Identify common factors, common multiples and prime numbers.
- Solve problems involving all 4 operations.
- Use estimation to check answers to calculations and determine accuracy, in the context of a problem.
- Use written division methods in cases where the answer has up to two decimal places.
- Solve problems which require answers to be rounded to specified degrees of accuracy.

Long division by chunking

$$\begin{array}{r}
 27 \\
 36 \overline{) 972} \\
 \underline{- 720} \quad (20 \times 36) \\
 252 \\
 \underline{- 252} \quad (8 \times 36) \\
 0
 \end{array}$$

↓
27



$$\begin{array}{r}
 27 \\
 36 \overline{) 972} \\
 \underline{- 720} \\
 252 \\
 \underline{- 252} \\
 0
 \end{array}$$

Introduce long division with remainders.

432 ÷ 15 becomes

$$\begin{array}{r}
 28 \text{ r } 12 \\
 15 \overline{) 432} \\
 \underline{300} \\
 132 \\
 \underline{120} \\
 12
 \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r}
 28 \\
 15 \overline{) 432} \\
 \underline{300} \quad 15 \times 20 \\
 132 \\
 \underline{120} \quad 15 \times 8 \\
 12
 \end{array}$$

$$\frac{12}{15} = \frac{4}{5}$$

Answer: $28 \frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r}
 28.8 \\
 15 \overline{) 432.0} \\
 \underline{300} \\
 132 \\
 \underline{120} \\
 120 \\
 \underline{120} \\
 0
 \end{array}$$

Answer: 28.8