

Maths Calculation Policy

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Maths Calculation Policy

We aim for all children to be:

- able to recall quickly and accurately basic number facts (e.g. number bonds, multiplication and division facts)
- fluent in applying quick, efficient mental and written methods of calculation.

Teachers are confident and skilled to teach mental and written calculation methods. The progression of methods mean that the pupils have a secure understanding of mental and written methods of calculation suitable for their stage of learning. This enables the pupils to choose appropriate calculation methods depending on the numbers. Pupils feel confident to recall, understand and make connections by using facts suitable for their stage of learning.

Appendix 1 - Age Related Expectations

Mental and Written Methods (Addition and Subtraction) Mental and Written Methods (Multiplication and Division) Mental and Written Methods (Number Facts)

Year					
1	2	3	4	5	6
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 $7 = \square - 9$	<i>Add and subtract two two-digit numbers using concrete objects, pictorial representations progressing to formal written methods</i> 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	Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction Add and subtract numbers mentally, including: * a three-digit number and ones * a three-digit number and tens a three-digit number and hundreds	Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition where appropriate signs Solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why	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	Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why Perform mental calculations, including with mixed operations and large numbers

Year					
1	2	3	4	5	6
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	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	Write and calculate mathematical statements for $\div$ using the x tables they know 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 methods 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	Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context Multiply and divide numbers mentally drawing upon known facts Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	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 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 Perform mental calculations, including with mixed operations and large numbers

Year					
1	2	3	4	5	6
Represent & use number bonds and related subtraction facts within 20 Add and subtract one-digit and two-digit numbers to 20, including zero	Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 Recall and use x and $\div$ facts for the 2, 5 and 10 x tables, including recognising odd and even numbers.	Recall and use x and $\div$ facts for the 3, 4 and 8 times tables.	Recall x and $\div$ facts for x tables up to 12 x 12.	Recall prime numbers up to 19 Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers Recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)	Recall x and $\div$ facts for x tables up to 12 x 12 and use to find other related facts

How shall I add?

- 4 + 1, 6 + 3, 10 + 4**
Number facts
Single digit numbers
Doubles
Ten and single digits
I just knew it!
- 3 + 7**
Use known addition facts
If I know 3 + 7 = 10 then I know 3 + 8 = 11 because it is 1 more
- 7 + 8**
Use near doubles
If I know 7 + 7 = 14 then I know 7 + 8 = 15 because it is 1 more
- 7 = 3 + 4**
Secure addition bonds of single digits and ten
- 12 + 4**
Counting on in 1s
- 24 + 1**
Find one more
Notice the relationships
- 1 more than 4 is 5**
1 more than 14 is 15
1 more than 24 is 25
- 37 + 10**
Add ten
- 7 + 4**
Count all

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How shall I subtract?

- 5 - 1, 7 - 3, 10 - 6**
Number facts
Single digit numbers
Teens subtract single digits
I just knew it!
- 3 + 7**
Use known addition facts to derive subtraction facts
If I know 3 + 7 = 10 then I know 10 - 3 = 7
- q - 7**
Find the difference between two numbers
*q is 2 more than 7
7 is 2 less than q so the difference between 7 and q is 2*
- q - 3**
Take away
- 23 - 1**
Find one less
Notice the relationships
- 1 less than 4 is 3**
1 less than 14 is 13
1 less than 24 is 23
- 16 - 4**
Counting back in 1s
- 37 - 10**
Take away ten

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How shall I multiply?

- Equal groups**
3 people each have 4 cats. How many cats are there in total?
There are 3 groups with 4 cats in each group
- Count in ones**
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
- Repeated addition**
 $4 + 4 + 4 = 12$
- Arrays**

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How shall I divide?

- Sharing**
12 shared into 3 equal groups
There are 12 cats. Three people each have the same number of cats. How many do they have each?
1 for you, 1 for you, 1 for you...
- Grouping**
How many groups of 3 are there in 12?
There are 12 cats. Each person owns 3 cats. How many people are there?
Grab a group of 3, grab a group of 3...
- $12 \div 3 = 4$
- 12 can be described as 3 columns of 4 or 4 rows of three**

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3

How shall I add?

Number facts
 $8 + 7, 9 + 9, 14 + 3$
 Number facts
 Single digit numbers
 Doubles
 Tens to make 100
I just knew it!

