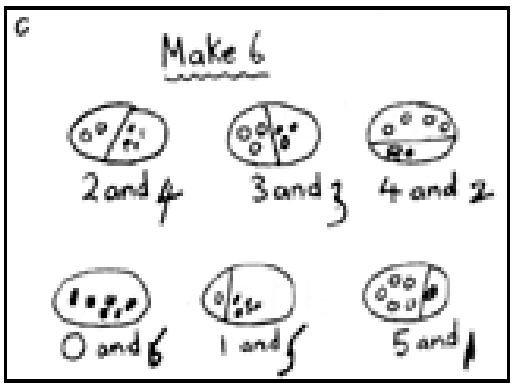
ADDITION

We have agreed throughout school to teach written methods of addition using partitioning. Many mental calculation strategies will continue to be used. They are not replaced by written methods.

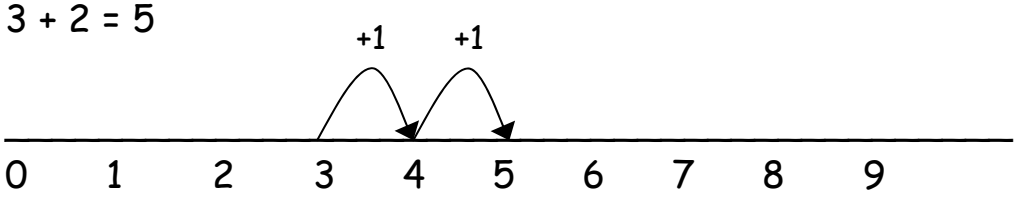
STAGE 1 (From F2 onwards)

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



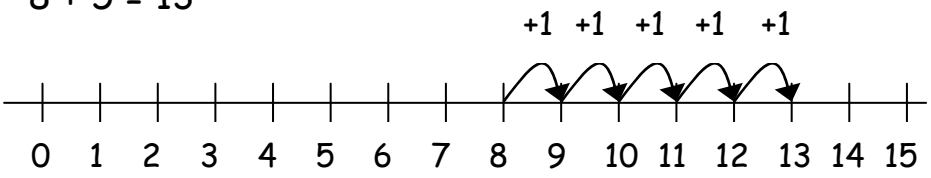
They use numberlines and practical resources to support calculation and teachers demonstrate the use of the number line.

3 + 2 = 5

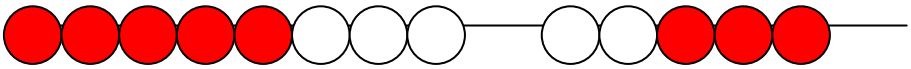


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



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



STAGE 2 (From Year 1 onwards)

Partitioning (least significant digits first in preparation for carrying)

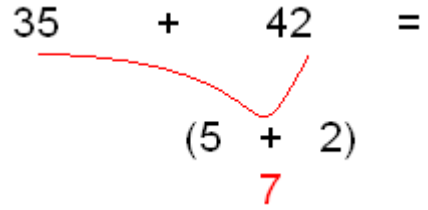
Not carrying method

35 + 42 = (5 + 2) + (30 + 40) = 77

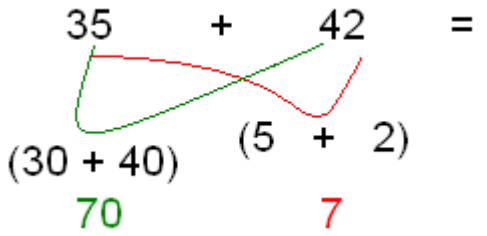
Step 1 (write all the question out)

35 + 42 =

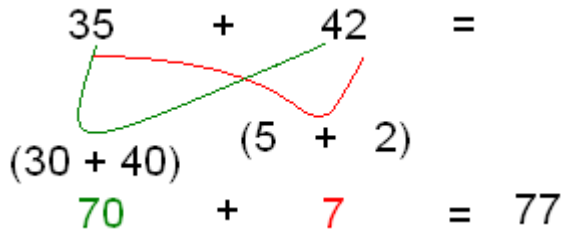
Step 2 (add the least significant digits-use brackets to begin with to show the child what is happening)



Step 3 (add the digits: Units, Tens, Hundreds etc.)



