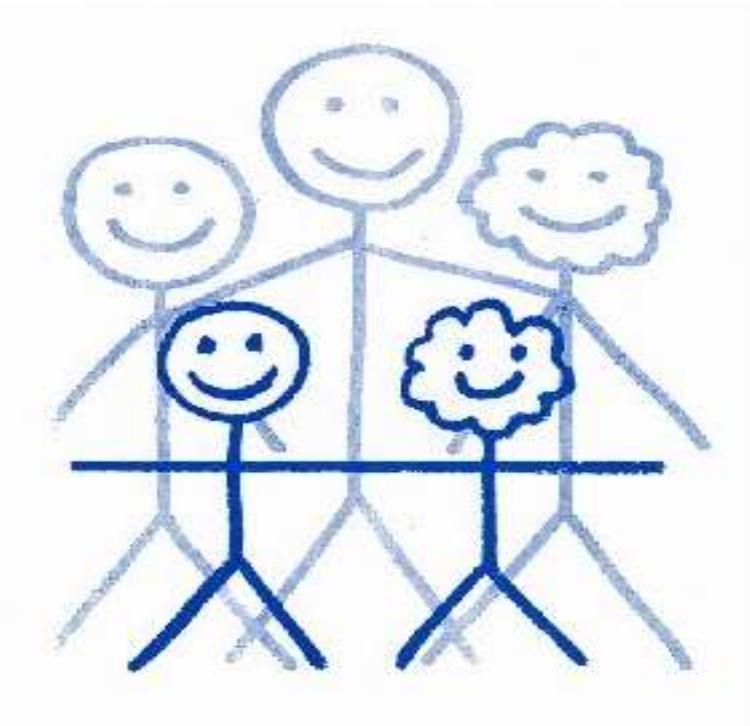
THORN GROVE PRIMARY SCHOOL



MATHEMATICS CALCULATING POLICY

PART ONE – ADDITION AND SUBTRACTION

Addition and subtraction should be taught simultaneously as children then appreciate relationships between operations. Inverse operation can be used as a checking strategy.

At all stages we must also consider the number system concept children need to underpin calculation strategies.

KS1

Statutory requirements of the 2014 national curriculum – Y1

Pupils should be taught to:

- read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = □ – 9.

Statutory requirements of the 2014 national curriculum – Y2

Pupils should be taught to:

- solve problems with addition and subtraction:
  - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - applying their increasing knowledge of mental and written methods
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - adding three one-digit numbers
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Lower KS2

Statutory requirements of the 2014 national curriculum – Y3

Pupils should be taught to:

- 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 three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.

Statutory requirements of the 2014 national curriculum – Y4

Pupils should be taught to:

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.

Upper KS2

Statutory requirements of the 2014 national curriculum – Y5

Pupils should be taught to:

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Statutory requirements of the 2014 national curriculum – Y6 (all operations)

Pupils should be taught to:

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

ADDITION

Nursery

Practical experiences

- Practical activities involving addition.
- Songs and rhymes

EYFS to Year 1

Add and subtract one digit and two digit numbers to 20 including zero

Step 1

2 + 5 =

Count out each set, then find the total

Step 2

2 + 5 =

Count on from first number (Cover first number or display as numeral)

Step 3

2 + 5
Leading to

5 +
5 + 2 (without counters)

Recognise the biggest number in the calculation and count on from it (using objects for smaller number if necessary)

Step 4

2 + 5
5 + 8
4 + 13
11 + 7

Recognise the biggest number in the calculation and count on from it mentally or using number line

Step 5 – includes knowledge of number bonds as well as the strategies from the previous steps

6 + 8 becomes
8 + 2 + 4

Partitioning the smaller number and use the tens number to bridge calculation

5 + 17 becomes
17 + 3 + 2

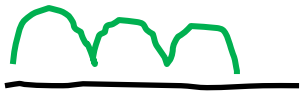
Year 2

Add and subtract numbers using concrete objects and pictorial representations, and mentally including (a 2 digit number and ones, a two digit number and tens, to two digit numbers, adding 3 one digit numbers)

Step 1

6 + 18
By counting on from the largest number

30 + 46
By counting on in tens



46 56 66 76

Step 2

6 + 58
By partitioning the smaller number through the multiple of 10
58 + 2 + 4

58 60 64

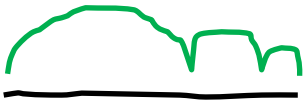
22 + 50
By counting in groups of ten and one from largest number

50 70 72

Step 3

TU + TU within 100

37 + 44



44 74 80 81

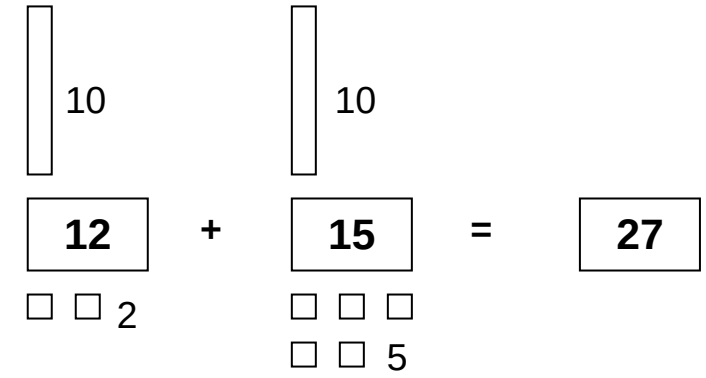
or
40 + 30 = 70
7 + 4 = 11
70 + 11 = 81

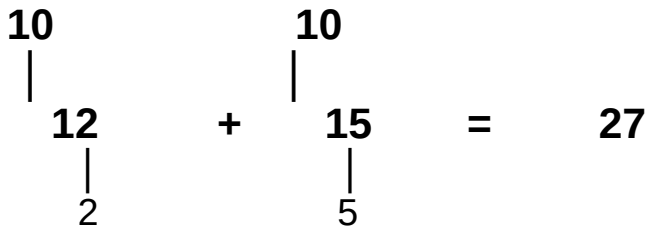
Or
44 + 40 – 3 = 81
Recall of facts to 20 and by recall of adding multiples of 10 will support this thinking