Use known facts
 $243 + 7$
 $300 + 700$
If I know $3 + 7 = 10$ then I know $243 + 7$ makes the next multiple of 10.
If I know $3 + 7 = 10$ then I know $3 \text{ hundreds} + 7 \text{ hundreds} = 10 \text{ hundreds}$

Add multiples of ten and hundred
 $325 + 200$
If I know $3 + 2 = 5$ then I know $3 \text{ hundreds} + 2 \text{ hundreds} = 5 \text{ hundreds}$

Formal written method
 $262 + 152$

$$\begin{array}{r} 262 \\ + 152 \\ \hline 414 \\ \hline 1 \end{array}$$

Partition and recombine
 $250 + 360$

$$200 + 50 + 300 + 60$$

$$500 + 110 = 610$$

Round then adjust
 $237 + 199$
 Add 200 then subtract 1

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3

How shall I subtract?

15 - 8, 18 - 5
Number facts
Single digit numbers
Teens and single digits
I just knew it!

240 - 7
Use known facts
1000 - 700
If I know $10 - 7 = 3$ then I know 10 hundreds - 7 hundreds = 3 hundreds

525 - 300
Take away multiples of ten and a hundred
If I know $5 - 3 = 2$ then I know 5 hundreds - 3 hundreds = 2 hundreds

230 - 80
Bridging boundaries by counting back in efficient steps
 $230 - 30 - 50 = 150$

234 - 152
Formal written method
$$\begin{array}{r} 234 \\ - 152 \\ \hline 182 \end{array}$$

 $234 = 100 + 130 + 4$

435 - 199
Round then adjust
Take away 200 then add 1

335 - 326
Find the difference between two numbers
335 is 9 more than 326
326 is 9 less than 335
so the difference between them is 9

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3

Rapid recall of
2x, 5x, 10x (year 2)
3x, 4x, 8x (year 3)
multiplication tables

Multiply by 10

100s	10s	1s
		■ ■
	■■	
■■■		

2
↓ x10
20
↓ x10
200

6 × 4
Use known facts
and place value

$$\begin{aligned} 6 \times 4 &= 24 \\ 60 \times 4 &= 240 \\ 6 \times 40 &= 240 \end{aligned}$$

~~6 × 10 × 4~~
 $= 24 \times 10$

8 × 3
Repeated addition

$$8 + 8 + 8 = 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3$$

How shall I multiply?

17 × 4
Partition and recombine

$$\begin{aligned} 10 \times 4 + 7 \times 4 \\ 40 + 28 = 68 \end{aligned}$$

15 × 16
Double and halve

$$\begin{aligned} 15 \times 16 &= 15 \times 2 \times 8 \div 2 \\ &= 30 \times 8 \\ &= 10 \times 3 \times 8 \\ &= 10 \times 24 \\ &= 240 \end{aligned}$$

8 × 3
Arrays

If I know 3 × 8
then I know 8 × 3

Scaling

The red tower is
3 times taller
than the grey tower

Formal written method

	10	7
4	40	28

$\begin{array}{r} 17 \\ \times 4 \\ \hline 68 \\ \hline \end{array}$

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3

How shall I divide?

Known facts:
Use 2x, 5x, 10x (year 2)
3x, 4x, 8x (year 3)
multiplication tables to derive division facts

240 ÷ 4
Use known facts and place value

$240 \div 4 = 60$
 $240 \div 40 = 6$
 $240 \div 4 = 60$

240 is ten times greater than 24

24 biscuits shared between 4 people means they will get 6 biscuits each.
If there are 10 times as many people and 10 times as many biscuits, how many biscuits each now?

240 ÷ 40 = 6
How many steps of 40 make 240?

How many 40s are there in 240?

Repeated addition

How many 40s are there in 240?

0 40 80 120 160 200 240

200 ÷ 10
Divide by 10

200 ÷ 10 = 20 so 20 is ten times smaller than 200

A tenth of 100s is 10s
A tenth of 10s is 1s
A tenth of 1s is 1 tenth so $1 \div 10 = \frac{1}{10}$

45 ÷ 3
Sharing equally

Ten for you, ten for you, ten for you.

52 ÷ 4
Partition and recombine

ten lots and the rest

$52 \div 4 = 13$
 $40 \div 4 = 10$
 $12 \div 4 = 3$
 $10 + 3 = 13$

42 ÷ 6
Double and halve

If there are half as many biscuits and half as many people...

$42 \div 6 = 21 \div 3$

Link to fractions

10 x 4
3 x 4

0 40 52

5

0.8 + 0.7, 4.5 + 4.5
Number facts
Single digit decimals
Doubles
Bonds of 1 and 100

I just knew it!

