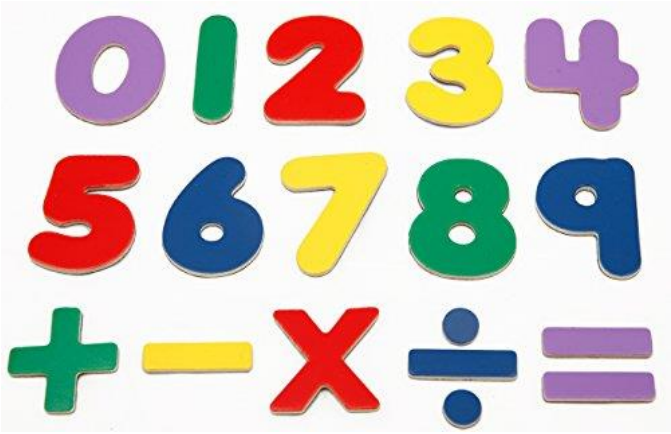
Mental Calculation Strategies for Y1-Y6



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(With thanks to Judith Lambert,
Ivydale Primary School)

October 2017

INTRODUCTION

This **mental calculation strategies** policy has been written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014).

It provides guidance on effective mental strategies for calculation and gives year-by-year expectations of a range of calculations that children should be able to do mentally (including with jottings/informal recording).

The content is set out under the following headings: addition & subtraction strategies; multiplication and division strategies.

This guidance has been aligned with the Southwark Medium Term Plans (revised 2016).

Our aim is that children will use mental methods (including with the use of jottings/informal recording) as their first port of call, when appropriate.
However, for calculations that they cannot do mentally, they will need to use an efficient written method accurately and with confidence (see **written calculation policy** – updated April 2017).

Underpinning skills and knowledge needed to calculate mentally

- The ability to count in a variety of ways, both forwards and backwards
- A secure sense of the number system
- An understanding of place value
- Recall of number bonds
- Recall of multiplication and division facts
- An understanding of mathematical vocabulary and signs associated with calculation

Principles of teaching mental calculation

- Ensure the underpinning skills and knowledge are secure
- Commit regular time to teaching mental calculation strategies
- Select and use appropriate resources, models and images
- Encourage the use of jottings/ informal recording
- Teach a range of mental strategies
- Develop quick and efficient strategies, choosing the most appropriate method for the calculation
- Give children the opportunity to explain, share and reason about methods

Diane Andrews, maths consultant (diane@countonmeconsultancy.co.uk), October 2017

With thanks to Judith Lambert, Ivydale Primary School, for her contributions

Underpinning skills and knowledge: end of year expectations	
Y1	• Count to and across 100, forwards and backwards, in ones, beginning with 0 or 1 or from any given number • Given a number, identify one more/one less • Recognise place value in teen numbers using practical apparatus and begin to recognise place value in other two-digit numbers • Read, write and interpret mathematical statements involving addition and subtraction, including the signs +, -, =, and understand the associated vocabulary • Recognise the relationship between addition and subtraction • Recall addition/subtraction facts to 10 and within 10 • Derive number bonds to 20 and within 20 • Count in multiples of twos, fives and tens (to the 10th multiple) • Understand and use the vocabulary (but not the signs) associated with multiplication and division in practical contexts • Recall doubles up to double ten (10 + 10) and find the corresponding halves
Y2	• Count to at least 100 in ones and in tens from 0 or any number, forwards and backwards • Given a number, identify 10 more/10 less • Recognise the place value of each digit in a two-digit number • Use the vocabulary associated with addition and subtraction • Recall addition/subtraction facts to 20 • Derive addition/subtraction facts of multiples of 10 to 100 e.g. 60 + 40 = 100 • Know that addition of two numbers can be done in any order (commutative) but that subtraction of one number from another cannot • Recognise and use the inverse relationship between addition and subtraction • Use estimation to check that an answer to a calculation is reasonable • Count in multiples of 2, **3**, 5 from 0, forwards and backwards (to the 12th multiple) • Recall multiplication/division facts for the 2, 5 and 10 times table to the 12th multiple • Read, write and interpret mathematical statements involving multiplication and division, including the signs x, ÷ and =, and understand and use the associated vocabulary • Know that multiplication of two numbers can be done in any order (commutative) but that division of one number by another cannot • Recall the doubles of multiples of 10 to 100 (e.g. double 40 is 80) and recall the related halves (e.g. half of 80 is 40)
Y3	• Given a number, identify 10 or 100 more/less • Recognise the place value of each digit in a three-digit number • Recall addition and subtraction facts for multiples of 10 to 100 • Derive addition and subtraction facts for multiples of five to 100 • Derive addition and subtraction facts for multiples of 100 to 1000 • Recognise the inverse relationship between addition and subtraction • Estimate the answer to a calculation and use inverse operations to check • Count in multiples of 2, 3, **4**, 5, **8**,10, **50** and **100** from 0, forwards and backwards (to the 12th multiple) • Recall multiplication/division facts for the 2, **3**, **4**, 5, **8** and 10 times tables • Understand the effect of multiplying/dividing numbers by 10 • Understand the commutative properties of addition and of multiplication • Recognise and use the inverse relationship between multiplication and division • Derive doubles of all two-digit numbers (e.g. double 42 is 84) and the corresponding halves (half of 84 is 42)

Y4	• Given a number, identify 10, 100 or 1000 more/less • Recognise the value of each digit in a four-digit number • Round any number to the nearest 10, 100 or 1,000 • Recognise the place value of each digit in a decimal number with up to two decimal places • Round decimal numbers with one decimal places to the nearest whole number • Find pairs of decimal numbers that total one (e.g.0.4 and 0.6) • Derive addition and subtraction facts for pairs of numbers that total 100 • Know addition/subtraction facts for multiples of 100 that total 1,000 • Derive addition and subtraction facts for multiples of 50 to 1,000 and multiples of 10 to 1,000 • Count in multiples of 2, 3, 4, 5, **6**, **7**,8, **9**,10, **11, 12**, **25**, 50, 100 and 1000 from 0, forwards and backwards (to the 12th multiple) • Recall multiplication and division facts for multiplication tables up to 12 x 12 • Understand the effect of multiplying by 0 or 1 and dividing by 1 • Recognise and identify factor pairs • Understand the effect of multiplying/dividing numbers by 10/100, including decimal numbers • Recall doubles of two-digit numbers and derive doubles of three-digit numbers and find the corresponding halves • Estimate the answer to a calculation, including the use of rounding, and use inverse operations to check
Y5	• Given a number identify 10/ 100/ 1,000/ 10,000 more or less • Recognise the place value of each digit in a six-digit whole number • Round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000 • Recognise the place value of each digit in a decimal number with up to three decimal places • Round decimal numbers with two decimal places to the nearest whole number or to one decimal place • Derive complements of 1 e.g. 0.83 and 0.17 = 1 • Count in multiples of 3, 4, 6, 7, 8, 9, 11,12, 25, 50,100 and 1,000 forwards and backwards • Consolidate multiplication and division facts for multiplication tables up to 12 x 12 • Find **all** factor pairs of a given number; find **all** common factors for a pair of numbers; identify multiples • Derive all square numbers to 12^2 (12 x 12 = 144) • Understand the effect of multiplying/dividing whole numbers, and decimal numbers with up to two decimal places, by 10, by 100 and by 1,000 • Derive doubles of three-digit and four-digit numbers (and decimal numbers with up to two decimal places) and find the corresponding halves • Estimate the answer to a calculation and use inverse operations to check
Y6	• **Consolidate all end of year expectations for Y5 and…** • Recognise the place value of each digit in a seven-digit whole number • Recall multiplication/division facts for all multiplication tables up to 12 x 12 **with fluency** • Identify factors, common factors, common multiples and prime factors • Recall all square numbers to 12^2 (12 x 12 = 144) • Understand the effect of multiplying/dividing whole numbers, and decimal numbers with up to **three** decimal places, by 10, by 100 and by 1,000 • Understand the order of operations using brackets (BODMAS)

Progression in addition and subtraction strategies

Year 1

Underpinning skills (end of year expectation)

- Count to and across 100, forwards and backwards, in ones, beginning with 0 or 1 or from any given number
- Given a number, identify one more/one less
- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and the equals (=) sign and understand and use the associated vocabulary
- Recognise the relationship between addition and subtraction
- Recall addition/subtraction facts to 10 and within 10
- Derive addition/subtraction facts to 20 and within 20
- Recall doubles up to double ten (10 + 10) and find the corresponding halves
- Recognise place value in teen numbers using practical apparatus and begin to recognise place value in other two-digit numbers

Strategies

Counting on and back in ones

Children will count on or back in ones, from 0, 1 or any number, including with the use of a marked number line and/ or a number track:

8 + 6 count on in ones from 8
16 + 3 count on in ones from 16
18 + 4 count on in ones from 18
10 – 4 count back in ones from 10
12 – 5 count back in ones from 12
17 – 4 count back in ones from 17
20 – 8 count back in ones from 20