Step 4

- Use partitioning to work out 2 digit addition

Model A





Model B

$$52 + 35 = 50 + 2 + 30 + 5$$
$$= 50 + 30 + 2 + 5$$
$$= 80 + 7$$

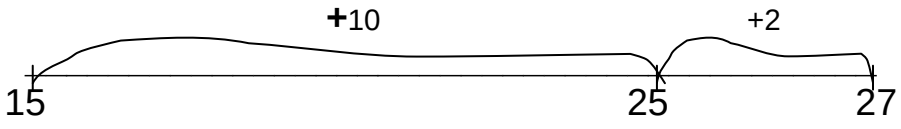
Show both models, using concrete model for as long as necessary, until children are secure with concept.

Success Criteria

1. Partition numbers into Tens and Units
2. Add the Tens
3. Add the units
4. Add all answers together

After working out children should always be encouraged to check the answer. Eg use inverse operation, alternative method, number line

eg **27 – 15**



Scaling up known number facts

- Understanding of place value in addition sequences

E.g. **4 + 4 = 8**
40 + 40 = 80
400 + 400 = 800

Step 6

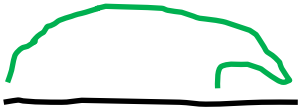
Addition of three single digits – look for bonds you know and doubles

6 + 9 + 3
6 + 3 =9
Double 9 = 18

Step 7

Special cases + 9

9 + 33



33 42 43

Using Doubles
29 + 30 is the same as
30 + 30 – 1

Year 3

Add and subtract number mentally including: a 3 digit number and ones, a 3 digit number and tens, a 3 digit number and hundreds, Two 2 digit numbers across a hundred

Step 1

Partitioning the numbers for TU + TU across 100

55 + 78
70 + 50 = 120
8 + 5 = 13
120 + 13 = 133

55 + 78
78 + 50 = 128
128 + 2 + 3 = 133

Recall of facts to 20 and by adding multiples of 10 will support this thinking

Step 2

Special cases

66 + 79

80 +66 – 1 = 145

Using doubles

76 + 78
Double 70 + double 6 + 2
Double 70 + double 8 – 2

Recall of facts to 20 and by adding multiples of 10 will support this thinking

Step 3

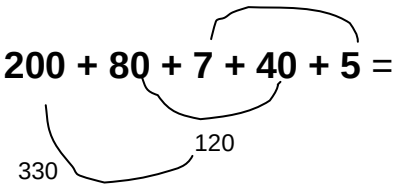
Partitioning
Adding ones and tens to a 3digit number

356 + 8
356 + 4 + 4 = 364

356 + 70
350 + 70 + 6 = 420

356 + 600
300 + 600 + 56 = 956

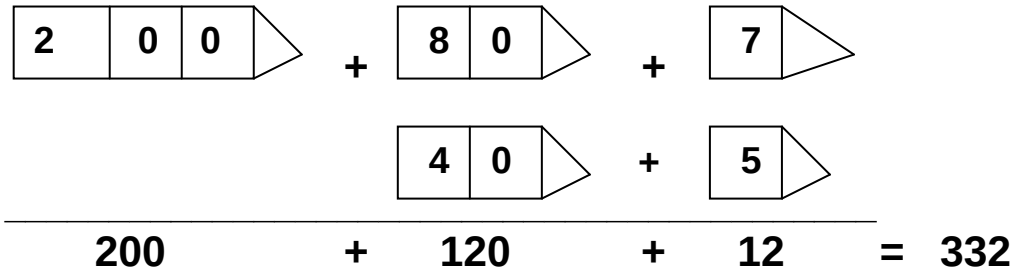
Partitioning HTU;



Success Criteria

1. Partition each number into Hundreds, Tens and Units
2. Add the 100s together
3. Add the 10s together
4. Add the units together
5. Add together the total number of 100s, 10s and units

Partitioning using place value arrow cards



Vertical recording of partitioning;

200 (200+0)
120 (80 + 40)
+ **12** (7 + 5)
332

Step 4

Addition of three digit + 2 digit numbers and 3-digit + 3 digit

```
  2 6 8
    7 9
  ------
  2 0 0
  1 3 0
    1 7
  ------
  3 4 7
```

```
  2 6 8
  1 7 9
  ------
    1 7
  1 3 0
  3 0 0
  ------
  4 4 7
```

