Shipley CE Primary Guide to NUMBER

Family guide to how we teach the four aspects of number:

- Addition
- Subtraction
- Multiplication
- Division

ADDITION

MENTAL CALCULATIONS

These are a **selection** of mental calculation strategies:

Mental recall of number bonds

6 + 4 = 10 □ + 3 = 10

25 + 75 = 100 19 + □ = 20

Use near doubles

6 + 7 = double 6 + 1 = 13

Addition using partitioning and recombining

34 + 45 = (30 + 40) + (4 + 5) = 79

Counting on or back in repeated steps of 1, 10, 100, 1000

86 + 57 = 143 (by counting on in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Add the nearest multiple of 10, 100 and 1000 and adjust

24 + 19 = 24 + 20 – 1 = 43

458 + 71 = 458 + 70 + 1 = 529

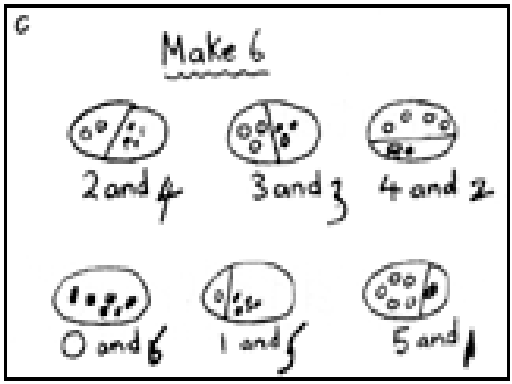
Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

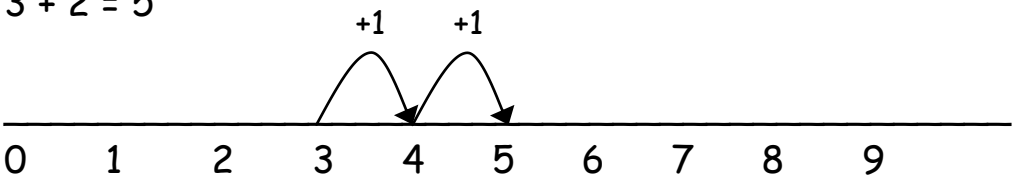
YR and Y1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



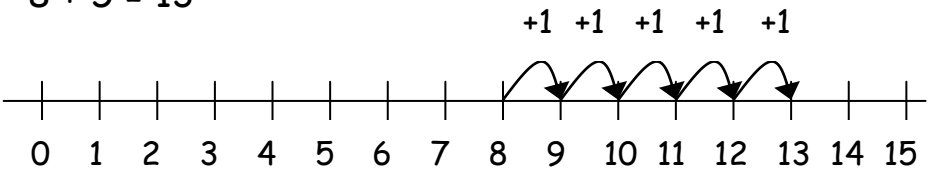
They use numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5

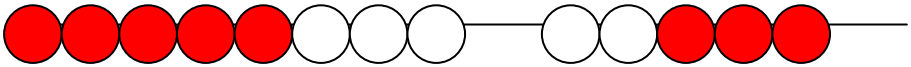


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



including bridging through ten by counting on 2 then counting on 3.

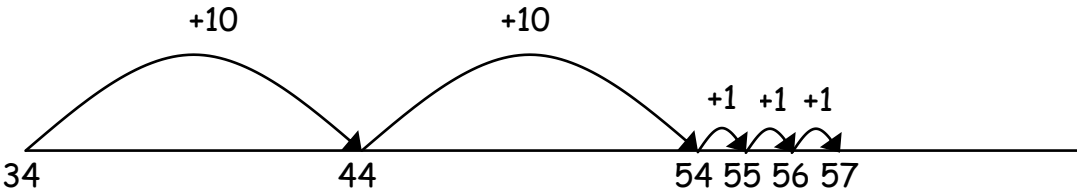


Y2

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

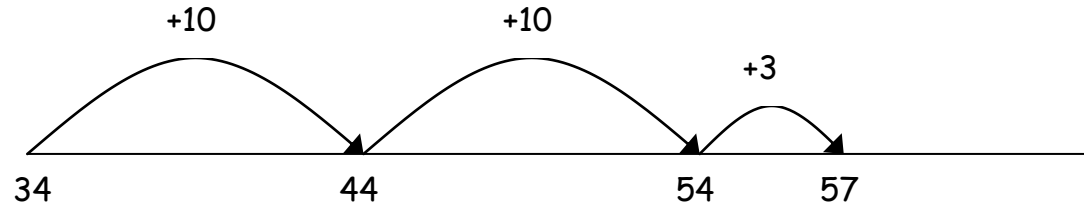
✓ First counting on in tens and ones.