Rapid fluency of 2 digit add 2 digit numbers

7 + 8
Use known facts

If I know $7 + 8 = 15$
then I know
 $0.7 + 0.8 = 1.5$

$7,000 + 8,000 = 15,000$
 $70,000 + 80,000 = 150,000$
 $700,000 + 800,000 = 1,500,000$

12,403 + 3,020
Use place value to add

If I know $2 + 3 = 5$
then I know
 $2000 + 3000 = 5000$

I have noticed,
one number has no
hundreds or ones, the
other has no tens.

0.016 + 0.007
Bridge through boundaries
by counting in efficient steps

0 0.016 0.020 0.023

25,748 + 46,374
Formal written method

Exchange ten of these for one of those!

$$\begin{array}{r} 25,748 \\ + 46,374 \\ \hline 72,122 \\ 1\ 1\ 1\ 1 \end{array}$$

Regroup and rename

35,040 + 22,070
Partition and recombine

$30,000 + 5,000 + 40 + 20,000 + 2,000 + 70$
 $50,000 + 7,000 + 110 = 57,110$

32,356 + 19,998
Round then adjust

Add 20,000 then subtract 2

0 32,356 52,354 52,356

How shall I add?

5

How shall I subtract?

Top Left: Number facts

- $9 - 4, 13 - 5, 18 - 9$
- Number facts
- Single digit decimals
- Halves
- Subtract from 1 and 100
- I just knew it!
- Rapid fluency of 2 digit subtract 2 digit numbers

Top Middle: Use known facts

- $15 - 8 = 7$
- Use known facts
- If I know $15 - 8 = 7$ then I know $15 - 0.8 = 0.7$
- $15,000 - 8,000 = 7,000$
- $150,000 - 80,000 = 70,000$
- $1,500,000 - 800,000 = 700,000$

Top Right: Use place value to subtract

- $40,012 - 3,005$
- Use place value to subtract
- 5 less than 12 is 7. Now it is easy to take away 3000
- If I know $40 - 3 = 37$ then I know that 40 thousand take away 3 thousand is 37 thousand
- $40,000 = 4$ tens of thousands or 40 thousands
- $12 = 1$ ten and 2 ones or 12 ones
- $40,012 = 40$ thousands and 12 ones
- take away 3 thousands and 5 ones
- equals 37 thousands and 7 ones.

Middle Left: Bridge through boundaries

- $0.54 - 0.17$
- Bridge through boundaries by counting in efficient steps
- $0.16 \quad 0.40 \quad 0.44 \quad 0.54$
- Arrows showing steps: $0.16 \rightarrow 0.40$ (+0.03), $0.40 \rightarrow 0.44$ (+0.04), $0.44 \rightarrow 0.54$ (+0.1)

Middle Right: Base 10 blocks

- Diagram showing base 10 blocks for $40,012 - 3,005$
- 40 thousands (4 rods), 12 ones (1 ten rod, 2 one units)
- 3 thousands (3 rods), 5 ones (5 one units)
- Result: 37 thousands (3 rods), 7 ones (7 one units)

Bottom Left: Formal written method

- $45,748 - 26,374$
- Formal written method
- Exchange ten of these for one of those!
- 3 | 6 | 1
- $\begin{array}{r} 45,748 \\ - 26,374 \\ \hline 19,374 \end{array}$
- Regroup and rename

Bottom Middle: Find the difference between two numbers

- $20,045 - 19,989$
- Find the difference between two numbers
- $+11 \quad +45$
- $19,989 \quad 20,000 \quad 20,045$
- 20,045
- 19,989
- 56

Bottom Right: Round then adjust

- $43,453 - 19,998$
- Round then adjust
- 10,000s | 1000s | 100s | 10s | 1s
- 43,453: 4 ten rods, 3 hundred rods, 4 ten rods, 5 one rods, 3 one units
- 19,998: 1 ten rod, 9 hundred rods, 9 ten rods, 9 one rods, 8 one units
- Take away 20,000 then add 2
- $0 \quad 23,453 \quad 23,455 \quad 43,453$
- Arrows showing steps: $23,453 \rightarrow 23,455$ (+2), $23,455 \rightarrow 43,453$ (+20,000)

5

Known facts:
Rapid recall of all multiplication tables up to 12×12

234×1000
Multiply by 10, 100, 1000

1000s	100s	10s	1s	$\frac{1}{10}$ s	$\frac{1}{100}$ s
			● ●	● ● ● ●	● ● ● ●
		● ● ● ●	● ● ● ●	● ● ● ●	
● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●		

$234 \times 10 = 2340$
 $234 \times 100 = 23400$
 $234 \times 1000 = 234000$

6×4
Use known facts and place value

$6 \times 4 = 24$
 $60 \times 4 = 240$
 $60 \times 40 = 2400$

$6 \times 10 \times 4 \times 10 = 24 \times 100 = 2400$

40 is ten times greater than 4

$0.6 \times 4 = 2.4$
4 jumps of 0.6

$0.6 \times 0.4 = 24$ hundredths
 $0.6 \times 0.4 = 0.24$

How shall I multiply?