Step 5

Addition of numbers with decimal places

1.5 + 1.5
Double 1 and double 0.5

1.6 + 1.7
1.7 + 0.3 + 1.3 = 3.3

Year 4

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

Step 1

Using mental strategy where appropriate

1460 + 499

1460 + 500 – 1 = 1959

2560 + 3570
6000 + 130 = 6130

Step 2

Addition of three digit + 3-digit and four digit + four digit

```
  5 7 6
  3 6 9
  9 4 5
  1   1
```

```
  7 2 6 8
  5 1 7 9
1 2 4 4 7
1   1 1
```

Step 3

Addition of numbers to 2 decimal places

```
    4. 4 5
    3. 5 5
    8. 0 0
      1 1
```

```
  5 7. 8 9
  4 6. 6 7
1 0 4. 5 6
  1 1 11
```

Year 5

Add and subtract numbers mentally with increasingly large numbers eg 5-digit – 4-digit multiple of 10

AND

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

Step 1

Using mental calculation by counting on

45678 + 3500 = 49178
45678 + 3000 = 48678
42678 +500 = 49178

5.78 + 2.45 = **8.23**
5.78 + 2 = 7.78
5.73 + 0.4 = 8.18
5.33 + 0.05 = 8.23

Step 2

Column addition with 5 or 6 digits

5 8 7 6 5
2_1 9_1 6_1 4_1 8 +
8 8 4 1 3

Step 3

Mixed decimals

57 .89 + 46.6 + 23.785

2 3. 7 8 5

5 7. 8 9

4 6. 6

1 2 8. 2 7 5

1 1 2 1

Year 6

Perform mental calculations, including with mixed operations and large numbers

Step 1

Partitioning

4.578 + 0.008 = 4.586

6.568 + 0.079 = 6.647
6.568 + 0.07 = 6.638
6.638 + 0.009 = 6.647

Step 2

Column addition with 5 or 6 digits

5 8 7 6 5

2_1 9_1 $6_1$4$_1$8 +

8 8 4 1 3

Step 3

Using all 4 operations

6 + 7 × 8 = 62
because multiplication first then addition when there are no brackets

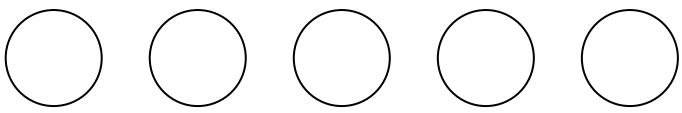
2780 – 910 + 1220 can be reordered to 2780 + 1220 – 910= 3090 as long as the symbol moves with the number

SUBTRACTION

Nursery

Number rhymes and songs / with actions
Use of practical resources to illustrate the song

Eg 5 currant buns in the bakers shop ……..
…… And took it right away



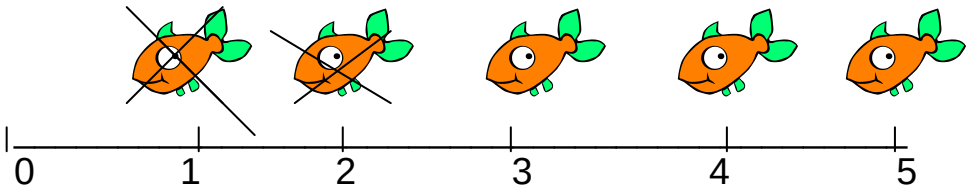
mark the place of the subtracted object, eg leave a plate for each bun.
Also take the opportunity to link to the inverse operation;
4 buns on the plates and one in the bag

EYFS and Year 1

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

Step 1

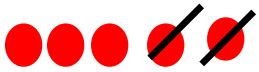
- Use of drawing and practical objects for taking away
- Pictorial representation
- Linked to number line underneath



5 – 2 = 3

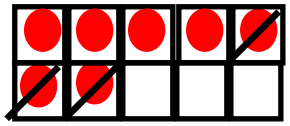
5 – 2

Count out 5 and remove 2 to find the answer



7 – 3

Using a 10 frame to subtract - The children may subsidise how many are remaining without having to count them all.



NB Add number line when pictorial representation is understood.

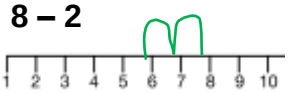
Step 2

7 – 2

Count back on the number line by saying start on 7, count back 1,2, what number are you on?

Step 3

8 – 2



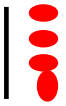
14 – 3

Count backwards mentally or using a number line.

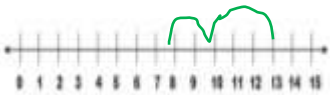
Step 4

15 – 5

Use tens and ones when the calculation doesn't bridge 10



13 – 5



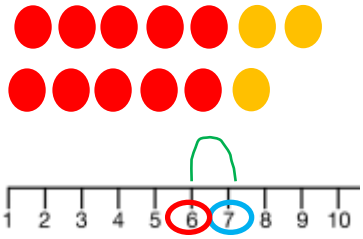
becomes **13 – 3 – 2**

Partitioning the number being subtracted through the multiple of 10 mentally or using a number line

Step 5

Difference

7 – 6 or find the difference between 7 and 6

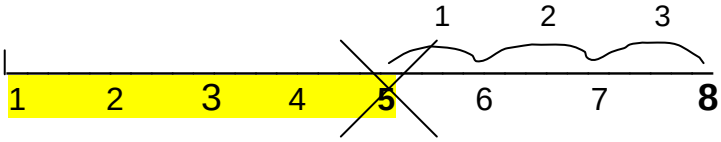


- Finding the difference or How many more!