34 + 23 = 57



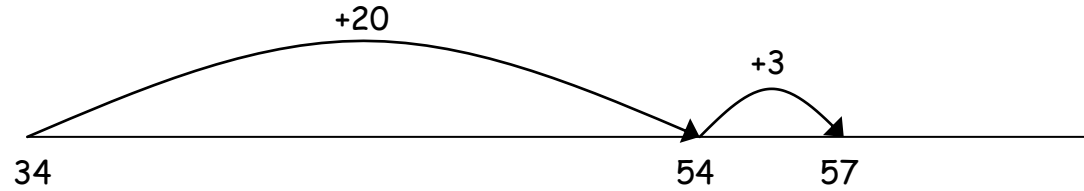
✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



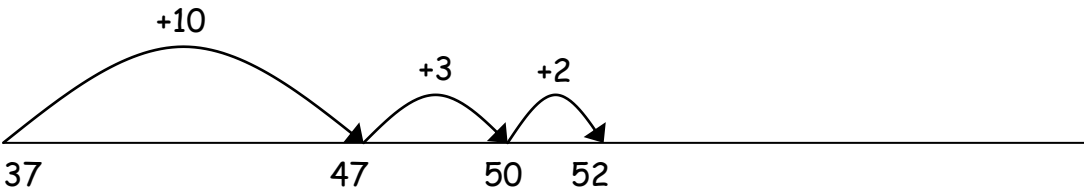
✓ Followed by adding the tens in one jump and the units in one jump.

34 + 23 = 57



✓ Bridging through ten can help children become more efficient.

37 + 15 = 52

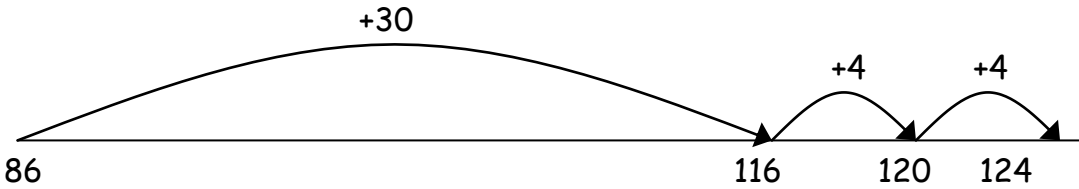


Y3

Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate.

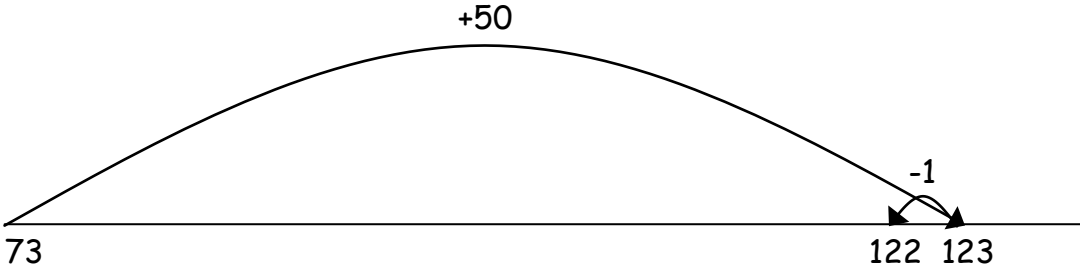
- ✓ Count on from the largest number irrespective of the order of the calculation.

38 + 86 = 124



- ✓ Compensation

49 + 73 = 122



Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

Expanded written method
Adding most significant digits first

```
  67
+ 24
  80  (60 + 20)
  11  ( 7 + 4)
  91
```

```
  267
+  85
  200
   140  (60 + 80)
    12  ( 7 +  5)
  352
```

Y4

Consolidate expanded written method, adding most significant digits first.
Leading on to adding the least significant digits first

67
+ 24
11 (7+4)
80 (60 + 20)
91

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- ✓ *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.*

Y5

Children should consolidate the carrying method involving numbers with at least four digits.