Use a counting stick to count forwards and backwards in ones, from any number, within 100

Ask children to count from 0, 1 or any number, in ones. When you clap, they count backwards. On the next clap, they count forwards, and so on…

Use counting songs and rhymes

Re-ordering numbers when adding

Children will know that it can sometimes be easier to re-order numbers when adding to start with the largest number, understanding that addition can be done in any order:

2 + 5 = 7 

5 + 2 = 7 

3 + 12 becomes 12 + 3
6 + 18 becomes 18 + 6

Partitioning numbers in different ways

Children will begin to use their knowledge of place value to add or subtract, without using counting strategies:

10 + 4 = 14
16 – 6 = 10
20 + 3 = 23

Children will begin to use their knowledge of number bonds to10 (then to 20) to partition when adding and subtracting:

7 + 4 = 7 + 3 + 1
18 + 3 = 18 + 2 + 1
14 – 6 = 14 – 4 – 2

Adding using recall of doubles

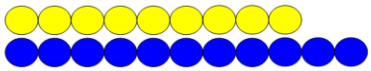
Children will use their knowledge of doubles to add:
5 + 5 is double 5

Children will begin to use their knowledge of doubles to add near doubles:
5 + 6 is double 5 add 1

Finding the difference by counting on

Children will use complementary addition to count on from the smaller number to the larger number to find a small difference, including with the use of resources, such as counters or a number track:

11 – 9 count up from 9 to 11 to find the difference



What's the difference between nine and eleven?
18 – 15 count up from 15 to find the difference
21 – 18 count up from 18 to 21 to find the difference

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:
7 + 3
Eight plus four
18 add 2
One more than 19
Twelve take away four
15 minus 6
20 – 5
One less than 21
The difference between ten and fourteen

Using related calculations

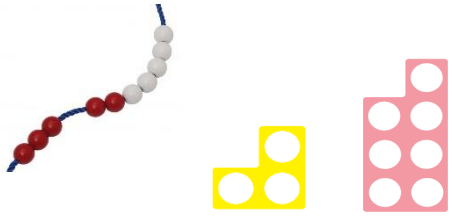
Children will use knowledge of place value and related calculations:

17 + 3 = 20 using 7 + 3 = 10

Children will use their understanding of the relationship between addition and subtraction and that addition can be done in any order, using resources to support understanding:

7 + 3 = 10
3 + 7 = 10
10 – 3 = 7
10 – 7 = 3

17 + 3 = 20
3 + 17 = 20
20 – 3 = 17
20– 17 = 3



Year 2

Underpinning skills (end of year expectation)

- Count to at least 100 in ones and in tens from 0 or any number, forwards and backwards
- Given a number, identify 10 more/10 less
- Recognise the place value of each digit in a two-digit number
- Use the vocabulary associated with addition and subtraction
- Recall addition/subtraction facts to 20
- Derive addition/subtraction facts of multiples of ten to 100 e.g. 60 + 40 = 100
- Know that addition of two numbers can be done in any order (commutative) but that subtraction of one number from another cannot
- Recognise and use the inverse relationship between addition and subtraction
- Recall the doubles of multiples of 10 to 100 (e.g. double 40 is 80) and recall the related halves (e.g. half of 80 is 40)
- Use estimation to check that an answer to a calculation is reasonable

Strategies

Counting on and back in tens and ones

Children will use their understanding of place value to support counting on or back, including with the use of a 100 square/ 200 grid to support and/or a number line:

42 + 5 count on in ones from 42
42 + 10 count on ten from 42
42 + 30 count on in tens from 42
42 + 35 count on in tens then ones from 42
56 – 4 count back in ones from 56
56 – 10 count back ten from 56
56 – 20 count back in tens from 56
56 – 24 count back in tens then ones from 56

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Use a counting stick to count forwards and backwards in ones from any number and to count forwards and backwards in tens from any number, to at least 100

Ask children to count from any two-digit number in tens. When you clap, they count on in ones. On the next clap, they count on in tens, and so on…

Partitioning numbers into tens and ones

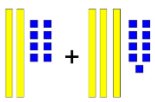
Children will use their understanding of place value to partition numbers into tens and ones:

30 + 2 = 32
32 – 2 = 30

Children will partition both numbers into tens and ones and then re-order and add
25 + 14 = 20 + 5 + 10 + 4 = 20 + 10 + 5 + 4
45 + 24 = 40 + 20 + 5 + 4 = 40 + 20 + 5 + 4

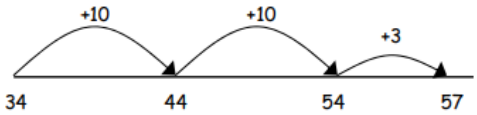
Consider the use of base ten resources to support
15 + 13 = 10 +5 +10 +3 = 10 + 10 + 5 + 3

28 + 39 = 20 + 8 + 30 + 9 = 20 + 30 + 8 + 9



Or, children will keep the first number as it is and partition the second number
25 + 14 = 25 + 10 + 4
34 + 23 = 34 + 20 + 3 = 34 + 10 + 10 + 3

Consider the use of an empty number line to record jottings



Children will partition the second number to subtract

68 – 24 = 68 –20 – 4
56– 34 = 56 – 30 – 4
Consider the use of base ten resources or an empty number line to count back

Children will use their knowledge of number bonds and place value to partition when adding and subtracting, bridging through multiples of ten, including with the use of empty number lines:

27 + 4 = 27 + 3 + 1
34 – 6 = 34 – 4 – 2

Re-ordering numbers when adding

Children will know that it can sometimes be easier to re-order numbers when adding:

Re-order to start with the largest number and understand the commutative property of addition:

23 + 56 becomes 56 + 23

Re-order to find pairs that total 10 (or 20) when adding three small numbers:
8 + 9 + 2 becomes 8 + 2 + 9 = 10 + 9
16 + 2 + 4 becomes 16 + 4 + 2 = 20 + 2

Add and subtract multiples of 10 and adjust

Children will use their knowledge of adding and subtracting 10 to add/subtract 9 or 11, including with the use of a 100 square or an empty number line:

42 + 9 = 42 + 10 – 1
42 + 11 = 42 + 10 + 1
42 – 9 = 42 – 10 + 1
42 – 11 = 42 – 10 – 1

Adding near doubles

Children will use their knowledge of doubles to add near doubles:

6 + 7 is double 6 and add 1
10 + 11 is double 10 add 1
12 + 13 is double 12 and add 1
20 + 19 is double 20 and subtract 1
40 + 39 is double 40 and subtract 1

Finding the difference by counting on

Children will use complementary addition to count on from the smaller number to the larger number to find a small difference, including with the use of an empty number line:

15 – 8 count on from 8 to 15 to find the diference
42 – 38 count on from 38 to 42 to find the difference
92 – 78 count on from 78 to 92 to find the difference

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:

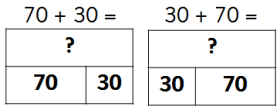
27 + 3
Ten more than 34
56 plus 12
The total of 50 and 4
60 add 40
20 – 6
100 subtract 50
Ten less than 86
65 minus 5
The difference between 29 and 31

Using related calculations

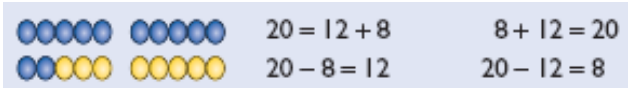
Children will use their understanding of place value and related calculations:

37 + 3 = 40 using 7 + 3 = 10
50 + 40 = 90 using 5 + 4 = 9
100 – 30 = 70 using 10 – 3 = 7

Children will use their knowledge that addition can be done in any order (addition is commutative):



Children will use their understanding of inverse operations and the commutative property of addition:



60 + 40 = 100 therefore…
40 + 60 = 100
100 – 40 = 60
100 – 60 = 40

Children will use inverse operations to solve empty box questions

48 + ☐ = 54
95 – ☐ = 88

Year 3

Underpinning skills (end of year expectation)

- Given a number, identify 10 or 100 more/less
- Recognise the place value of each digit in a three-digit number
- Recall addition and subtraction facts for multiples of 10 to 100
- Derive addition and subtraction facts for multiples of five to 100
- Derive addition and subtraction facts for multiples of 100 to 1000
- Understand the commutative properties of addition and the inverse relationship between addition and subtraction
- Derive doubles of all two-digit numbers (e.g. double 42 is 84)
- Estimate the answer to a calculation and use inverse operations to check

Strategies

Counting on and back in hundreds, tens and ones

Children will use their understanding of place value to support counting on or back, including with The use of a 200 grid and/or an empty number line:

82 + 30 count on in tens from 82
142 + 32 count on in tens and ones from 142
82 + 100 count on one hundred from 82
142 + 100 count on one hundred from 142
462 + 300 count on in hundreds from 462
136 – 40 count back in tens from 136
156 – 25 count back in tens and ones from 156
452 – 100 count back one hundred from 452
752 – 400 count back in hundreds from 752