Pictorially:

8 – 5 = 3

using a number line: find the difference by counting on



This is easy to illustrate using a commercial number line. I.e John has 5 stickers Mary has 8 stickers. How many more has Mary got?

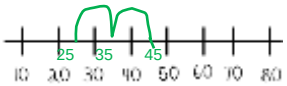
Year 2

Add and subtract numbers using concrete objects and pictorial representations, and mentally including (a 2 digit number and ones, a two digit number and tens, to two digit numbers, adding 3 one digit numbers)

Step 1
Subtracting by counting backwards in tens or ones

28 – 4

45 – 20
Use tens and ones when the calculation doesn't bridge 10



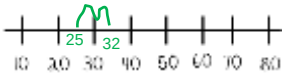
Partitioning
28 – 8 = 20
76 – 70 = 6

- Partitioning (2)

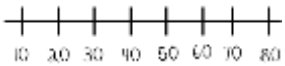
  93 – 76 =
  (93 – 70) – 6 = 23 – 6
  = 17

  use Dienes apparatus / money to model

Step 2
Subtracting in groups of ten(rather than counting in tens) or groups of ones (by partitioning number being subtracted through multiple of 10)
32 – 7
32 – 2 – 5

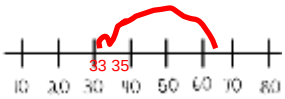


64 – 40
Use a number line or manipulatives



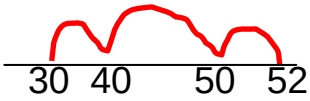
Step 3

65 – 32



52 – 16

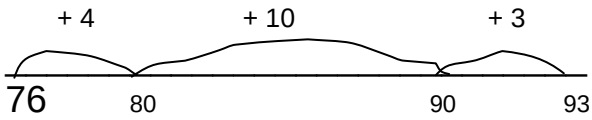
This calculation bridges through 10 so we need to partition the 16 into 2/4/10 or 12/4 and subtract



As a word problem

There are 93 girls in Y4 and 76 boys. How many more girls than boys?

- use counting on to find the difference

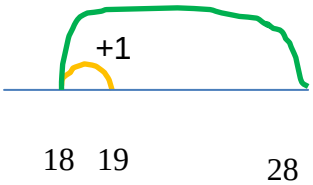


= 17

Special cases

When subtracting 9 or 19

28 – 9



Or 28 – 10 + 1

Missing numbers

- use understanding of inverse operations / commutativity to solve problems

90 - □ = 37

90 - 37 = □ 90 – 30 = 60

60 – 7 = 53

or **37 + □ = 90** use counting on

Year 3

Add and subtract number mentally including: a 3 digit number and ones, a 3 digit number and tens, a 3 digit number and hundreds, Two 2 digit numbers across a hundred

Step 1

Partitioning

Subtracting ones and tens from a 3digit number

567 – 60 = 507
745 – 700 = 45
832 – 2 = 830

364 – 8
364 – 4 – 4 = 356

356 – 70
356 – 50 – 20 = 286

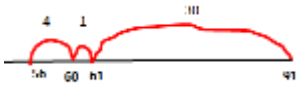
956 – 600
956 – 600 = 356

Step 2

TU – TU

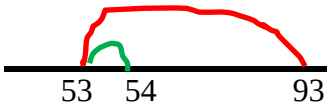
By counting back in tens and ones

91 – 35
91 – 30 – 1 – 4



Special cases

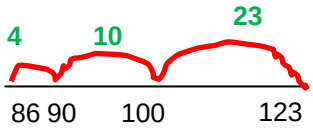
93 – 39 as
93 – 40 + 1



Step 3

Subtraction up to three digits

123 – 86 = 37



£5.67 – £2.20

£5.67 – £2.00 = £3.67
£3.67 – 20p = £3.47

Step 4
Expanded column subtraction

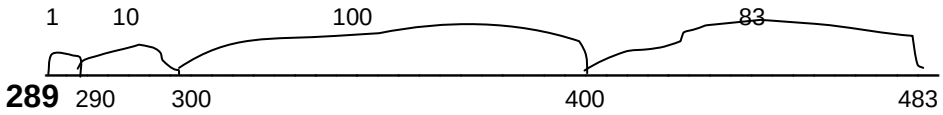
347 – 165 = 182

200	140	7
~~300~~	40	7
100	60	5
100	80	2

436 – 177 = 259

300	120	16
~~400~~	~~30~~	7
100	70	7
200	50	9

number line model leading to vertical method:



= 194

- vertical method leading to formal column subtraction

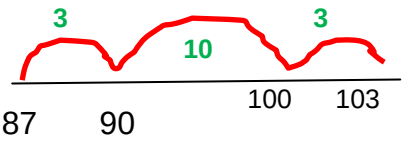
(use 100) (use 10)

	300		170		13
	~~400~~	+	~~80~~	+	~~3~~
-	200	+	80	+	9
	100	+	90	+	4

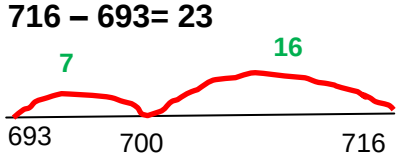
Difference

Difference
(see also subtraction up to three digits)

103 – 87 = 16
When numbers are close together, count on from the smallest number through the multiple of ten or count back from the largest to the smallest through the multiple of ten.