587	3587
+ 475	+ 675
1062	4262
1 1	1 1 1

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to three digits and the same number of decimal places;*

- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m – 280 cm.*

Y6

Children should extend the carrying method to numbers with any number of digits.

SUBTRACTION

MENTAL CALCULATIONS

Mental recall of subtraction facts

10 – 6 = 4 17 - □ = 11

20 - 17 = 3 10 - □ = 2

Find a small difference by counting up

82 – 79 = 3

Counting on or back in repeated steps of 1, 10, 100, 1000

86 - 52 = 34 (by counting back in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 - 19 = 24 - 20 + 1 = 5

458 - 71 = 458 - 70 - 1 = 387

Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

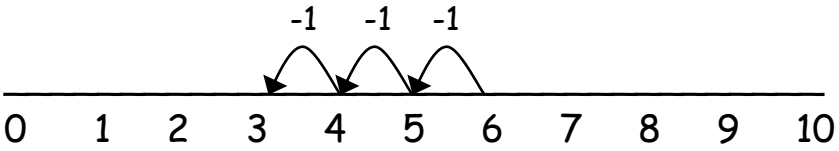
MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Year R and Year 1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

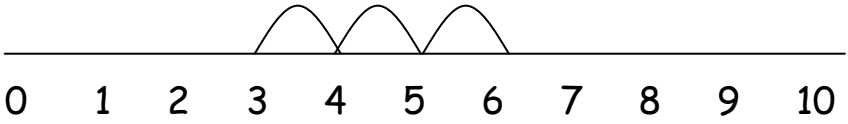
They use numberlines and practical resources to support calculation. Teachers *demonstrate* the use of the numberline.

6 – 3 = 3



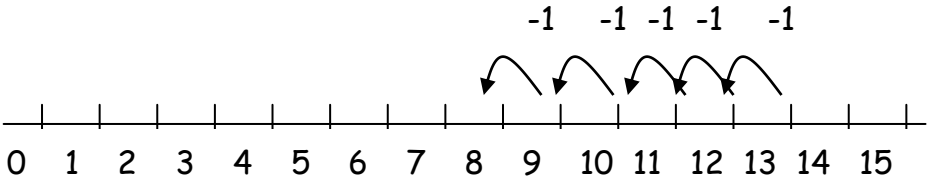
The numberline should also be used to show that 6 - 3 means the 'difference between

6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



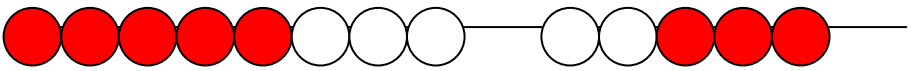
Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 – 5 = 8



Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

13 – 5 = 8

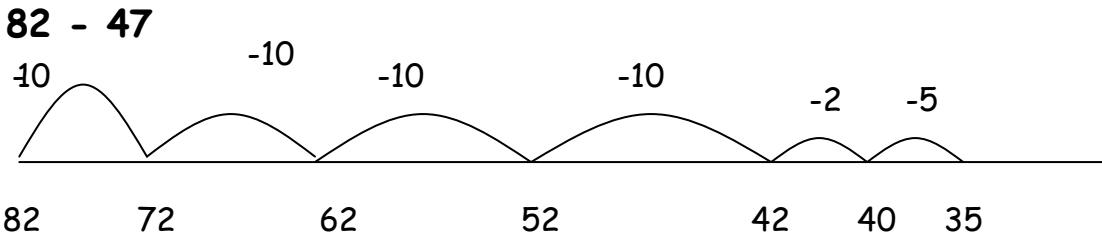


Year 2

Children will begin to use empty number lines to support calculations.

Counting on

Count up from 47 to 82 in jumps of 10 and jumps of 1.



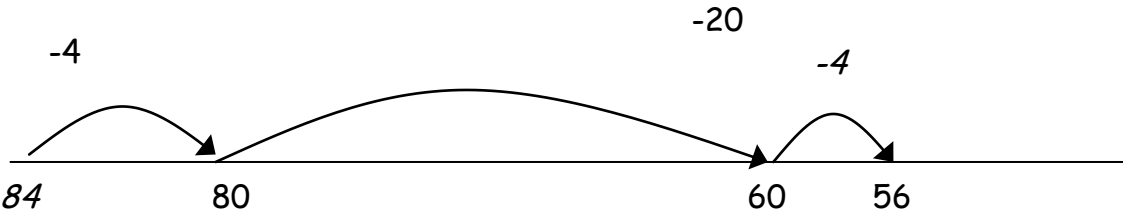
Help children to become more efficient with counting on by:

- ✓ Subtracting the units in one jump;
- ✓ Subtracting the tens in one jump and the units in one jump;
- ✓ Bridging through ten.