Step 4 (add the Tens and Units)



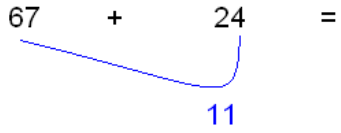
Carrying method

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

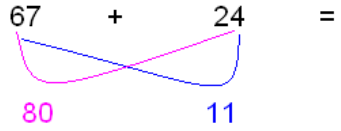
Step 1 (write the question out)

67 + 24 =

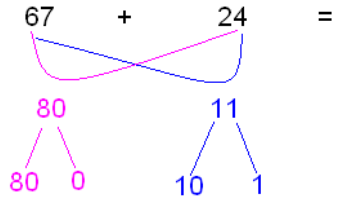
Step 2 (add the least significant digits-this example is without brackets)



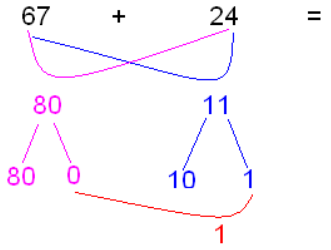
Step 3 (add the digits in order of significance)



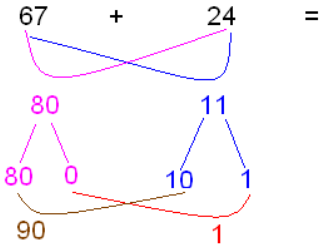
Step 4 (partition until there are multiples of 10/100)



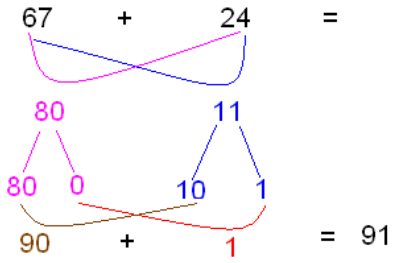
Step 5 (add the least significant digits)



Step 6 (add the digits: Units, Tens, Hundreds etc.)



Step 7 (add the Tens and Units)



STAGE 3 (From Year 3 onwards)

Expanded written method

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

STAGE 4 (From Year 3 onwards)

Making the direct link with the expanded written method

587 + 475

(i)

587
+475
12

→

587
+475
2
1

(ii)

587
+475
12
150

→

587
+475
6 2
1 1

(iii)

```
  587                          587
 +475          ------>        +475
   12                        10 6 2
  150                          1 1
  900
 1062
```

STAGE 5 (From Year 3 onwards)

Extend method to include decimals.

Year 4 – Using methods, begin to add two or more 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, particularly when adding mixed amounts such as £3.59 + 78p

Examples:

£4.21 + £3.87

£2.24 + £5.23 + £1.36

Year 5 – 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 mixed amounts such as 3.2m + 350cm.

Examples:

£6.72 + £8.56 + £2.30

72.5km + 54.6km

Year 6 – Add two or more decimal fractions with up to four digits and either one or more decimal places. Know that decimal points should line up under each other, particularly when adding mixed amounts such as 15.5kg + 750g.

Examples:

124.9 + 7.25

401.2 + 26.85 + 0.71

Progression of numbers used in KS2:

Y3	Y4	Y5	Y6
TU + TU, developing to HTU + TU or HTU + HTU Extend to decimals (money)	HTU + TU, then HTU + HTU Extend to decimals	HTU + HTU, then ThHTU + ThHTU Extend to decimals	ThHTU + ThHTU, then numbers with any number of digits (Extend to decimals)

SUBTRACTION

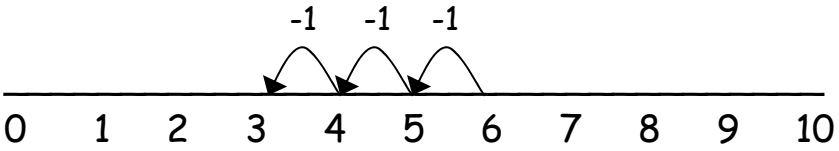
We have agreed throughout school to teach written methods of subtraction using number lines and then leading to the standard written method. Many mental calculation strategies will continue to be used. They are not replaced by written methods.

STAGE ONE (From F2 onwards)

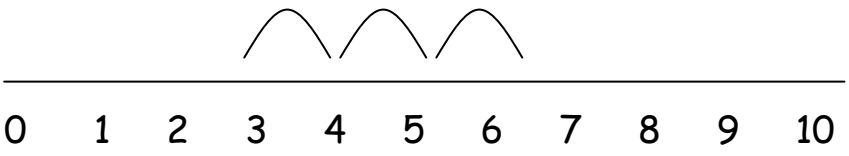
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures.