716 – 693= 23



Year 4

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

Step 1
Partitioning

1678 – 600 = 1078
2689 – 80 = 2609
6839 – 9 = 6830
7484 – 1100 = 6384

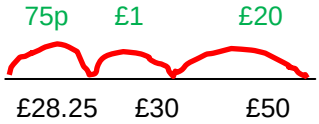
Step 2
Using mental calculation when appropriate by counting back

5678 – 2342 =
5678 – 2000 = 3678
3678 – 300 = 3378
3378 – 40 = 3338
3338 – 2 = 3336

See difference also

Step 3
Subtraction up to four digits

£50 – £28.25 = £21.75



Step 4
Expanded column subtraction

With three digit numbers asY3 and 4-digit numbers

3326 – 2678 = 658

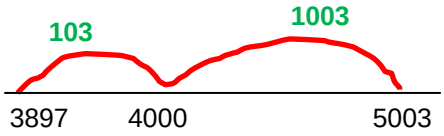
2000	**1200**	**120**	**16**
~~**3000**~~	~~**-300**~~	~~**-20**~~	**6**
2000	**600**	**70**	**8**
	600	**50**	**8**

Moving to compact decomposition as Year 5
Decomposition (examples)

537	615
- 119	- 157
418	418

Step 5
Difference

5003 – 3897= **1106**



Year 5

Add and subtract numbers mentally with increasingly large numbers eg 5-digit – 4-digit multiple of 10

AND

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

Step 1
Partitioning

6.76 – 0.06 = 6.7
7.47 – 0.4 = 7.07

Step 2
Using mental calculation by counting back

45678 – 3500 = 42178
45678 – 3000 = 42678
42678 – 500 = 42178

5.78 – 2.45 =3.33
5.78 – 0.05 = 5.73
5.73 – 0.4 = 5.33
5.33 – 2 = 3.33

Step 3
Difference
Use bonds to 100 to support

£10 – £7.71 = £2.29
Use a number line or jottings

£7.71 £8.00 = 29p
£8.00 → £10.00 = £2

7 – 2.45 = 4.55

2.45 → 3 = 0.55
3 → 7 = 4

Step 4
Column subtraction

$$\begin{array}{r} {}^{2}\not{3}\ {}^{1}8\ 7\ {}^{5}\not{6}\ {}^{1}5 \\ 1\ 9\ 2\ 4\ 8 \\ \hline 1\ 9\ 5\ 1\ 7 \end{array}$$

Year 6

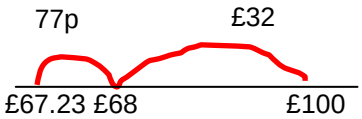
Perform mental calculations, including with mixed operations and large numbers

Step 1
Partitioning

4.578 – 0.008 = 4.57
6.378 – 0.07 = 6.308

Step 2
Difference using larger numbers and number facts

£100 – 67.23= £32.77



Step 3
Difference (use mixed decimals)

6.45 – 1.7 = 4.75

1.7 → 2 = 0.3
2 → 6.45 = 4.45

PART TWO – MULTIPLICATION AND DIVISION

As with addition and subtraction the concepts of multiplication and division should be taught at the same time.

KS1

Statutory requirements of the 2014 national curriculum – Y1

Pupils should be taught to:

- 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.

Statutory requirements of the 2014 national curriculum – Y2

Pupils should be taught to:

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

Lower KS2

Statutory requirements of the 2014 national curriculum – Y3

Pupils should be taught to:

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which ‘n’ objects are connected to ‘m’ objects.

Statutory requirements of the 2014 national curriculum – Y4

Pupils should be taught to:

- recall multiplication and division facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Upper KS2

Statutory requirements of the 2014 national curriculum – Y5

Pupils should be taught to:

- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

- recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

Statutory requirements of the 2014 national curriculum – Y6 (all operations)

Pupils should be taught to:

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Nursery

Through role play/general play situations find pairs of.
e.g. How many socks will we need for the three bears?
How many buckets and spades will we need for everyone to have one each in the sand?

Reception

- Sorting objects into groups
  e.g. We have got 4 biscuits how can we share them out equally (fairly) between the two of us?
- Playing pairs game i.e snap,
  Recognising the doubles in dominoes and dice games
  (using the language you have a pair/you have a double)

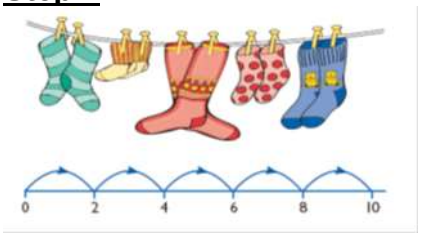
Year 1

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

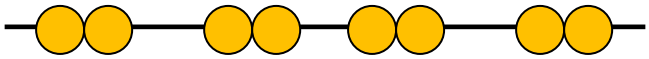
Step 1

Count in multiples of twos, fives and tens

Step 2

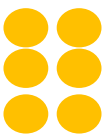


Sharing models and images



Step 3

There are two apples on one plate.
How many apples on 3 plates?