Year 3

Children will continue to use empty number lines with increasingly large numbers and be encouraged to count on in larger multiples of 10.

84 -56



These can also be used as number lines counting on to show links with addition.

Year 4

Counting up (Complementary addition)

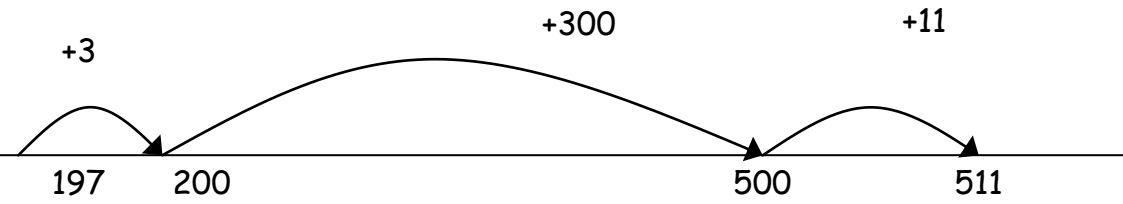
754
-86
4 (to make 90)
10 (to make 100)
600 (to make 700)
50 (to make 750)
4 (to make 754)
668

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;*
- ✓ *know that decimal points should line up under each other.*

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

511 – 197 = 314



Year 5

Counting up

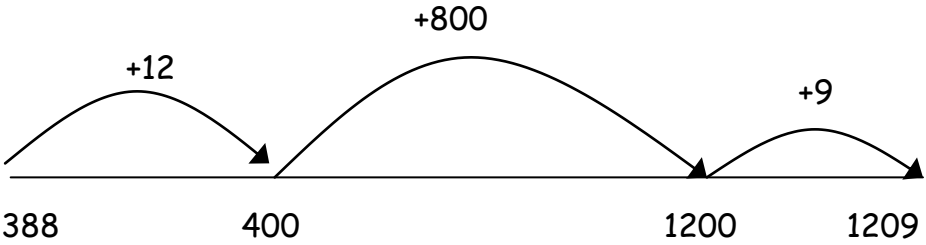
754
-286
14 (300)
454 (754)
468

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other.*

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

1209 – 388 = 821



Year 6

Decomposition

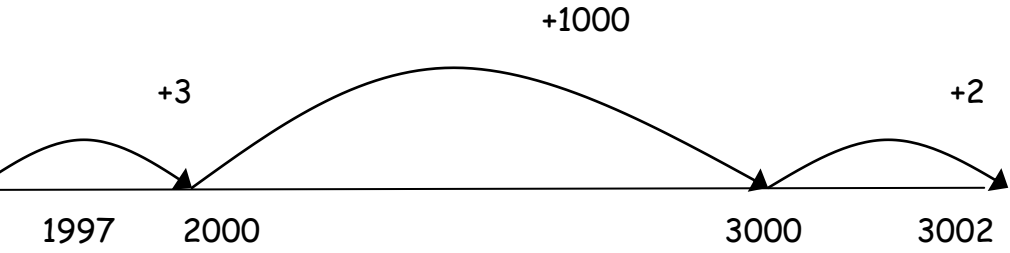
$$\begin{array}{r} {}^{5}\not{6}\,{}^{13}\not{4}\,{}^{1}\not{7} \\ -\ 2684 \\ \hline 3783 \end{array}$$

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other.*

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc children should be encouraged to recognise that a mental method (or informal jottings) is more efficient

3002 – 1997 = 1005



MULTIPLICATION

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

Doubling and halving
Applying the knowledge of doubles and halves to known facts.
e.g. 8 x 4 is double 4 x 4

Using multiplication facts

Year 2
- 2 times table
- 5 times table
- 10 times table

Year 3
- 2 times table
- 3 times table
- 4 times table
- 5 times table
- 6 times table
- 10 times table

Year 4 Derive and recall all multiplication facts up to 10 x 10

Years 5 & 6 Derive and recall quickly all multiplication facts up to 10 x 10.