Use a counting stick to count on or back in tens or hundreds from any number within 1,000

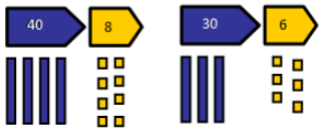
Ask children to count from any two–digit or three-digit number in tens. When you clap, they count backwards. On the next clap, they count forwards, and so on…

Partitioning numbers in different ways

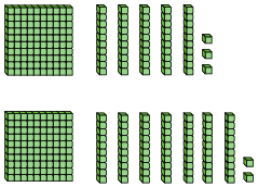
Children will use their understanding of place value to partition numbers:

Children partition both numbers into tens and ones and then re-order and add
63 + 54 = 60 + 3 + 50 + 4 = 60 + 50 + 3 + 4 = 110 + 7

Consider the use of base ten resources to support
48 + 36 = 40 + 8 + 30 + 6 = 40 + 30 + 8 + 6

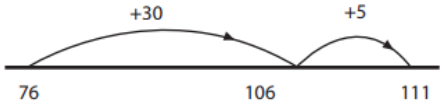


Children partition both numbers into hundreds, tens and ones and then re-order and add
123 + 235 = 100 + 20 + 3 + 200 + 30 + 5 = 100 + 200 + 20 + 30 + 3 + 5 = 300 + 50 + 8
Consider the use of base ten resources to support
154 + 172



Or, children will keep the first number as it is and partition the second number
76 + 35 = 76 + 30 + 5

Consider the use of an empty number line to record jottings

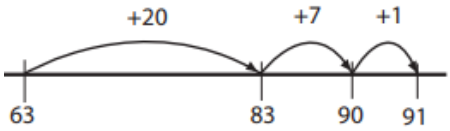


Encouraging children to use number lines in this way provides a mental image that can assist with mental calculations

125 + 34 = 125 + 30 + 4
146 + 135 = 196 + 100 + 30 + 5
236 – 142 = 236 – 100 – 40 – 2

Children use their knowledge of number bonds and place value to partition when adding and subtracting, bridging through multiples of 10 or 100

63 + 28 = 63 + 20 +7 + 1



85 – 37 = 85 – 30 – 5 – 2

127 + 8 = 127 + 3 + 5
234 – 5 = 234 – 4 – 1
103 – 7 = 103 – 3 –4

Re-ordering numbers when adding

Children will know that it can sometimes be easier to re-order numbers when adding:

Re-order to start with the largest number and understand the commutative property of addition
23 + 356 becomes 356 + 23

Re-order to find pairs that total multiples of 10 when adding/subtracting three small numbers

11 + 15 + 9 becomes 11 + 9 + 15 = 20 + 15
92 + 12 + 8 becomes 92 + 8 + 12 = 100 +12
42 – 7 – 2 becomes 42 – 2 – 7 = 40 – 7

Add and subtract multiples of 10 or 100 and adjust

Children use their knowledge of adding and subtracting multiples of 10 or 100 to add/subtract 9, 19, 29 or 11, 21, 31 or 99, 101… including with the use of an empty number line:

142 + 19 = 142 + 20 – 1
342 + 21 = 342 + 20 + 1
142 – 19 = 142 – 20 + 1
442 + 99 = 442 + 100 – 1
345 – 99 = 345 – 100 + 1

Adding near doubles

Children use their knowledge of doubles to add near doubles:

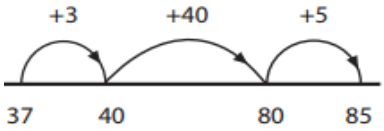
15 + 16 = double 15 add 1
25 + 26 = double 25 and add 1
50 + 60 = double 50 and add 10

Finding the difference by counting on

Children use complementary addition to count on from the smaller number to the larger number to find a small difference, including with the use of an empty number line:

104 – 95 count up from 95
202 – 198 count up from 198
212 – 199 count up from 199

It is sometimes easier to count on to find a difference even if the difference isn't small



85 – 37 count up from 37

'37 and 3 makes 40 and 40 makes 80 and 5 makes 85. So add 3 + 40 + 5 to get the answer'
Encouraging children to use number lines in this way provides a mental image that can assist with mental calculations

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions using a range of vocabulary:

70 + 30
Ten more than 194
The total of 500 and 400
Add 100 to 245
The sum of 9, 10 and 11
Increase 85 by 40
100 – 20
1,000 subtract 400
100 less than 186
265 minus 60
Decrease 200 by 30
The difference between 99 and 101

Using related calculations

Children will use knowledge of place value and related calculations:

140 + 150 = 290 using 14 + 15 = 29
300 + 700 = 1,000 using 30 + 70 = 100

Children will continue to use the inverse relationship between addition and subtraction and the commutative property of addition:

145 + 36 = 181 therefore…
36 + 145 = 181
181 – 36 = 145
181 – 145 = 36

Children will use inverse operations to solve empty box questions

148 + ☐ = 154
195 – ☐ = 184
☐ + 100 = 345

If you know that 700 + 300 = 1,000, what else do you know?

Year 4

Underpinning skills (end of year expectation)

- Given a number, identify 10, 100 or 1000 more/less
- Recognise the place value of each digit in a four-digit number
- Round any number to the nearest 10, 100 or 1,000
- Recognise the place value of each digit in a decimal number with up to two decimal places
- Round decimal numbers with one decimal places to the nearest whole number
- Find pairs of decimal numbers that total one (e.g. 0.6 + 0.4)
- Know addition/subtraction facts for multiples of 100 that total 1,000
- Derive addition and subtraction facts for all pairs of numbers that total 100 e.g. 68 + 32
- Derive addition and subtraction facts for multiples of 50 to 1,000 and multiples of 10 to 1,000
- Recall doubles of two-digit numbers and derive doubles of three-digit numbers
- Estimate the answer to a calculation, including using the skill of rounding, and use inverse operations to check

Strategies

Counting on and back in thousands, hundreds, tens and ones

Children will use their understanding of place value to support counting on or back, including with the use of an empty number line:

564 + 400 count on in hundreds from 564
960 + 200 count on in hundreds from 960
1,250 + 68 count on in tens and then ones from 1,250
4,458 +1,000 count on one thousand from 4,458
4,450 + 3,000 count on in thousands from 4,450
936 – 40 count back in tens from 936
1,856 – 35 count back in tens and ones from 1,856
1,456 – 500 count back in hundreds from 1,456
6,452 – 1,000 count back one thousand from 6,452
8,450 – 5,000 count back in thousands from 8,450

Ask children to count on in hundreds from any three-digit number. When you clap, they count on in tens. On the next clap, they count back in hundreds, and so on…

Partitioning numbers in different ways

Children will partition both numbers into hundreds, tens and ones and then add
163 + 224 = 100 + 200 + 60 + 20 + 3 + 4 = 300 + 80 + 7
Consider the use of base ten resources to support

Or, children will keep the first number as it is and partition the second number
163 + 244 = 163 + 200 + 40 + 4
625 – 434 = 625 – 400 – 30 – 4
1,567 + 1,349 = 1,567 + 1000 + 300 + 40 + 9
Consider the use of an empty number line to record jottings

Children will extend their understanding of place value to partition decimal numbers and then add
5.0 + 3.5 = 5.0 + 3.0 + 0.5
4.6 + 2.3 = 4.0 + 2.0 + 0.6 + 0.3 = 6.0 + 0.9

Children will use their knowledge of number bonds and place value to partition when adding and subtracting, bridging through multiples of 10, 100 or 1,000, including with the use of an empty number line to record jottings:

127 + 83 = 127 + 3 + 80 = 130 + 80
234 – 15 = 234 – 14 – 1 = 220 – 1
488 + 15 = 488 + 12 + 3

Re-ordering numbers when adding

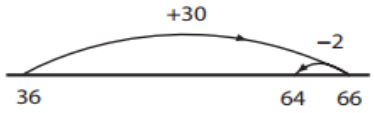
Children will know that it can sometimes be easier to re-order numbers when adding:
Re-order to start with the largest number and understand the commutative property of addition
210 + 856 becomes 856 + 210

Re-order to find pairs that total multiples of 1, 10 or 100 when adding/subtracting three small numbers
88 + 65 + 12 becomes 88 +12 + 65 = 100 + 65
25 + 36 + 75 becomes 75 + 25 + 36 = 100 + 36
50 + 82 + 150 becomes 150 + 50 + 82 = 200 +82
142 – 5 – 12 becomes 142 – 12 – 5 = 130 – 5
0.3 + 1.5 + 0.7 becomes 1.5 + 0.7 + 0.3 = 1.5 + 1

Add and subtract multiples of 10 or 100 and adjust

Children use their knowledge of adding and subtracting multiples of 10 or 100 and adjusting to add/subtract, including with the use of an empty number line:

36 + 28 = 36 + 30 – 2 = 64 (28 rounds up to 30)



Encouraging children to use number lines in this way provides a mental image that can assist with mental calculations