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

6 – 3 = 3

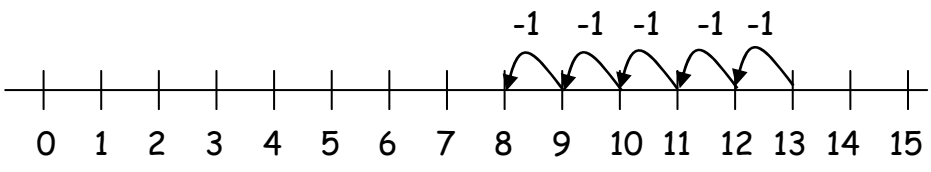


The numberline should also be used to show that 6-3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



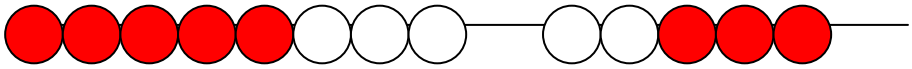
Children then begin to use numbered lines to support their own calculations –using a numbered line to count back in ones.

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.

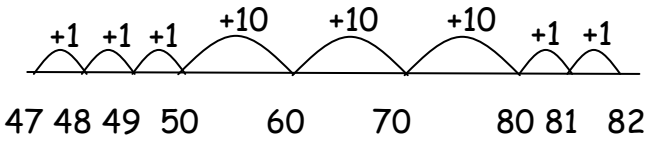
13 – 5 = 8



STAGE TWO (From Year 1 onwards)

As the calculations involve using bigger numbers, it is more efficient to count on.

82 - 47

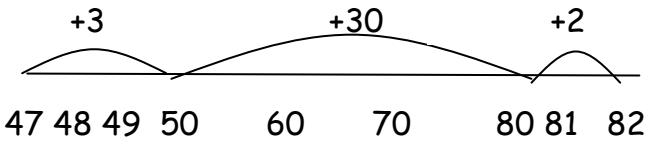


Help children to become more efficient with counting on by:

- Adding the units in one jump and the tens in one jump

In Year 3 children will continue to use empty number lines with increasingly large numbers (they should move on to adding to the next multiple).

82 - 47



STAGE THREE (From the end of Year 3)

(i) Expanded method (ii)
Leading to the standard written method

754 -86	= 700 + 50 + 4 80 + 6		754 -86
	= 700 + 40 + 14 80 + 6	Adjust from T to U	4 1 754 - 86
	= 600 + 140 + 14 80 + 6 600 + 60 + 8	Adjust from H to T = 668	6 141 7 54 - 86

STAGE FOUR (Year 4 onwards)
Extend chosen method to include decimals

Year 4 – Using methods similar to those above, begin to find the difference between two three-digits sums of money, with or without adjustment from the pence to the pounds. Know that decimal points should line up under each other. For example:
£8.95 –
£4.38

£7.50 –
£2.84

Year 5 – Using the chosen method, 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. For example:
£9.42 - £6.78

72.5km – 4.6km

Year 6 – Using the chosen method, subtract the two or more decimal fractions with up to three digits either one or two decimal places. Know that decimal points should line up under each other. For example:
324.9 – 7.25
14.24 – 8.7

Progression of numbers used in KS2:

Y3	Y4	Y5	Y6
TU – TU, developing to HTU – TU or HTU - HTU	HTU – TU, then HTU – HTU, extend to decimals	HTU – HTU, then ThHTU – ThHTU, extend to deicmals	ThHTU – ThHTU, then with any number of digits, extend to decimals

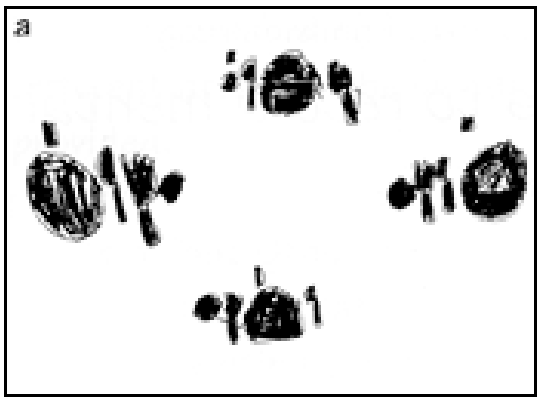
MULTIPLICATION

We have agreed throughout school to teach written methods of multiplication using the grid method and partitioning and then leading to the traditional standard written method. Many mental calculation strategies will continue to be used. They are not replaced by written methods.