Using and applying division facts
Children should be able to utilise their tables knowledge to derive other facts.
e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Use closely related facts already known
13 x 11 = (13 x 10) + (13 x 1)
= 130 + 13
= 143

Multiplying by 10 or 100
Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.
Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

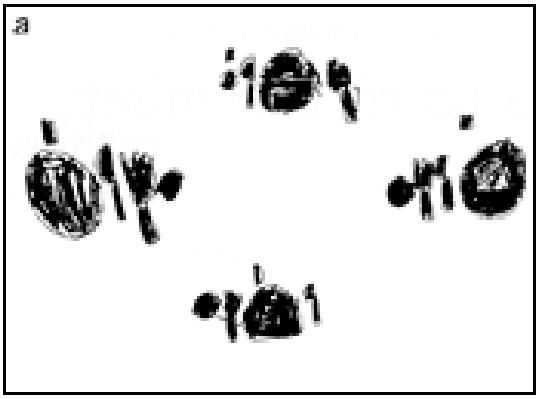
Partitioning
23 x 4 = (20 x 4) + (3 x 4)
= 80 + 12
= 102

Use of factors
8 x 12 = 8 x 4 x 3

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

YR and Y1

Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups.



Y2

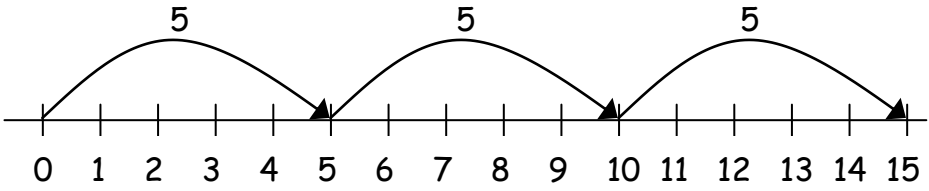
Children will develop their understanding of multiplication and use jottings to support calculation:

- ✓ **Repeated addition**

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3

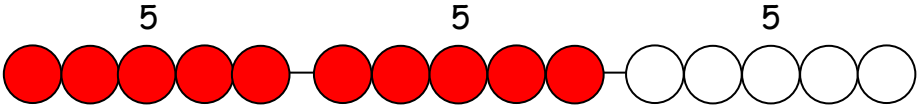
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5



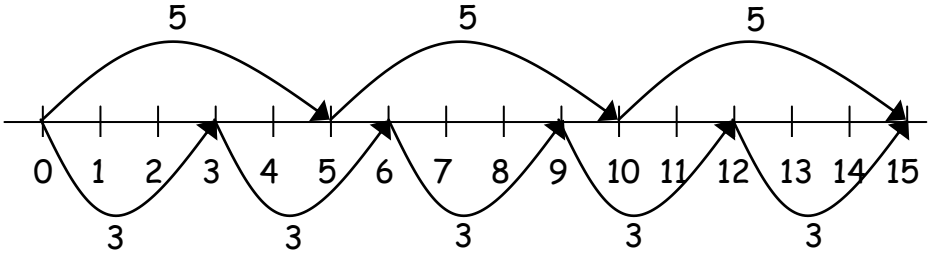
and on a bead bar:

5 x 3 = 5 + 5 + 5



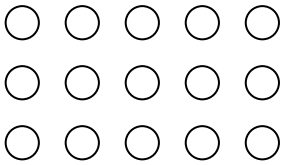
✓ **Commutativity**

Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.



✓ **Arrays**

Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



5 x 3 = 15

3 x 5 = 15

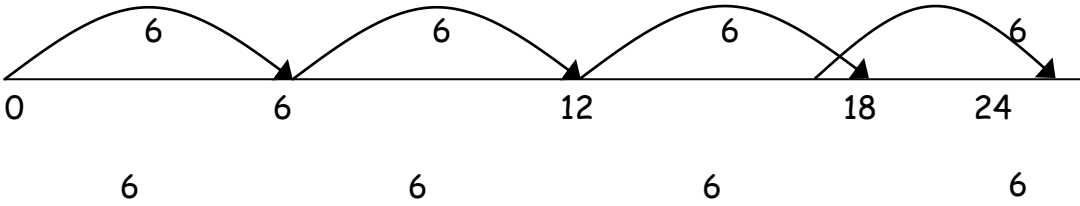
Y3

Children will continue to use:

✓ **Repeated addition**

4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4

Children should use number lines or bead bars to support their understanding.