542 + 29 = 542 + 30 – 1 (29 rounds up to 30)
458 + 99 = 458 + 100 – 1 (99 rounds up to 100)
942 – 18 = 942 – 20 + 2 (18 rounds up to 20)
942 + 99 = 942 + 100 – 1 (99 rounds up to 100)
1,256 – 98 = 1,256 –100 +2 (98 rounds up to 100)
2,565 + 999 = 2,565 +1,000 –1 (999 rounds up to 1,000)

Adding near doubles

Children use their knowledge of doubles to add near doubles:
35 + 34 = double 35 and subtract 1
45 + 46 = double 45 and add 1
60 + 62 = double 60 and add 2
150 + 152 = double 150 and add 2

Finding the difference by counting on

Children will use complementary addition to count on from the smaller number to the larger number to find a **small** difference, including with the use of an empty number line:

504 – 498 count up from 498
902 – 887 count up from 887
1,004 – 998 count up from 998

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions using a range of vocabulary:

700 + 300
100 more than 984
The total of 250 and 150
The sum of 30 + 40 + 50
100 – 25
100 less than 1,086
1,000 minus 250
Decrease 1,000 by 400
The difference between 198 and 205

Using related calculations

Children will use knowledge of place value and related calculations:
Use 45 + 23 = 68 to solve 450 + 230 and 4.5 + 2.3

Children will continue to use the inverse relationship between addition and subtraction and the commutative property of addition:

850 + 150 = 1,000 therefore…
150 + 850 = 1,000
1,000 – 150 = 850
1,000 – 850 = 150

If you know that 1,000 – 250 = 750, what else do you know?

Children will use inverse operations to solve empty box questions

548 + ☐ = 654
995 – ☐ = 894
850 + ☐ = 1,000

Year 5

Underpinning skills (end of year expectation)

- Given a number identify 10/ 100/ 1,000/ 10,000 more or less
- Recognise the place value of each digit in a six-digit whole number
- Round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000
- Recognise the place value of each digit in a decimal number with up to three decimal places
- Round decimal numbers with two decimal places to the nearest whole number or to one decimal place
- Derive complements of 1 e.g. 0.83 and 0.17 = 1
- Derive doubles of three-digit and four-digit numbers (and decimal numbers with up to two decimal places) and find the corresponding halves
- Estimate the answer to a calculation, including using the skill of rounding, and use inverse operations to check

Strategies

Counting on and back in tens of thousands, thousands, hundreds, tens and ones

Children will use their understanding of place value to support counting on or back, including with the use of an empty number line:

864 + 500 count on in hundreds from 864
1,960 + 200 count on in hundreds from 1,960
1,250 + 268 count on in hundreds, tens and then ones from 1,250
9,458 + 3,000 count on in thousands from 9,458
25,250 + 3,500 count on in thousands and then hundreds from 25,250
456,000 + 40,000 count on in tens of thousands from 456,000
1,936 – 740 count back in hundreds and then tens from 1,936
5,856 – 235 count back in hundreds, tens and ones from 5,856
16,400 – 5,000 count back in thousands from 16,400
61,450 – 30,000 count back in tens of thousands from 61,450

Ask children to count on in thousands from any three-digit number. When you clap, they count on in hundreds. On the next clap, they count back in thousands, and so on…

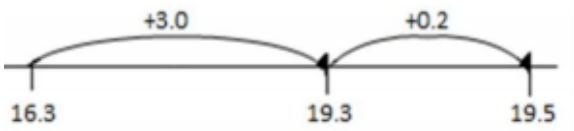
Partitioning numbers in different ways

Children partition the second number into thousands, hundreds, tens and ones and then add/subtract:

540 + 284 = 540 + 200 + 80 + 4
2,456 + 2,500 = 2,456 + 2,000 + 500
1,650 – 240 = 1,650 – 200 – 40
Consider the use of an empty number line to record jottings

Children use their understanding of place value to partition decimal numbers and then add/subtract

2.75 + 3.25 = 2.75 + 3.00 + 0.25 = 5.75 + 0.25
16.3 + 3.2 = 16.3 + 3.0 + 0.2



Children use their knowledge of number bonds and place value to partition when adding and subtracting, bridging through multiples of 10, 100 or 1,000

896 + 134 = 896 + 4 + 130 = 900 + 130
2,165 – 47 = 2,165 – 45 – 2
1,995 + 245 = 1,995 + 5 + 200 + 40
3.8 + 2.6 = 3.8 + 0.2 + 2.4 = 4.00 + 2.4

Re-ordering numbers when adding

Children will know that it can sometimes be easier to re-order numbers when adding:

Re-order to start with the largest number and understand the commutative property of addition

230 + 1,856 becomes 1,856 + 230

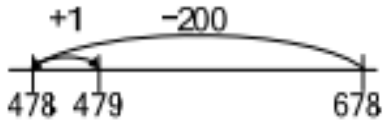
Re-order to find pairs that total multiples of 1, 10,100 or 1,000 when adding/subtracting three numbers

488 + 65 + 12 becomes 488 + 12 + 65 = 500 + 65
750 + 73 + 250 becomes 750 + 250 + 73 = 1,000 + 73
142 – 5 – 12 becomes 142 – 12 – 5 = 130 – 5
158 + 47 – 38 becomes 158 – 38 + 47 = 120 + 47
0.35 + 1.5 + 0.65 becomes 0.65 + 0.35 + 1.5 = 1.0 + 1.5
1.7 + 2.8 + 0.3 becomes 1.7 + 0.3 + 2.8 = 2 + 2.8

Add and subtract multiples of 10, 100 or 1,000 and adjust

Children will use their knowledge of adding and subtracting multiples of 10, 100 or 1,000 and adjusting to add/subtract, including with the use of an empty number line:

542 + 29 = 542 + 30 – 1 (29 rounds up to 30)
942 – 38 = 142 – 40 + 2 (38 rounds up to 40)
942 + 99 = 942 + 100 – 1 (99 rounds up to 100)
1,856 – 201 = 1,856 – 200 – 1 (201 rounds down to 200)
1,256 – 98 = 1,256 – 100 +2 (98 rounds up to 100)
2,565 + 999 = 2,565 + 1,000 –1 (999 rounds up to 1,000)
678 – 199 = 678 – 200 + 1 (199 rounds up to 200)



Encouraging children to use number lines in this way provides a mental image that can assist with mental calculations

Adding near doubles

Children will use their knowledge of doubles to add near doubles:

1.5 + 1.6 = double 1.5 and add 0.1
125 + 126 = double 125 and add 1
500 + 600 = double 500 and add 100
390 + 380 = double 400 and subtract 10 and then subtract 20

Finding the difference by counting on

Children will use complementary addition to count on from the smaller number to the larger number to find a **small** difference, including with the use of an empty number line:

904 – 898 count up from 898
1,010 – 998 count up from 998
1,002 – 877 count up from 877
2,017 – 1,998 count up from 1,998
8,004 – 6,999 count up from 6,999

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:

The total of 250 and 150
7,000 + 3,000
The sum of 2,500 and 2,500
The total of 300 + 500 + 700
100 more than 950
Increase 850 by 300
1,000 – 150
100 less than 1,086
1,000 minus 650
Decrease 1,250 by 400
The difference between 2,001 and 1,995

Using related calculations

Children will use knowledge of place value and related calculations:
Use 63 – 48 to solve 680 – 430 and 6.3 – 4.8

Children will continue to use the inverse relationship between addition and subtraction:

$\square - 100 = 1{,}059$

$1{,}998 + \square = 2{,}002$

If you know that 1,000 – 110 = 890, what else do you know?

If you know that 0·75 + 0·25 = 1·00, what else do you know?