STAGE ONE (From F2 onwards)

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.



STAGE TWO (From Year 1 onwards)

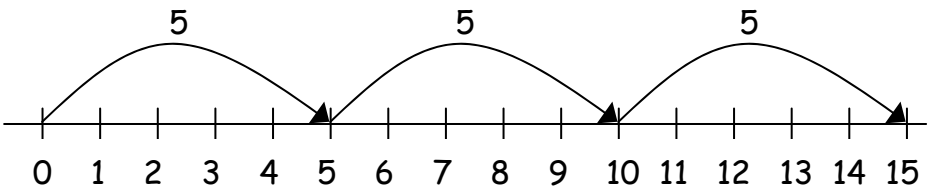
Children will develop their understanding of multiplication and use jottings to support calculation:

They will learn that multiplication is repeated addition.

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

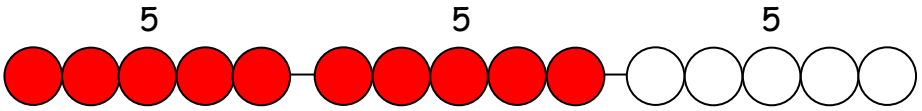
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5

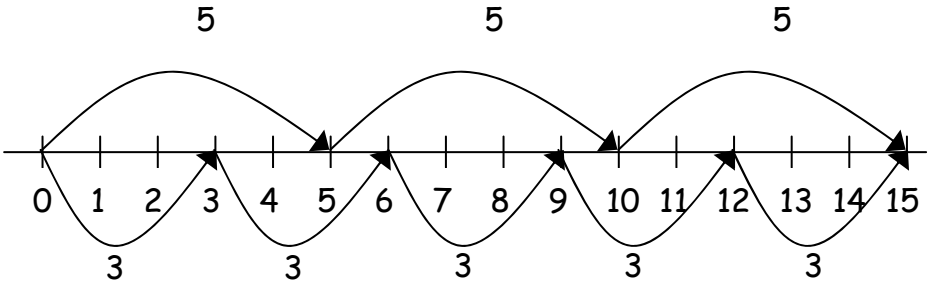


and on a bead bar:

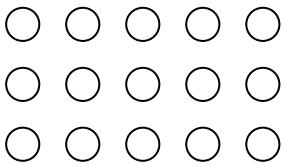
5 x 3 = 5 + 5 + 5



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



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

STAGE THREE (From Year 3 onwards)

Grid method/partitioning

Example: 23 x 8

x	20	3
8	160	24

160
+ 24
184

- Always encourage children to approximate first.

Example, 23 x 8 is approximately 20 x 10 = 200

STAGE FOUR (From Year 5 onwards)

Extend to larger numbers

Example: TU x TU

72 X 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

2100
+ 560
+ 60
+ 16
2736
1

STAGE FIVE (From Year 5 onwards)

Traditional standard method – introduce this alongside the partitioning method to ease transition and clarity of method.

Example:
4346 is approximately 4346 x 10 = 43460

4346
x 8
34768
2 3 4

STAGE SIX (From Year 5 onwards)

Extend preferred method to use of decimals

Year 5 – extend to simple decimals with one decimal place. Multiply by a single digit, approximating first. Know that decimal points should line up under each other.

4.9 x 3 is approximately 5 x 3 = 15

4.9 x 3 4.0 x 3 = 12.0
0.9 x 3 = 2.7
14.7

Year 6 – extend to decimals with up to two decimal places. Multiply by a single digit, approximating first. Know that decimal points should line up under each other.

4.92 x 3 is about 5 x 3 = 15

4.92 x 3 4.00 x 3 = 12.00
0.90 x 3 = 2.70
0.02 x 3 = 0.06
14.76

Begin to extend to multiplying by two –digit numbers: for example, 4.92 x 73 is about 5 x 70 = 350.

Progression of numbers used in KS2

Y3	Y4	Y5	Y6
TU x U	TU x U	HTU x U TU x TU Extend to numbers with one decimal place	ThHTU x U and HTU x TU Extend to numbers with two decimal places.

DIVISION

We have agreed throughout school to teach division using chunking. Many mental calculation strategies will continue to be used. They are not replaced by written methods.