6 6 6 6

✓ **Arrays**

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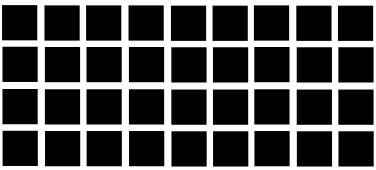


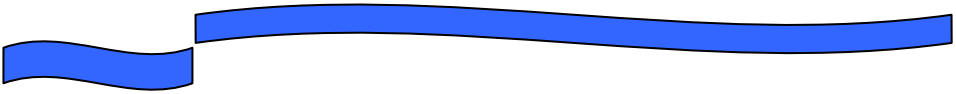
9 x 4 = 36

9 x 4 = 36

Children will also develop an understanding of

✓ **Scaling**

e.g. Find a ribbon that is 4 times as long as the blue ribbon



5 cm 20 cm

✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

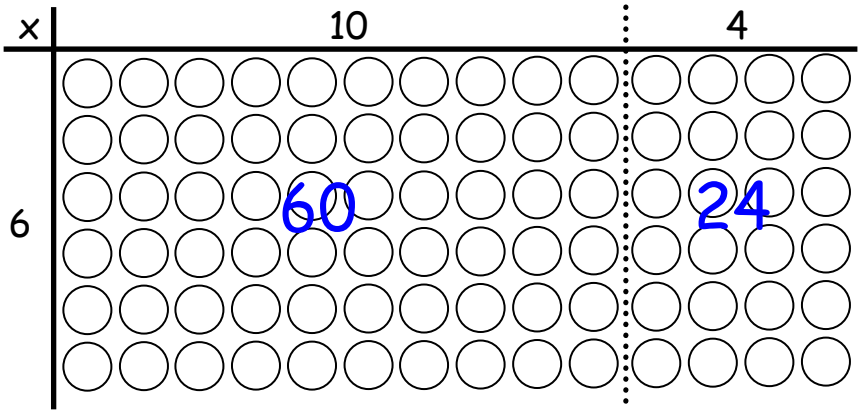
□ x 5 = 20 3 x △ = 18 □ x O = 32

✓ **Partitioning**

38 x 5 = (30 x 5) + (8 x 5)
= 150 + 40
= 190

Y4

Children will continue to use arrays where appropriate leading into the grid method of multiplication.



(6 x 10) + (6 x 4)

60 + 24

84

Grid method

TU x U

(Short multiplication – multiplication by a single digit)

23 x 8

Children will approximate first

23 x 8 is approximately 25 x 8 = 200

x	20	3
8	160	24

$$\begin{array}{r} 160 \\ +\ 24 \\ \hline 184 \\ \hline \end{array}$$

Y5

Grid method

HTU x U

(Short multiplication – multiplication by a single digit)

346 x 9

Children will approximate first

346 x 9 is approximately 350 x 10 = 3500

x	300	40	6
9	2700	360	54

$$\begin{array}{r} 2700 \\ +\ 360 \\ +\ 54 \\ \hline 3114 \\ \hline 1\ 1 \end{array}$$

TU x TU
(Long multiplication – multiplication by more than a single digit)

72 x 38

Children will approximate first
72 x 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

$$\begin{array}{r} 2100 \\ +\ 560 \\ +\ 60 \\ +\ 16 \\ \hline 2736 \\ {\scriptstyle 1} \end{array}$$

Using similar methods, they will be able to multiply decimals with one decimal place by a single digit number, approximating first. They should know that the decimal points line up under each other.

e.g. 4.9 x 3

Children will approximate first
4.9 x 3 is approximately 5 x 3 = 15

×	4	0.9
3	12	2.7

$$\begin{array}{r} 12 \\ +\ 2.7 \\ \hline 14.7 \end{array}$$

Y6

ThHTU x U
(Short multiplication – multiplication by a single digit)

4346 x 8

Children will approximate first
4346 x 8 is approximately 4346 x 10 = 43460

	4000	300	40	6
x				
8	32000	2400	320	48

32000
+
2400
+
320
+
48

34768

HTU x TU

(Long multiplication – multiplication by more than a single digit)

372 x 24

Children will approximate first

372 x 24 is approximately 400 x 25 = 10000

x	300	70	2
20	6000	1400	40
4	1200	280	8

6000
+
1400
+
1200
+
280
+ 40
+ 8
8928
1

Using similar methods, they will be able to multiply decimals with up to two decimal places by a single digit number and then two digit numbers, approximating first. They should know that the decimal points line up under each other.