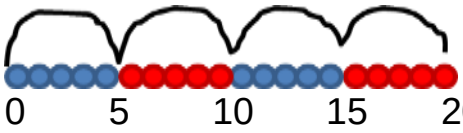
Year 2

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

Step 1

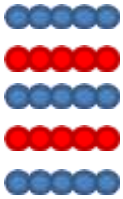
Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers

Step 2

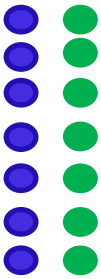


5 × 4 = 20

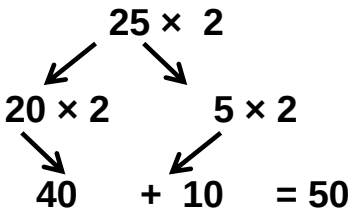
5 × 4 = 20

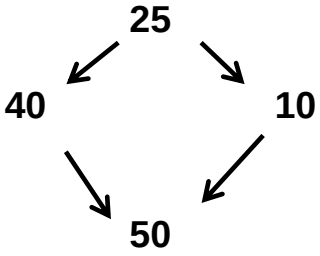


Step 3

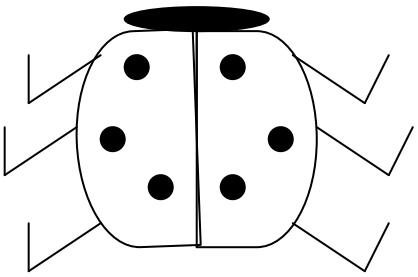


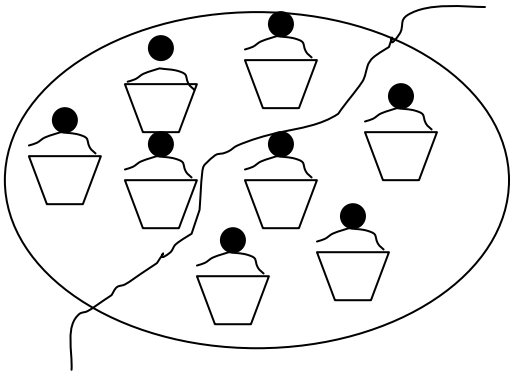
Recall and derive doubles





Practical illustrations of **finding half of numbers** not just fractions of shapes!





Step 4

- Counting in 2s, 5s and 10s on and back starting at zero
  then counting from other numbers.
  - Know times tables and related division facts for the 2, 5 and 10 times tables
  - Know halves and doubles of numbers to 10

- Repeated addition with small numbers, illustrated by

1. practical examples.

2+2+2=

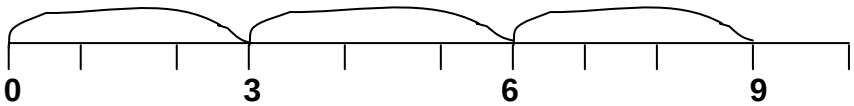
3x2=6

2. arrays

3x2=6 **2x3=6**

3. number lines

3+3+3=



3x3=9

Year 3

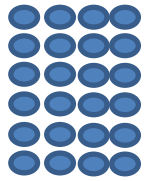
Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods

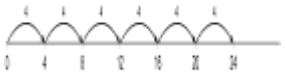
Step 1

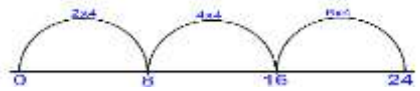
Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables

Multiply single digits by 20,30,40,50 and 80

Step 2







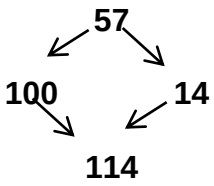
4 × 6 = 24

Use arrays and number lines to count in multiples

Step 3

Using partitioning to multiply

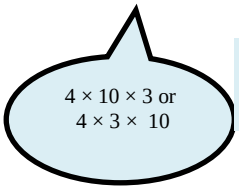
57 × 2 = 114
50 × 2 7 × 2
100 + 14 =114



Step 4

48 × 3 = 144
(Partitioning)

×	40	8
3	120	24



120 + 24
= 144

Year 4

×	60	7
9	540	63

540 + 63 = 603

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

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

Step 1

Recall multiplication and division facts for multiplication tables up to 12 × 12 (facts for 6,7,9,11,12 are new)

Multiply single digits by 60,70, and 90

Step 2

Mental

Multiplying by 10 and 100
Eg. 24 × 100

Th	H	T	U
		2	4
2	4	0	0

Partitioning
267 × 2
200 × 2 = 400
60 × 2 = 120
7 × 2 = 14

400 + 120 + 14 = 534

Step 3

67 × 9

× 60 7

9 540 63

437 × 6

×	400	30	7
6	2400	180	42

2400 + 180 + 42 = 2622

Step 4

Partitioning grid multiplication leading to formal compact methods

67 × 9 =

$$\begin{array}{r} 6\ 7 \\ {}^{6}\ 9 \\ \hline 6\,0\,3 \end{array}$$

Y4

- To **learn** multiplication facts and related division facts up to 12 x 12

Y3 methods extend to include 3 digit numbers x 1 digit.