STAGE ONE (From F2 onwards)

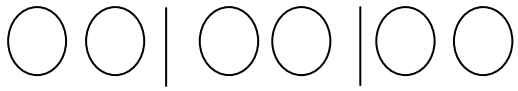
Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

STAGE TWO (From Year 2 onwards)

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

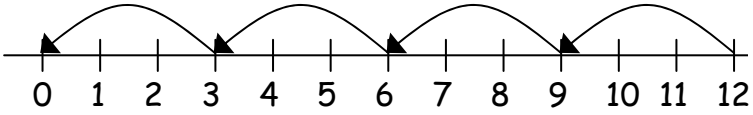
Grouping:

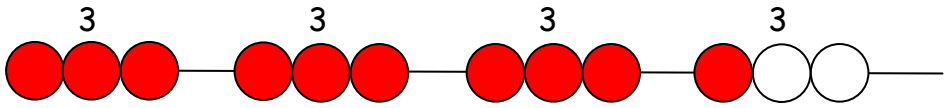
There are 6 sweets, how many people can have 2 sweets each?



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?'

Use symbols to stand for unknown numbers to complete equations using inverse operations.

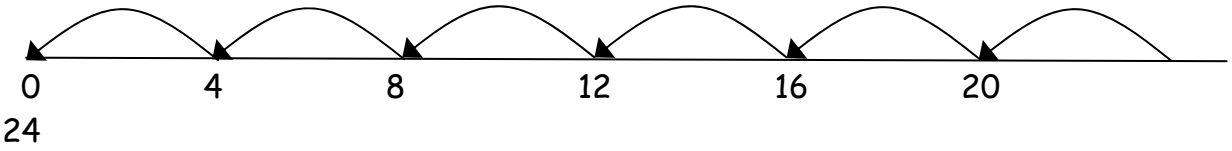
□ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4

STAGE THREE (From Year 3 onwards)

Repeated subtraction using a number line

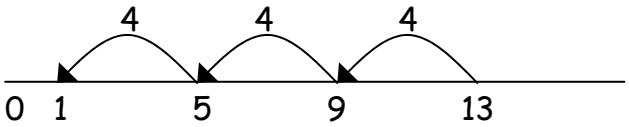
Children will use an empty number line to support their calculation.

24 ÷ 4 = 6



Children should also move onto calculations involving remainders.

13 ÷ 4 = 3 r 1



Use symbols to stand for unknown numbers to complete equations using inverse operations.

26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

STAGE FOUR (From Year 4 onwards)

Chunking

Example:

256 ÷7 =

10 x 7	= 70	
10 x 7	= 70	140
10 x 7	= 70	210
1 x 7	= 7	217
1 x 7	= 7	224
1 x 7	= 7	231
1 x 7	= 7	238
1 x 7	= 7	245
1 x 7	= 7	252
1 x 7	= 7	

Once the child gets to 252 they should realise that adding another 7 would take them over 256. This means that whatever they add to 252 to get to 256 is their remainder.

Answer 36 r 4

- Always encourage the children to approximate first.

Example: 256 ÷7 lies between 210 ÷7 = 30
and 280 ÷7 = 40

Children need to be able to decide what to do after division and round up or down depending 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)

STAGE FIVE (From the end of Year 4 through to Year 5 and Year 6)

Refine with fewer steps.

Example: 256 ÷7

30 x 7 = 210
6 x 7 = 42 → 252

Answer: 36 r 4

Once the child gets to 252 they should realise that adding another 7 would take them over 256. This means that whatever they add to 252 to get to 256 is their remainder.

STAGE SIX (From Year 5 onwards)

Example: 972 ÷36 (is approximately 1000 ÷ 40 = 25)

20 x 36 = 720
2 x 36 = 72 → 792
2 x 36 = 72 → 864
2 x 36 = 72 → 936
1 x 36 = 36 → 972

Answer: 27 (obviously if the children are able to they could do 7 x 72 or 5 x 72 and 2 x 72).

STAGE SEVEN (From Year 6 onwards)

Extend to use of decimals with up to 2 decimal places
Approximate first. Know that decimal points should line up with each other.

Example: 87.5 ÷ 7 =

10 x 7 = 70
2 x 7 = 14 → 84

Answer 12 r3.5

Progression of numbers used in KS2

Y4	Y5	Y6
TU ÷ U	HTU ÷ U	HTU ÷ TU Extend to numbers with two decimal places.