For example:

4.92 x 3

Children will approximate first
4.92 x 3 is approximately 5 x 3 = 15

x	4	0.9	0.02
3	12	2.7	0.06

$$\begin{array}{r} 12 \\ +\ 0.7 \\ +\ 0.06 \\ \hline 12.76 \end{array}$$

By the end of year 6, children will have a range of calculation methods, mental and written.

Children should be encouraged to approximate their answers before calculating. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

DIVISION

PROGRESSION THROUGH CALCULATIONS FOR DIVISION

MENTAL CALCULATIONS

Doubling and halving

Knowing that halving is dividing by 2

Deriving and recalling division facts

Tables should be taught every day from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.

Year 2	2 times table 5 times table 10 times table
Year 3	2 times table 3 times table 4 times table 5 times table 6 times table 10 times table
Year 4	Derive and recall division facts for all tables up to 10 x 10
Year 5 & 6	Derive and recall quickly division facts for all tables up to 10 x 10

Using and applying division facts

Children should be able to utilise their knowledge of tables to derive other facts.

e.g. If I know 3 x 7 = 21, what else do I know?

30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Use of factors

378 ÷ 21 378 ÷ 3 = 126 378 ÷ 21 = 18

126 ÷ 7 = 18

Use related facts

Given that 1.4 x 1.1 = 1.54

What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

YR and Y1

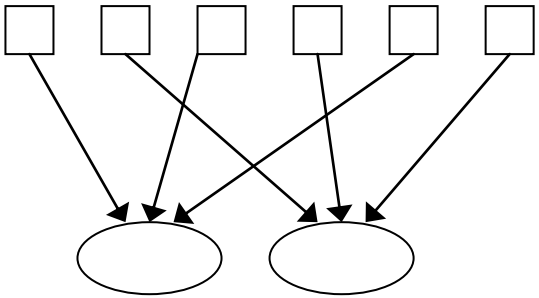
Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

Y2

Children will develop their understanding of division and use jottings to support calculation

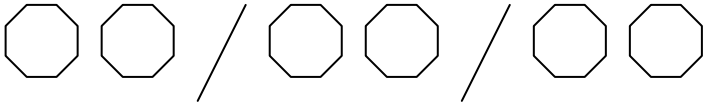
- ✓ **Sharing equally**

6 sweets shared between 2 people, how many do they each get?



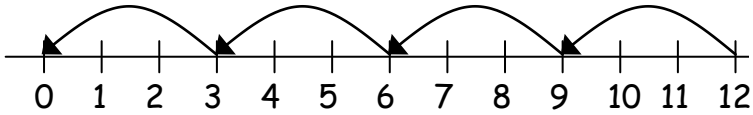
✓ **Grouping or repeated subtraction**

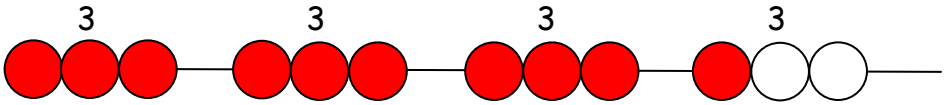
There are 6 sweets, how many people can have 2 sweets each?



✓ **Repeated subtraction using a number line or bead bar**

12 ÷ 3 = 4





The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?'

✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

□ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4

Y3

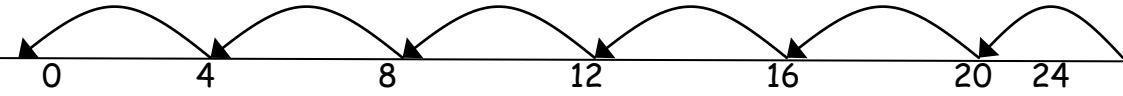
Ensure that the emphasis in Y3 is on grouping rather than sharing.