Y5

Step 6

- Extend to two digit by a multiple of 10

42x30

x	**40**	**2**	**=1260**
30	**1200**	**60**	

\ /

add mentally

Success Criteria

1. Draw a grid
2. Partition the 2-digit number and write it on the top line
3. Multiply each part by the multiplier NB. x30 is the same as x3 x10
4. Add the products together

- Extend to 2, 3 and 4 digit by 1 and 2 digit

34x27

x	30	4	
20	600	80	→ 680) add these mentally if possible
7	210	28	→ 238)

Success Criteria

1. Draw a grid
2. Partition both numbers into tens and units and write in the grid
3. Calculate products and complete all four parts of the grid
4. Add the horizontal products together to get a sub total
5. Add the sub totals together to get a final total

Step 7

Short multiplication

24 × 6 becomes

```
  2 4
×   6
-----
  1 4 4
    2
```

Answer: 144

342 × 7 becomes

```
  3 4 2
×     7
-------
  2 3 9 4
    2 1
```

Answer: 2394

2741 × 6 becomes

```
  2 7 4 1
×       6
---------
  1 6 4 4 6
    4 2
```

Answer: 16 446

- **Success Criteria**
  1. Multiply the units column
  2. Carry any tens
  3. Multiply the tens column
  4. Add on any carried tens

- Expanded vertical notation (hug, hug, kiss, kiss)

56	
x 27	
1000	**(50 x 20)**
120	**(6 x 20)**
350	**(50 x 7)**
42	**(6 x 7)**
1512	

Success Criteria

1. Use (X) to identify the four calculations required
2. Work out product of each one and write answers in correct HTU columns
3. Use column addition to find the total

- Compact method-same calculation different layout

34x27

	34	
x	**27**	
	238	**(7x34)**
+	**680**	**(20x34)**
	918	

Success Criteria

1. Partition one 2-digit number into tens and units
2. Identify the two calculations required
3. Work out product of each one and write answers in correct HTU columns
4. Use column addition to find the total

Y6

Standard long multiplication

24 × 16 becomes

```
    2
   2 4
 × 1 6
-------
 2 4 0
 1 4 4
-------
 3 8 4
-------
```

Answer: 384

124 × 26 becomes

```
    1 2
   1 2 4
 ×   2 6
---------
 2 4 8 0
   7 4 4
---------
 3 2 2 4
---------
 1 1
```

Answer: 3224

124 × 26 becomes

```
    1 2
   1 2 4
 ×   2 6
---------
   7 4 4
 2 4 8 0
---------
 3 2 2 4
---------
 1 1
```

Answer: 3224

Success Criteria

1. Set out the numbers according to place value.
2. Multiply each digit of the top number by the digit in the units column of the bottom number, starting with the units column and then the tens. Remember to carry over and then add on to the next product.
3. Because you are now going to multiply by the tens column, put a zero in the units column of your answer before you start.
4. Multiply each digit of the top number by the digit in the tens column of the bottom number.
6. Add the two answers to obtain the final answer.

Division

As with addition and subtraction the concepts of multiplication and division should be taught at the same time.

Step 1

F1

- Through role play/ general play situations find pairs of. E.g. How many socks will we need for the three bears? How many buckets and spades will we need for everyone to have one each in the sand?

F2

- Sorting objects into groups e.g. We have got 4 biscuits how can we share them out equally (fairly) between the two of us?
- Playing pairs game e.g. snap, pelmanism. Recognising the doubles in dominoes and dice games (using language you have a pair/ you have double).

Y1

Step 2

- Counting in 2s and 10s.
- Identifying doubles via dice games and using dominoes.

- Practical illustrations of finding half of numbers not just fractions of shapes!

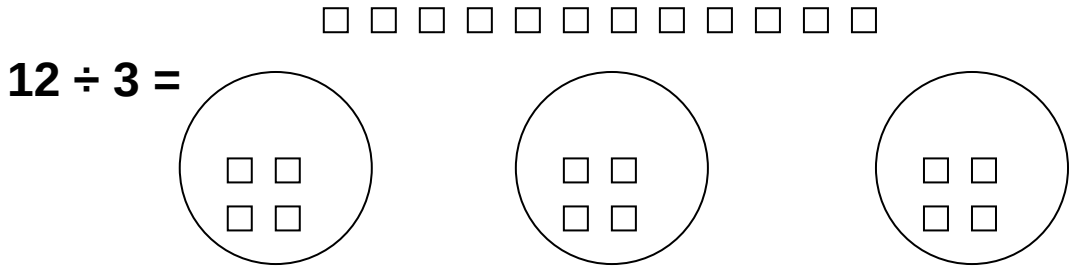
Before the children progress through the next steps they should:

- **Be able to halve numbers and begin to understand relationship between x and ÷, such that division facts can be derived from multiplication.**

10 ÷ 2 = 5 **5 x 2 = 10**

Y2/3

They should have experience of sharing



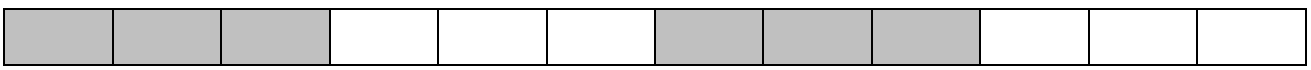
12 ÷ 3 =

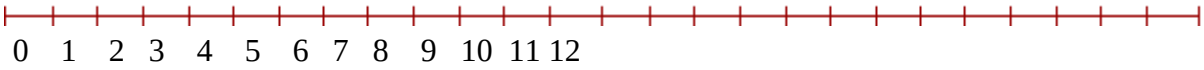
Success Criteria

1. Look at the bigger number
2. Share objects into groups, so each group has an equal amount
3. How many objects are in each group?

- and of grouping (repeated subtraction) using arrays

12÷3= how many 3's make 12?





- counting up and back

Success Criteria – counting on

1. Start at zero
2. Count up in correct number of steps
3. Stop when you reach the biggest number
4. How many jumps did you make?

Success Criteria – counting back

1. Start at the biggest number
2. Count back in correct number of steps
3. Stop when you reach zero
4. How many jumps did you make?