Year 6

Underpinning skills (end of year expectations)

- Given a number identify 10/ 100/ 1,000/ 10,000/ 100,000/ 1,000,000 more or less
- Recognise the place value of each digit in a seven-digit whole number
- Round any number up to 10,000,000 to the nearest 10, 100, 1,000, 10,000, 100,000 or 1,000,000
- Recognise the place value of each digit in a decimal number with up to three decimal places
- Round decimal numbers with two decimal places to the nearest whole number or to one decimal place
- Derive complements of 1 e.g. 0.64 and 0.36 = 1
- Estimate the answer to a calculation, including using the skill of rounding, and use inverse operations to check
- Derive doubles of three-digit and four-digit numbers (and decimal numbers with up to three decimal places)

Strategies

Counting on and back in steps of powers of ten (in tens, hundreds, thousands, tens of thousands, hundreds of thousands and in millions)

Children will use their understanding of place value to support counting on or back, including with the use of an empty number line:

1,960 + 300 count on in hundreds from 2,960
12,250 + 260 count on in hundreds and then tens from 12,250
25,458 + 3,000 count on in thousands from 25,458
25,250 + 5,500 count on in thousands and then hundreds from 25,250
1,456,250 + 60,000 count on in tens of thousands from 1,456,250
2,256,500 + 200,000 count on in hundreds of thousands from 2,256,500
3,450,000 + 4,000,000 count on in millions from 3,450,000

1,045 – 200 count back in hundreds from 1,045
12,936 – 720 count back in hundreds and then tens from 12,936
125,856 – 235 count back in hundreds, tens and ones from 5,856
165,452 – 5,000 count back in thousands from 165,452
261,456 – 30,000 count back in tens of thousands from 261,456
1,857,450 – 500,000 count back in hundred thousand from 1,857,450
5,250,000 – 3,000,000 count back in millions from 5,250,000

Partitioning numbers in different ways

Children will partition the second number and then add/subtract, including with the use of an empty number line:

6,540 + 1,284 = 6,540 +1,000 + 200 + 80 +4
8,456 - 2,500 = 8,456 - 2,000 - 500
455,460 + 2,458 = 455,460 + 2,000 + 400 + 50 + 8

Children use their understanding of place value to partition decimal numbers and then add/subtract:

12.75 + 5.25 = 12.75 + 5.00 + 0.2 + 0.05

Children will use their knowledge of number bonds and place value to partition in different ways when adding and subtracting, bridging through multiples of powers of ten:

5,296 + 234 = 5,296 + 4 + 230
8,564 – 170 = 8,584 – 164 – 6
5.6 + 3.5 = 5.6 + 0.4 + 3.1

Consider using an empty number line to record jottings

Re-ordering numbers when adding

Children will know that it can sometimes be easier to re-order numbers when adding:

Re-order to start with the largest number and understand the commutative property of addition
640 + 5,257 becomes 5,257 + 640

Re-order to find pairs that total multiples of power of ten when adding/subtracting three numbers
1,488 + 165 + 12 becomes 1,488 + 12 + 165 = 1,500 + 165
4.8 + 2.5 –1.8 becomes 4.8 –1.8 + 2.5

Add and subtract multiples of 10, 100 or 1,000 and adjust

Children will use their knowledge of adding and subtracting multiples of 10, 100 or 1,000 and adjusting to add/subtract, including with the use of an empty number line:

845 + 28 = 845 + 30 – 2 (28 rounds up to 30)
1,942 + 99 = 1,942 + 100 – 1 (99 rounds up to 100)
5,856 – 198 = 5,856 – 200 + 2 (198 rounds up to 200)
6,565 + 999 = 2,565 + 1,000 –1 (999 rounds up to 1,000)
8,250 – 998 = 8,250 –1,000 + 2 (998 rounds up to 1,000)

Adding near doubles

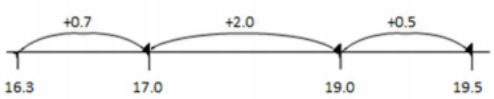
Children will use their knowledge of doubles to add near doubles:

2.5 + 2.6 = double 2.5 and add 0.1
490 + 480 = double 500 and subtract 30

Finding the difference by counting on

Children will use complementary addition to count on from the smaller number to the larger number to find a small difference, including with the use of an empty number line:

908 – 897 count up from 897
1,015 – 998 count up from 998
1,102 – 877 count up from 877
2,017 – 1,988 count up from 1,988
3,000 – 2,899 count up from 2,899
10,004 – 8,997 count up from 8,997
19.5 – 16.3 count up from 16.3



Encouraging children to use number lines in this way provides a mental image that can assist with mental calculations

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:

70,000 + 30,000
The sum of 12,500 and 2,000
The total of 300 + 500 + 700
Add together 1.8 and 3.2
Increase 2,500 by 999
1,000 – 155
10 subtract 2.8
100 less than 10,086
1,000 minus 555
The difference between 2,001 and 1,995

Using related calculations

Children will use knowledge of place value and related calculations:
680 + 430, 6.8 + 4.3, 0.68 + 0.43 can all be worked out using the related calculation 68 + 43

Children will continue to use the inverse relationship between addition and subtraction:

$\square$ – 10,000 = 42,560

1.85 + $\square$ = 2.00

If 998 + n = 1,012 what is the value of n?
If 1,500 – m = 600 what is the value of m?

If you know 0.55 + 0.45 = 1.00, what else do you know?

Progression in multiplication and division strategies

Year 1

Underpinning skills (end of year expectation)

- Count in multiples of twos, fives and tens (to the 10th multiple)
- Understand and use the vocabulary (but **not** the signs) associated with multiplication and division in practical contexts
- Recall doubles up to double ten (10 + 10) and find the corresponding halves

Strategies

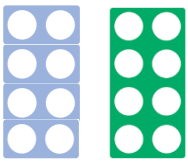
Counting

Children will count in multiples of two, five and ten, to the 10th multiple:
Use a counting stick to count forwards (and backwards)
Drop 2p coins into a jar and count in twos (then use 10p or 5p coins)
Count children when in pairs
Use counting songs and rhymes

Combining groups

Children will combine groups of 2, 5 or ten, in practical situations:
Five pairs of socks. How many socks altogether?
2, 4, 6, 8, 10

Four groups of two is eight



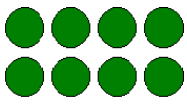
Sharing and grouping

Children will share a set of objects, equally:
Share 12 apples equally between two children. How many apples will they each get? (Sharing)

There are 15 biscuits in a pack. If we put five biscuits on a plate, how many plates will we need? (Grouping)

Describing arrays

Children will develop an understanding of multiplication and division by describing and making simple arrays:

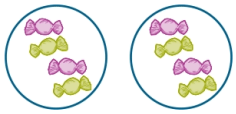


Four groups of two
Two groups of four
Eight counters altogether
Share eight counters equally between two children

Doubling and halving

Children will find doubles and halves, in practical situations:

Make the link between doubling and finding two groups of



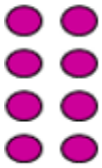
Double four is eight. Two groups of four is eight

Use fingers to show doubles 'Show me double four'

Find double dominoes and describe them, making the link with addition and two groups
Double six is twelve, 6 + 6 = 12, two groups of six is twelve

Make the link between halving and equal sharing between two
Half of twelve is six
Share twelve apples equally between two children

Make the link between doubling and halving
Double four is eight. Half of eight is four



Rapid recall

Give children the opportunity to respond rapidly to oral questions, using a range of vocabulary:

Two groups of ten
Three lots of five
How many groups of two are there in eight?
Share ten apples between two children
Double four
Half of twelve

Year 2

Underpinning skills (end of year expectation)

- Count in multiples of 2, **3**, 5 and 10 from 0, forwards and backwards (to the 12th multiple)
- Recall multiplication/division facts for the 2, 5 and 10 times table to the 12th multiple
- Read, write and interpret mathematical statements involving multiplication and division, including the signs x, ÷ and =, and understand and use the associated vocabulary
- Know that multiplication of two numbers can be done in any order (commutative) but that division of one number by another cannot
- Recall the doubles of multiples of 10 to 100 (e.g. double 40 is 80) and recall the related halves (e.g. half of 80 is 40)

Strategies

Counting

Children will count in multiples of two, **three**, five and ten, to the 12th multiple:
Use a counting stick to count forwards (and backwards)

Ask children to count from zero in a known multiple e.g. fives. When you clap, they count backwards. On the next clap, they count forwards, and so on…

Drop 2p coins into a jar and count in twos (then use 10p and 5p coins)

Count around the clock in fives

Use counting songs and rhymes

Combining groups

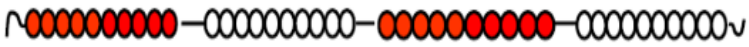
Children will count groups of two, three, five and ten:
Five apples in a bag. How many apples in four bags?
5, 10, 15, 20

Multiplication as repeated addition

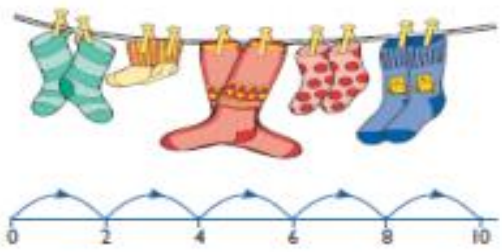
Children will represent multiplication as repeated addition

Four groups of five
5, 10, 15, 20
5 + 5 + 5 + 5 = 20
4 x 5 = 20

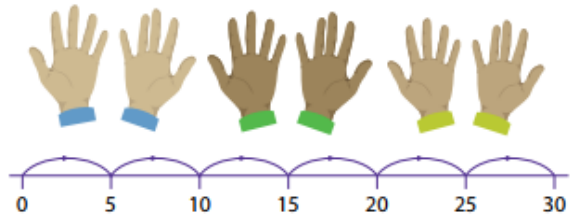
Four groups of ten
10, 20, 30, 40
10 +10 +10 +10 = 40
4 x 10 = 40



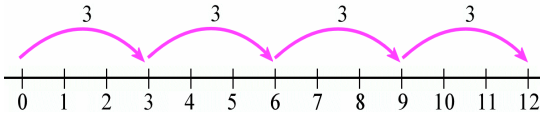
Children can also begin to use empty number lines to count on in groups (multiples) of 2, 3, 5 and 10