Children will continue to use:

- ✓ **Repeated subtraction using a number line**

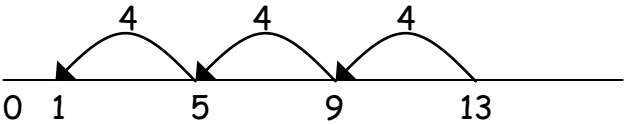
Children will use an empty number line to support their calculation.

24 ÷ 4 = 6



Children should also move onto calculations involving remainders.

13 ÷ 4 = 3 r 1



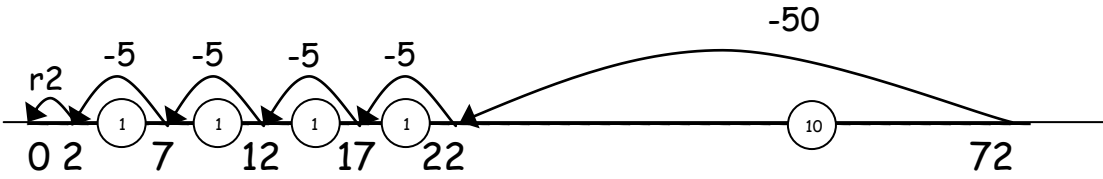
- ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

Y4

Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s – numbers with which the children are more familiar.

Moving onto:



Then onto the vertical method:

Short division TU ÷ U

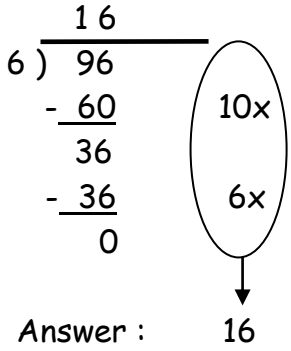
72 ÷ 3

3) 72
- 30 (10x)
42
- 30 (10x)
12
- 6 (2x)
6
- 6 (2x)
0

Answer : 24

Leading to subtraction of other multiples.

96 ÷ 6



Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 62 ÷ 8 is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

e.g. I have 62p. Sweets are 8p each. How many can I buy?
Answer: 7 (the remaining 6p is not enough to buy another sweet)

Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?
Answer: 8 (the remaining 6 apples still need to be placed into a box)

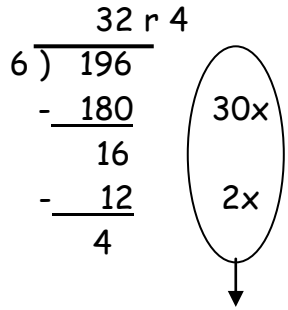
Y5

Children will continue to use written methods to solve short division TU ÷ U.

Children can start to subtract larger multiples of the divisor, e.g. 30x

Short division HTU ÷ U

196 ÷ 6



Answer : 32 remainder 4 or 32 r 4

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

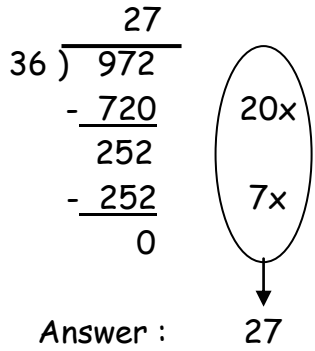
Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 240 ÷ 52 is 4 remainder 32, but whether the answer should be rounded up to 5 or rounded down to 4 depends on the context.

Y6

Children will continue to use written methods to solve short division TU ÷ U and HTU ÷ U.

Long division HTU ÷ TU

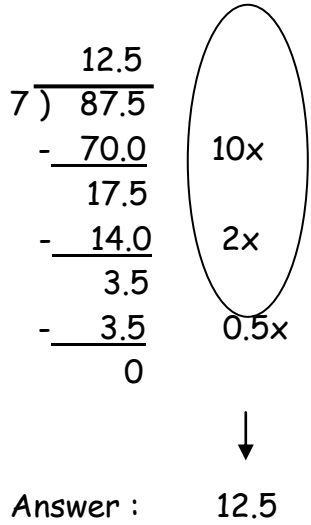
972 ÷ 36



Any remainders should be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3\ ^{2}/_{10}$ which could then be written as $3\ ^{1}/_{5}$ in its lowest terms.

Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other.

87.5 ÷ 7



By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.
Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy.
Children should be encouraged to consider if a mental calculation would be appropriate before using written method.