- be able to work out examples such as 12 ÷ 3 by rephrasing as 'how many 3s make 12?'
  then counting up in multiples of 3 to 12. 3,6,9,12. 4 x 3 = 12
  therefore there are 4 threes in 12

Y4

Step 5

The idea of repeated subtraction 'how many_make_'is carried through to the informal written method-'CHUNKING' –repeated subtraction of the divisor and multiples of the divisor.

- Model with a simple calculation to link to mental

Eg. **12 ÷ 3**

12		
- 3	**(1x3)**	**4 groups of 3**
9		**have been**
- 3	**(1x3)**	**subtracted**
6		
- 3	**(1x3)**	
3		
- 3	**(1x3)**	

0

Success Criteria

1. Take away one chunk of the divisor
2. Subtract from large number to find out how many are left
3. Repeat this process until you reach zero or there is not enough left to subtract a full chunk
4. Count how many chunks you have taken away

- Increase size of numbers so that the chunking written method is more efficient than counting up.

Subtract any 'chunk' the child knows but suggest the 10^{th} multiple as a known fact.

Success Criteria

1. Take away chunks (groups) of the divisor
2. Subtract from large number to find out how many are left
3. Repeat this process until you reach zero or there is not enough left to subtract a full chunk
4. Count how many chunks (groups) you have taken away

e.g. **73 ÷ 5** *how many 5's make 73?*

73
-50 (10x5)
23
-20 (4x5)
3 *how many 5's have been subtracted?*
14 sets of 5 and 3 remainder

73 ÷ 5 = 14 r 3

Y5

Step 6

Extend chunking to introduce division notation and up to 4 digits by 1 digit.

5 √ 73
- 50 (10x5)
23
20 (4x5) 10 + 4
3

Answer = 14 r 3

Step 7

- Extend to up to 4 digit divided by 2 digit

36 √ 972
- 720 (20x36)
252
180 (5x36)
72
72 (2x36) 20 + 5 + 2

Answer = 27

Step 8

- Extend to short hand division

81 ÷ 3

3 √ 60 + 21

20 + 7 = 27

Success Criteria

1. Partition large number into multiples of the divisor
2. Divide each part of the larger number by the divisor
3. Add the answers to form a total for the division

Step 9

Short division

98 ÷ 7 becomes

$$7\overline{)98} = 14$$

Answer: 14

432 ÷ 5 becomes

$$5\overline{)432} = 86 \text{ r } 2$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$11\overline{)496} = 45\tfrac{1}{11}$$

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

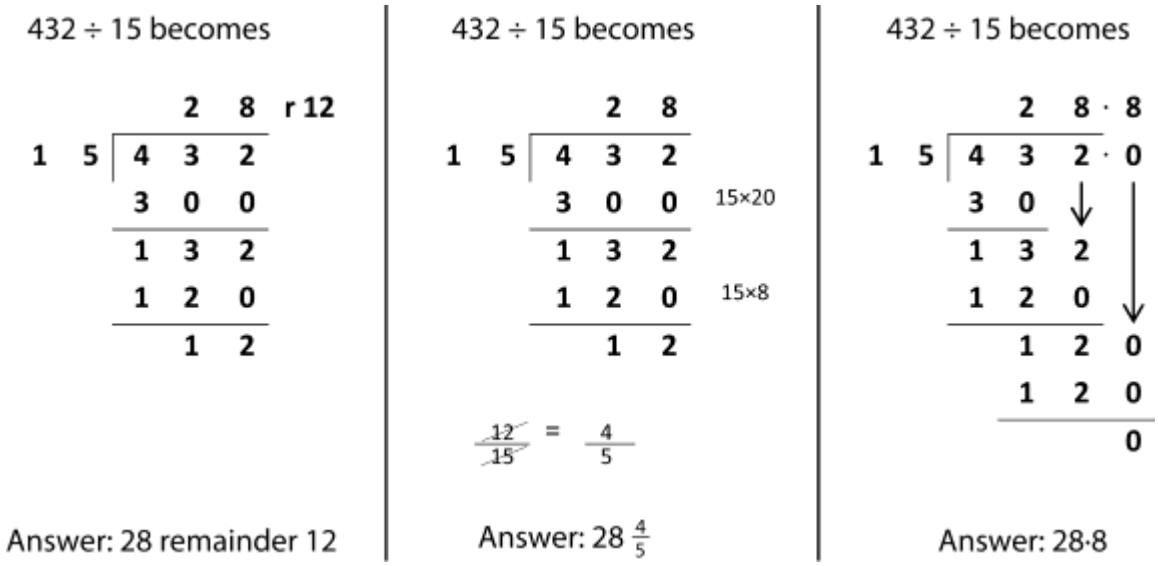
Success Criteria

1. Divide the divisor into the first digit.
2. Write above how many times it divides into the number.
3. Carry over the remainder.
4. Repeat until you get to the end of the dividend.
5. If the divisor is too great and doesn't divide into the digit, carry the whole of that digit over.

Y6

Step 10

- Extend short division up to 4 digit by 2 digit
- Long division



Success Criteria

- Divide the divisor into the first digit. If it doesn't go, carry over the number.
- Divide the divisor into the next digit/ 2 digits.
- Write how many times it divides in above.
- Take the product of the divisor and the number of times it divides and insert below and then subtract this from the dividend.
- Bring down the next digit.
- Continue in this way until there are no digits to bring down.