2, 4, 6, 8, 10
Five jumps of two
2 + 2 + 2 + 2 + 2 = 5 x 2 = 10



Six groups of five
0, 5, 10, 15, 20, 25, 30
5 + 5 + 5 + 5 + 5 + 5
6 x 5 = 30



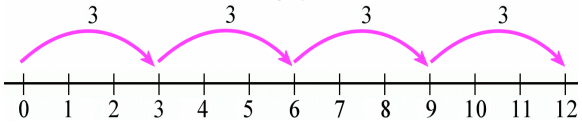
Four groups of three, four jumps of three
0, 3, 6, 9, 12
3 + 3 + 3 + 3 = 12
4 x 3 = 12

Sharing and grouping

Children will move from sharing to grouping:

Twenty apples are shared equally between five children. How many apples will they each have? (Sharing)
I have 20 apples and I want to put them into bags of five. How many bags do I need?
5, 10, 15, 20 (Grouping)
20 ÷ 5 = 4

Children can use empty number lines to count on, to make the link with multiplication



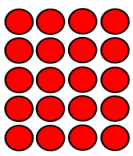
How many groups of three are there in twelve?
12 ÷ 3 = 4

Counting back on a number line makes the link with repeated subtraction
12 – 3 – 3 – 3 – 3

Arrays

Children will further develop an understanding of multiplication by describing and making arrays:

Four groups of five
5 + 5 + 5 + 5 = 20
4 x 5 = 20

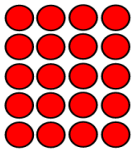


This can also be described as
Five groups of four
4 + 4 + 4 + 4 + 4 = 20
5 x 4 = 20

By making arrays children will see that multiplication can be done in any order (multiplication is commutative)

4 x 5 = 20
5 x 4 = 20

Arrays can also be used to support an understanding of division



20 counters altogether. How many groups of five are there?
20 ÷ 5 = 4
How many groups of four are there?
20 ÷ 4 = 5

Children can count on (count forwards), to make the link with multiplication
How many fives are there in twenty? 5, 10, 15, 20 (four groups of five)

Children can make their own arrays with counters, describing them using the language of multiplication and division

Doubling and halving

Children will find doubles and related halves of numbers making the link with multiplying and dividing by two:

Double 12 is 24.
Two groups of 12 is 24
12 x 2 = 24

Half of 24 is 12
Share 24 equally between two
24 ÷ 2 = 12

Rapid recall

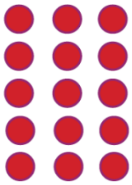
Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:

Four groups of five
6 x 10
Eight times two
Five multiplied by three
3 x 0
Double 40
How many twos in 16?
How many groups of five are there in twenty?
Divide 40 by 10
30 ÷ 5
Half of 80

Using related calculations

Children will use knowledge of place value, inverse operations and related calculations:

3 x 5 = 15 therefore…
5 x 3 = 15
15 ÷ 5 = 3
15 ÷ 3 = 5
3 x ☐ = 15
☐ ÷ 5 = 3



Double 4 is 8 therefore …
Double 40 is 80
Half of 80 is 40

Year 3

Underpinning skills (end of year expectation)

- Count in multiples of 2, 3, **4**, 5, **8**,10, **50** and **100** from 0, forwards and backwards (to the 12th multiple)
- Recall multiplication/division facts for the 2, **3**, **4**, 5, **8** and 10 times tables to the 12th multiple
- Understand and use the vocabulary and signs associated with multiplication and division
- Understand the effect of multiplying/dividing numbers by 10
- Understand the commutative properties of multiplication
- Recognise the inverse relationship between multiplication and division
- Derive doubles of all two-digit numbers (e.g. double 42 is 84) and the corresponding halves (half of 84 is 42)

Strategies

Counting

Children will count in multiples of 2, 3, **4**, 5, **8**, 10, **50** and **100** to the 12th multiple:

Use a counting stick to count forwards (and backwards) asking related multiplication and division questions
Ask children to count from zero in a known multiple e.g. fours. When you clap, they count backwards. On the next clap, they count forwards, and so on…
Count around the clock in fives
Play Fizz, buzz with multiples of three and five
Use counting songs and rhymes

Arrays

Children will further develop an understanding of multiplication and division by describing and making arrays:

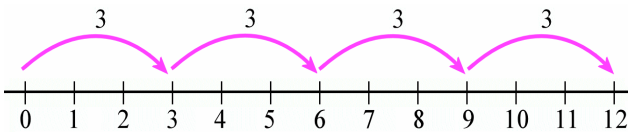
6 x 3 = 18
3 x 6 = 18
18 ÷ 3 = 6
18 ÷ 6 = 3

Discuss the commutative property of multiplication and that multiplication and division are inverse operations

Give children 12 (or 24) counters and ask them to make an array, then describe their array using multiplication and division facts

Using empty number lines

Children can also use empty number lines to count on in multiples of 2, 3, 4, 5, 8 and 10



0, 3, 6, 9, 12
Four groups of three
Four jumps of three
4 x 3 = 12

Children can use empty number lines to record division, counting on/forwards to make the link with multiplication

How many threes are in there in twelve?
12 ÷ 3 = 4

Counting back on a number line makes the link with repeated subtraction
12 – 3 – 3 – 3 – 3 = 0

Remainders can be modelled with arrays and/or with empty number lines

Using partitioning to multiply and divide

Children will multiply teen number by a known multiple using their knowledge of place value:

14 x 5 (partition 14 into 10 + 4)
10 x 5 = 50
4 x 5 = 20
50 + 20 = 70
14 x 5 = 70

Consider the use of base ten resources to support

This can also be recorded using a grid

X	10	4
5	50	20

Add the partial products together
50 + 20 = 70
14 x 5 = 70

Children can also **begin** to use partitioning to divide
42 ÷ 3 (partition 42 into 30 and 12)
30 ÷ 3 = 10
12 ÷ 3 = 4
10 + 4 = 14
42 ÷ 3 = 14

Multiplying and dividing by ten and multiples of ten

Children will use their understanding of place value to multiply by ten and multiples of ten:
3 x 10 = 30
30 ÷ 10 = 3

Consider using a rectangular array to model multiplication by ten

7 x 10 = 70
70 x 10 = 700

Multiply by ten by shifting digits one place to the left and placing zero in the ones/units column as a place holder

70 ÷ 10 = 7
700 ÷ 10 = 70

Divide by ten by shifting digits one place to the right

Consider using a place value chart to support understanding of multiplying and dividing by ten

24 x 10 = 240
240 ÷ 10 = 24

Extend with multiplying by other multiples of ten
3 x 20 = 3 x 10 x 2 = 60

4 x 30 = 4 x 3 x 10 = 120

Doubling and halving

Children will find doubles and related halves of numbers making the link with multiplying and dividing by two:

Double 24 is 48
2 x 24 = 28

Half of 48 is 24
48 ÷ 2 = 24

Children can use partitioning to support finding doubles of two-digit numbers
Double 38 (partition 38 into 30 + 8)

Double 30 = 60
Double 8 = 16
60 + 16 = 76

Double 38 = 76
Half of 76 = 38

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:

6 x 4
8 multiplied by 5
4 x 0
Double 60
36 ÷ 4
8 ÷ 8
How many threes 'go into' 27?
Half of 120

Using related calculations

Children will use knowledge of place value, inverse operations and related calculations:

8 x 5 = 40 therefore…
5 x 8 = 40
40 ÷ 5 = 8
40 ÷ 8 = 5

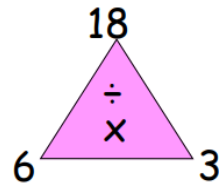
8 x □ = 32

□ ÷ 6 = 3

3 x 4 = 12 therefore 3 x 40 = 120, 30 x 4 = 120

Double 25 is 50. Therefore double 250 is 500
Half of 50 is 25. Therefore half of 500 is 250

Write four facts using this trio of numbers



If you know 8 x 4 = 32, what else do you know?

Year 4

Underpinning skills (end of year expectation)

- Count in multiples of 2, 3, 4, 5, **6**, **7**,8, **9**,10, **11, 12**, **25**, 50, 100 and 1000 from 0, forwards and backwards (to the 12th multiple)
- Recall multiplication and division facts for multiplication tables up to 12 x 12
- Understand the effect of multiplying by 0 or 1 and dividing by 1
- Recognise and identify factor pairs
- Understand the effect of multiplying/dividing numbers by 10/100, including decimal numbers
- Recall doubles of two-digit numbers and derive doubles of three-digit numbers and find the corresponding halves
- Estimate the answer to a calculation, including the use of rounding, and use inverse operations to check

Strategies

Counting

Count in multiples of 2, 3, 4, 5, **6**, **7**, 8, **9**, 10, **11, 12**, **25**, 50, 100 and 1000 from 0, forwards and backwards (to the 12th multiple):

Use a counting stick to count forwards (and backwards) asking related multiplication and division questions

Ask children to count from zero in a known multiple e.g. sixes. When you clap, they count backwards. On the next clap, they count forwards, and so on…..