15×42
Using factors and distributive law

$15 \times 48 = 15 \times 6 \times 8 = 90 \times 8 = 720$

$15 \times 14 = 15 \times 6 + 15 \times 8 = 90 + 120 = 210$

427×38
Formal written method

423 x 4
Partition and recombine

423×4

400	20	3
x4	x4	x4
1600	80	12

$1600 + 80 + 12 = 1692$

427 x 38
Formal written method

	400	20	7
30	12,000	600	210
8	3,200	160	56

427×38
 $\underline{3416}$
 $\underline{12810}$
 16226

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5

Known facts:
Use recall of all multiplication tables up to 12 x 12 to derive division facts

Include calculations where remainders occur

$24 \div 4$
Use known facts and place value

$$\begin{aligned} 24 \div 4 &= 6 \\ 240 \div 40 &= 6 \\ 2400 \div 400 &= 6 \\ 24,000 \div 4000 &= 6 \end{aligned}$$

$$\begin{aligned} 24,000 \div 400 &= \frac{24 \times 1000}{4 \times 100} \\ \frac{240}{4} &= 60 \end{aligned}$$

24,000 is a thousand times greater than 24

24 biscuits shared between 4 people means they will get 6 biscuits each.
If there are 1000 times as many people and 1000 times as many biscuits, how many biscuits each now?

$24 \div 0.6$
Use known facts and place value

0.6 is ten times smaller than 6

$24 \div 0.6 = 4$
How many steps of 0.6 make 2.4?

$24 \div 1000$
Divide by 10, 100, 1000

$$\begin{aligned} 24 &\downarrow \div 10 \\ 2.4 &\downarrow \div 10 \\ 0.24 &\downarrow \div 10 \\ 0.024 & \end{aligned}$$

How shall I divide?

$5724 \div 4$
Formal written method

$$\begin{array}{r} 14 \\ 4 \overline{) 5724} \end{array}$$

$1512 \div 24$
Using factors

$$1512 \div 6 \div 4$$

$$\begin{array}{r} 1431 \\ 4 \overline{) 5724} \end{array}$$

$496 \div 8$
Partition and recombine

$$\begin{aligned} 496 &\div 8 \\ 480 &\div 8 = 60 \\ 16 &\div 8 = 2 \\ 60 + 2 &= 62 \end{aligned}$$

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Compact vertical

$$23454 + 596$$

$$\begin{array}{r} 23454 \\ + \quad 596 \\ \hline 24050 \\ \text{1 1 1} \end{array}$$

$$23.7 + 48.56$$

$$\begin{array}{r} 23.70 \\ + 48.56 \\ \hline 72.26 \\ \text{1 1} \end{array}$$



Decomposition

$$2748 - 364$$

$$\begin{array}{r} \overset{6}{2}\overset{1}{7}48 \\ - \quad 364 \\ \hline 2384 \end{array}$$

$$72.5 - 45.73$$

$$\begin{array}{r} \overset{6}{7}\overset{1}{2}\overset{1}{5}0 \\ - \quad 45.73 \\ \hline 26.77 \end{array}$$

Written Methods



Long multiplication

$$5172 \times 38$$

$$\begin{array}{r} 5172 \\ \times 38 \\ \hline 41376 \\ + 155160 \\ \hline 196536 \\ \text{1} \end{array}$$



Short Division

$$559 \div 13$$

$$\begin{array}{r} \overset{0}{4}\overset{3}{} \\ 13 \overline{) 559} \\ \underline{55} \\ 9 \end{array}$$

$$562 \div 13$$

$$\begin{array}{r} \overset{0}{4}\overset{3}{}.\overset{2}{2}\overset{3}{} \\ 13 \overline{) 562.30} \\ \underline{55} \\ 12 \\ \underline{13} \\ 0 \end{array}$$

$$\begin{aligned} 562 \div 13 \\ = 43 \text{ r } 2 = 43 \frac{2}{13} \\ = 43.2 \text{ (to 1 dp)} \end{aligned}$$

Using known multiplication facts	1	13
	2	26
	4	52
	5	65
	8	104
	10	130