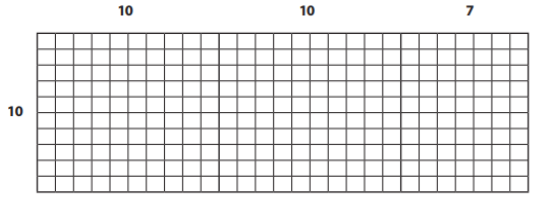
Play Fizz, buzz with multiples of three and five (or multiples of four and six)

Multiplying and dividing by 10/100

Children will use their understanding of place value to multiply/divide by ten and multiples of ten:
9 x 10 = 90
90 x 10 = 900
Multiply by ten by shifting digits one place to the left and placing zero in the ones/units column as a place holder

90 ÷ 10 = 9
900 ÷ 10 = 90
Divide by ten by shifting digits one place to the right

27 x 10 = 270
270 ÷ 10 = 27



This area model shows how a two-digit number has been partitioned into tens and ones and multiplied by 10. Children can then visualise this at a later stage to aid mental calculation

54 x 10 = 540
540 ÷ 10 = 54

Multiply and divide by multiples of ten
6 x 30 = 6 x 3 x 10 = 18 x 10 = 180
180 ÷ 30 = 180 ÷ 10 ÷ 3 = 18 ÷ 3 = 6

Extend with decimal numbers
2·4 x 10 = 24
24 ÷ 10 = 2·4

Children will use their understanding of place value to multiply/divide by one hundred:
4 x 100 = 400
400 ÷ 100 = 4

35 x 100 = 3,500
3,500 ÷ 100 = 35

Multiply by one hundred by shifting digits two places to the left and placing zero in the ones/units column as a place holder
Divide by one hundred by shifting digits two places to the right

Extend with decimal numbers (with one decimal place)
2·4 x 100 = 240
240 ÷ 100 = 2·4

Consider using a place value chart to support understanding of multiplying and dividing numbers by 10/100

Using partitioning and the distributive law to multiply

Children will multiply a two-digit number by a known multiple using their understanding of place value:

16 x 5 = (10 x 5) + (6 x 5)
= 50 + 30
= 80

32 x 3 = (30 x 3) + (2 x 3)
= 90 + 6
= 96

This can also be recorded using a grid

X	30	2
3	90	6

Add the partial products together

24 x 7 = (20 x 7) + (4 x 7)
=140 + 28
= 168

X	20	4
7	140	28

Add the partial products together

Using partitioning to divide

Children will use their knowledge of partitioning numbers in different ways to divide a two-digit number by a single-digit number:

48 ÷ 3 (partition 48 into 30 and 18)

30 ÷ 3 = 10
18 ÷ 3 = 6
10 + 6 = 18

48 ÷ 3 = 18

Extend by simplifying the recording

78 ÷ 6 = (60 ÷ 6) + (18 ÷ 6)
10 + 3 = 13

78 ÷ 6 = 13

Using multiples and factor pairs

Children will begin to recognise and use factor pairs to aid multiplication:

7 x 20 = 7 x 2 x 10 = 14 x 10
6 x 15 = 6 x 5 x 3 = 30 x 3
4 x 24 = 4 x 2 x 12 = 8 x 12

Children will use their knowledge of multiples, factors and their understanding that multiplication can be done in any order (multiplication is commutative) to multiply three numbers together:

2 x 6 x 5 = 2 x 5 x 6 = 10 x 6
3 x 7 x 4 = 3 x 4 x 7 = 12 x 7

Doubling and halving

Children will find doubles and related halves of numbers making the link with multiplying and dividing by two:
Double 75 is 150
2 x 75 = 150

Half of 150 is 75
150 ÷ 2 = 75

Children can use partitioning to support finding doubles and halves of two-digit and three-digit numbers:

Double 86 (partition 86 into 80 + 6)

Double 80 = 160
Double 6 = 12
160 + 12 = 172

Double 86 is 172

Double 248 (partition 248 into 200 + 40 + 8)

Double 200 = 400
Double 40 = 80
Double 8 = 16
400 + 80 +16 = 496

Double 248 is 496

Half of 632 (partition 632 into 600 and 32)
Half of 600 = 300
Half of 32 = 16
300 + 16 = 316

Half of 632 is 316

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions using a range of vocabulary:

8 x 6
7 multiplied by 5
What is the product of 9 and 10?
Multiply three by twelve
7 x 0
Double 64

Divide 28 by 4
36 ÷ 9
How many sixes ‘go into’ 42?
12 ÷ 12
77 divided by 11
Half of 420

Using related calculations

Children will use knowledge of place value, inverse operations and related calculations:

Write four facts using this trio of numbers

12 x 6 = 72
6 x 12 = 72
72 ÷ 6 = 12
72 ÷ 12 = 6

8 x 6 = 48 therefore 8 x 60 = 480, 80 x 6 = 480, 8 x 600 = 4,800…

If you know 6 x 8 = 48, what else do you know?

Double 75 is 150. Therefore double 750 is 1,500

14 x 5 becomes 7 x 10 (halve 14 and double 5)

Derive the 6x table facts by doubling the 3x table facts; derive the 12x table facts by doubling the 6x table facts

Year 5

Underpinning skills (end of year expectation)

- Count in multiples of 3, 4, 6, 7, 8, 9, 11,12, 25, 50,100 and 1,000 forwards and backwards
- Consolidate multiplication and division facts for multiplication tables up to 12 x 12
- Find **all** factor pairs of a given number; find **all** common factors for a pair of numbers; identify multiples
- Derive all square numbers to 12^2 (12 x 12 = 144)
- Understand the effect of multiplying/dividing whole numbers, and decimal numbers with up to two decimal places, by 10, by 100 and by 1,000
- Derive doubles of three-digit and four-digit numbers(and decimal numbers with up to two decimal places) and find the corresponding halves
- Estimate the answer to a calculation and use inverse operations to check

Strategies

Counting

Count in multiples of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 25, 50, 100 and 1000 from 0, forwards and backwards (to the 12^{th} multiple):

Use a counting stick to count forwards (and backwards) using known multiples, asking related multiplication and division questions; extend by counting in other multiples e.g. multiples of 40 or multiples of 0.4, using knowledge of place value

Ask children to count from zero in a known multiple e.g. 25s. When you clap, they count backwards. On the next clap, they count forwards, and so on…

Multiplying and dividing by 10/100/1,000

Children will use their understanding of place value to multiply/divide by ten and multiples of ten:

Multiply by ten by shifting digits one place to the left (and placing zero in the ones/units column as a place holder, when appropriate

0.9 x 10 = 9
9 x 10 = 90
90 x 10 = 900
900 x 10 = 9,000

4.5 x 10 = 45
45 x 10 = 450
450 x 10 = 4,500

45 x 20 = 45 x 2 x 10 = 900

Divide by ten by shifting digits one place to the right

9 ÷ 10 = 0.9
90 ÷ 10 = 9
900 ÷ 10 = 90
9,000 ÷ 10 = 900

45 ÷ 10 = 4.5
450 ÷ 10 = 45
4,500 ÷ 10 = 450

900 ÷ 20 = 900 ÷ 10 ÷ 2 = 45

Children will use their understanding of place value to multiply/divide by one hundred and multiples of 100:

Multiply by one hundred by shifting digits two places to the left (and placing zero in the ones/units column as a place holder, when appropriate)

Divide by one hundred by shifting digits two places to the right

0.4 x 100 = 40
40 ÷ 100 = 0.4
40 x 100 = 4,000
4,000 ÷ 100 = 40

2.45 x 100 = 245
245 ÷ 100 = 2.45

24 x 200 = 24 x 2 x 100 = 48 x 100 = 4,800
4,800 ÷ 200 = 4,800 ÷ 100 ÷ 2 = 48 ÷ 2 = 24

Children will use their understanding of place value to multiply/divide by one thousand:
Multiply by one thousand by shifting digits three places to the left (and placing zero in the ones/units column as a place holder, when appropriate)

Divide by one thousand by shifting digits three places to the right

62 x 1,000 = 62,000
62,000 ÷ 1,000 = 62

2.5 x 1,000 = 2,500
2,500 ÷ 1,000 = 2.5

0.45 x 1,000 = 450
450 ÷ 1,000 = 0.45

Consider using a place value chart to support understanding of multiplying and dividing numbers by 10/100/ 1000

Using partitioning and the distributive law to multiply

Children will multiply a two-digit number by a known multiple using their understanding of place value:

36 x 7 = (30 x 7) + (6 x 7)
= 210 + 42
= 252

47 x 8 = (40 x 8) + (7x 8)
= 320 + 56
= 376

Using partitioning to divide

Children will use their knowledge of partitioning numbers in different ways to divide a two-digit number by a single-digit number, including answers with remainders:

84 ÷ 6 = (60 ÷ 6) + (24 ÷ 6)

60 ÷ 6 = 10
24 ÷ 6 = 4

84 ÷ 6 = 14

87 ÷ 5 = (50 ÷ 5) + (37 ÷ 5)

50 ÷ 5 = 10
37 ÷ 5 = 7 remainder 2

87 ÷ 5 = 17 remainder 2 (or 17 2/5)

Extend with three-digit numbers divided by a single digit number:

132 ÷ 6 = (120 ÷ 6) + (12÷ 6)
20 + 2 = 22
132 ÷ 6 = 22

Using factor pairs

Children will recognise and use factor pairs to aid multiplication and division:

8 x 16 = 8 x 8 x 2 = 64 x 2 =128
12 x 14 = 12 x 7 x 2 = 84 x 2 = 168
25 x 12 = 25 x 4 x 3 = 100 x 3 = 300

90 ÷ 6 = (90 ÷ 3) ÷ 2 = 30 ÷ 2 =15
120 ÷ 8 = (120 ÷ 4) ÷ 2 = 30 ÷ 2 = 15

Doubling and halving

Children will know or derive doubles and related halves of numbers:

Double 75 is 150, half of 150 is 75

Double 7.5 is15, half of 15 is 7.5

Double 0.75 is1.5, half of 1.5 is 0.75

Children can use partitioning to support finding doubles of two-digit and three-digit numbers:

Double 176 (partition 176 into 100 + 70 +6)
Double 100 = 200
Double 70 = 140
Double 6 = 12
200 + 140 +12 = 352
Double 176 is 352

Half of 256 (partition 256 into 200 + 50 + 6)
Half of 200 = 100
Half of 50 = 25
Half of 6 = 3
100 + 25 + 3 = 128
Half of 256 is 128

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions using a range of vocabulary:

8 x 7
7 multiplied by 3
Multiply 7 by 9
What is the product of 9 and 6?
Double 135
What is six squared?
9 x 0
8^2

45 ÷ 9
Divide 56 by seven
How many twelves ‘go into’ 72?
64 divided by 8
Divide 96 by 12
What is the quotient when you divide 63 by 7?
144 ÷ 144
Half of 428

Using related calculations

Children will use knowledge of place value, inverse operations and related calculations:

12 x 8 = 96 therefore…
8 x 12 = 96
96 ÷ 12 = 8
96 ÷ 8 = 12

8 x □ = 9.6

960 ÷ □ =12

If you know 12 x 8 = 96, what else do you know?

46 x 5 becomes 23 x 10 (halve 46 and double 5)

35 x 14 becomes 70 x 7 (double 35 and halve 14)

75 x 4 can be found by doubling and doubling again

Year 6

Underpinning skills (end of year expectation)

- Recall multiplication/division facts for all multiplication tables up to 12 x 12 **with fluency**
- Identify factors, common factors, common multiples and prime factors
- Recall all square numbers to 12^2 (12 x 12 = 144)
- Understand the effect of multiplying/dividing whole numbers, and decimal numbers with up to three decimal places, by 10, by 100 and by 1,000
- Understand the order of operations using brackets (BODMAS)
- Estimate the answer to a calculation and use inverse operations to check

NB Ensure that underpinning skills, knowledge and strategies from previous year groups are secure

Strategies

Counting

Count in multiples of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 25, 50, 100 and 1000 from 0, forwards and backwards (to the 12^{th} multiple):

Use a counting stick to count forwards (and backwards) using known multiples, asking related multiplication and division questions; extend by counting in other multiples e.g. multiples of 70 or multiples of 0.7, using knowledge of place value

Ask children to count from zero in a known multiple e.g. 25s. When you clap, they count backwards. On the next clap, they count forwards, and so on; extend by counting in multiples of 250 or 2.5

Multiplying and dividing by 10/100/1,000

Children will use their understanding of place value to multiply/divide by ten and multiples of ten:

Multiply by ten by shifting digits one place to the left (and placing zero in the ones/units column as a place holder, when appropriate

6.5 x 10 = 65
65 x 10 = 650
650 x 10 = 6,500

65 x 20 = (65 x 10) x 2 = 1,300

Divide by ten by shifting digits one place to the right

65 ÷ 10 = 6.5
650 ÷ 10 = 65
6,500 ÷ 10 = 650

1,300 ÷ 20 = (1,300 ÷ 10) ÷ 2

Children will use their understanding of place value to multiply/divide by one hundred and multiples of 100:

Multiply by one hundred by shifting digits two places to the left (and placing zero in the ones/units column as a place holder, when appropriate)

Divide by one hundred by shifting digits two places to the right

2.05 x 100 = 205
205 ÷ 100 = 2.05

2.5 x 300 = (2.5 x 100) x 3 = 250 x 3 = 750
750 ÷ 300 = (750 ÷ 100) ÷ 3 = 7.5 ÷ 3 = 2.5

Children will use their understanding of place value to multiply/divide by one thousand and **extend** with multiples of 1,000:

Multiply by one thousand by shifting digits three places to the left (and placing zero in the ones/units column as a place holder, when appropriate)
Divide by one thousand by shifting digits three places to the right

162 x 1,000 = 162,000
162,000 ÷ 1,000 = 162

7.5 x 1,000 = 7,500
7,500 ÷ 1,000 = 7.5

0.25 x 1,000 = 250
250 ÷ 1,000 = 0.25

48 x 2,000 = (48 x 1,000) x 2 = 48,000 x 2 = 96,000
96,000 ÷ 2,000 = (96,000 ÷ 1,000) ÷ 2 = 48

Consider using a place value chart to support understanding of multiplying and dividing numbers by 10/100/ 1000

Using partitioning and the distributive law to multiply

Children will multiply a two-digit number by a known multiple using their understanding of place value:

46 x 7 = (40 x 7) + (6 x 7)
= 280 + 42
= 322

2.6 x 8 = (2x 8) + (0.6 x 8)
= 16 + 4.8
= 20.8

Using partitioning to divide

Children will use their knowledge of partitioning numbers in different ways to divide a two-digit number or a three-digit number by a single-digit number, including answers with remainders:

85 ÷ 5 = (50 ÷ 5) + (35 ÷ 5)
10 + 7 = 17
85 ÷ 5 = 17

97 ÷ 6 = (60 ÷ 6) + (37 ÷ 6)
60 ÷ 6 = 10
37 ÷ 6 = 6 remainder 1
97 ÷ 6 = 16 remainder 1 (or $16_{1/6}$)

161 ÷ 7 = (140 ÷ 7) + (21÷ 7)
140 ÷ 7 = 20
21 ÷ 7 = 3
154 ÷ 7 = 23

Using factor pairs

Children will recognise and use factor pairs to aid multiplication and division:

9 x 18 = 9 x 9 x 2 = 81 x 2 = 162
25 x 16 = 25 x 4 x 4 = 100 x 4 = 400
35 x 18 = 35 x 2 x 9 = 70 x 9 = 630

150 ÷ 6 = (150 ÷ 3) ÷ 2 = 50 ÷ 2 = 25
210 ÷ 14 = (210 ÷ 7) ÷ 2 = 30 ÷ 2 = 15

Doubling and halving

Children will know or derive doubles and related halves of numbers:

Use the fact double 85 is 170 to derive…
Half of 170; double 8.5; half of 17; double 0.85; half of 1.7

Children can use partitioning to support finding doubles of two-digit and three-digit numbers, including decimal numbers:

Double 387 (partition 387 into 300 + 80 +7)
Double 387 = 600 + 160 + 14 = 774

Half of 984 (partition 984 into 900 + 80 + 4)
Half of 984 = 450 + 40 + 2 = 492
(Use inverse to check)

Half of £71.30 (partition £71.30 into £70 + £1.00 + £0.30)
Half of £71.30 = £35 + +£0.50 + £0.15 =£35.65
(Use the inverse operation inverse to check)

Rapid recall

Give children the opportunity to respond rapidly to oral and written questions, using a range of vocabulary:

8 x 7
70 multiplied by 3
What is the product of 9 and 8?
25 x 4
Double 258
What is twelve squared?
9^2
What is two cubed?
10^3

72÷ 9
Divide 56 by seven
What is the quotient when 132 is divided by 12
How many twelves 'go into' 96?
200 ÷ 25
Half of 1,500

Using related calculations

Children will use knowledge of place value, inverse operations and related calculations:

9 x $\square$ = 6.3

630 ÷ $\square$ = 9

6 x a = 72, a =?

36 = a x b what are the possible values of a and b

If you know 9 x 7 = 63, what else do you know?

46 x 50 becomes 23 x 100 (halve 46 and double 50)

45 x 14 becomes 90 x 7 (double 45 and halve 14)

How does 9 x 12 = 108 help you to calculate 18 x 6?

13 x 99 = (13 x 100) – 99

125 x 4 can be found by doubling and doubling again
500 ÷ 4 can be found by halving and halving again

NOTES