Calculation Guidelines for Foundation Stage

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Children begin to record in the context of play or practical activities and problems.			

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Begin to relate addition to combining two groups of objects • Make a record in pictures, words or symbols of addition activities already carried out. • Construct number sentences to go with practical activities • Use of games, songs and practical activities t o begin using vocabulary Solve simple word problems using their fingers $5 + 1 = 6$ Can find one more to ten. Higher Ability/ Gifted and Talented children progress to using a number line. They jump forwards along the number line using finger. $5 + 3 = 8$ 0 1 2 3 4 5 6 7 8 9 10	Begin to relate subtraction to 'taking away' • Make a record in pictures, words or symbols of subtraction activities already carried out • Use of games, songs and practical activities to begin using vocabulary • Construct number sentences to go with practical activities • Relate subtraction to taking away and counting how many objects are left. $5 - 1$ $= 4$ ●●●●✖ $5 - 1 = 4$ Can find one less to ten. Higher Ability/ Gifted and Talented Progression: $8 - 3 = 5$ 0 1 2 3 4 5 6 7 8 9 10 Counting backwards along a number line using finger.	Real life contexts and use of practical equipment to count in repeated groups of the same size: • Count in twos; fives; tens Also chanting in 2s, 5s and 10s. 10, 20 30, 40 50, 60, 70 80, 90 100	Share objects into equal groups Use related vocabulary Activities might include: • Sharing of milk at break time • Sharing sweets on a child's birthday • Sharing activities in the home corner • Count in tens/twos • Separate a given number of objects into two groups (addition and subtraction objective in reception being preliminary to multiplication and division) Count in twos, tens How many times? How many are left/left over? Group Answer Right, wrong What could we try next? How did you work it out? Share out Half, halve

ADDITION GUIDELINES

Year One	Year Two	Year Three
+ = signs and missing numbers	**+ = signs and missing numbers**	**+ = signs and missing numbers**

Year One

+ = signs and missing numbers

Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.
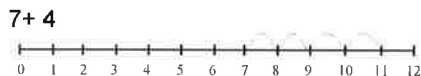
2 = 1+ 1
2 + 3 = 4 + 1
3 = 3
2 + 2 + 2 = 4 + 2

Missing numbers need to be placed in all possible places.

3 + 4 = ☐	☐ = 3 + 4
3 + ☐ = 7	7 = ☐ + 4
☐ + 4 = 7	7 = 3 + ☐
☐ + ▽ = 7	7 = ☐ + ▽

The Number Line

Children use a numbered line to count on in ones.
Children use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line.

7+ 4

0 1 2 3 4 5 6 7 8 9 10 11 12

Year Two

+ = signs and missing numbers
Continue using a range of equations as in Year 1 but with appropriate, larger numbers.
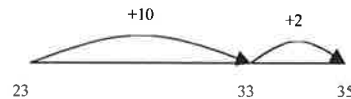Extend to
14 + 5 = 10 + ☐
and
32 + ☐ + ☐ = 100   35 = 1 + ☐ + 5

Partition into tens and ones and recombine
12 + 23 =
10 + 20 = 30
 2 + 3 = 5
30 + 5 = 35
Count on in tens and ones
23 + 12 = 23 + 10 + 2
            = 33 + 2
            = 35

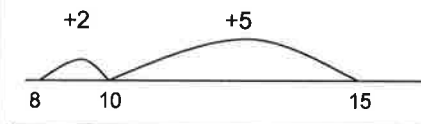+10   +2

23   33   35

The Empty Number Line:
Partitioning and bridging through 10.

The steps in addition often bridge through a multiple of 10

e.g.
Children should be able to partition the 7 to relate adding the 2 and then the 5.

8 + (2+5)

+2   +5

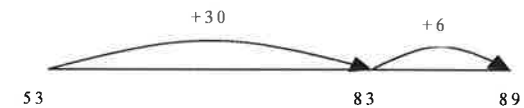8   10   15

Year Three

+ = signs and missing numbers
Continue using a range of equations as in Year 1 and 2 but with appropriate, larger numbers.

Partition into tens and ones
- Partition both numbers and recombine.
- Count on by partitioning the second number only e.g.

36 + 53 =
30 + 50 = 80
 6 + 3 = 9
80 + 9 = 89

+30   +6

53   83   89

Add a near multiple of 10 to a two-digit number
Secure mental methods by using a number line to model the method. Continue as in Year 2 but with appropriate numbers
e.g. 35 + 19 is the same as 35 + 20 – 1.

Children need to be secure adding multiples of 10 to any two-digit number including those that are not multiples of 10.
48 + 36 = 84

+30
          +2   +4

48   78 80   84
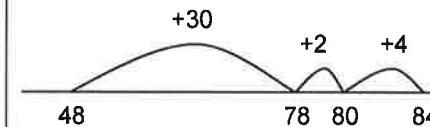
pencil and paper procedures. Introduce the expanded written method.

53 + 42 = 125
  50 + 3   Then   53
+ 40 + 2   + 42
_____   _____
 90 + 5 = 95   5
                                       90
                                      _____
                                       95

	Add 9 or 11 by adding 10 and adjusting by 1 e.g. Add 9 by adding 10 and adjusting by 1 35 + 9 = 44	**This will lead onto formal written method.**
	35 +10 44 45 -1	53 $+\ 42$ $\overline{95}$ If children are ready introduce the **formal written method,** where it is necessary to "carry" across the columns and bridge 100. The digits carried should be recorded under the line in the correct column.
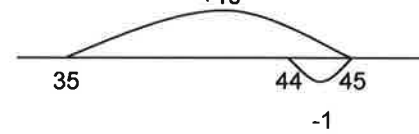
	ADDITION GUIDELINES	
Year Four	Year Five	Year Six

+ = signs and missing numbers
Continue using a range of equations as in Year 1 and 2 but with appropriate numbers.

Partition into tens and ones and recombine
Either partition both numbers and recombine or partition the second number only e.g.
$55 + 37 = 55 + 30 + 7$
$\qquad = 85 + 7$
$\qquad = 92$

55   +30   85   +7   92

Add the nearest multiple of 10, then adjust

Continue as in Year 2 and 3 but with appropriate numbers e.g. 63 + 29 is the same as 63 + 30 - 1

Pencil and paper procedures. Revisit the expanded method. Add numbers with 4 and 5 digits.
$367 + 185 = 431$
either   or

```
  367          300 + 60 + 7
+ 185          100 + 80 + 5
   12          400 +140+12 = 552
  140
  400
  552
```

+ = signs and missing numbers
Continue using a range of equations as in Year 1 and 2 but with appropriate numbers.

Partition into hundreds, tens and ones and recombine
Either partition both numbers and recombine or partition the second number only e.g.
$358 + 73 = 358 + 70 + 3$
$\qquad = 428 + 3$
$\qquad = 431$

358   +70   428   +3   431

Add or subtract the nearest multiple of 10 or 100, then adjust
Continue as in Year 2, 3 and 4 but with appropriate numbers e.g. 458 + 79 = is the same as 458 + 80 - 1

Pencil and paper procedures
Extend to numbers with at least four digits
$3587 + 675 = 4262$

```
  3587
+  675
  4262
  1 1 1
```

Revert to expanded methods if the children experience any difficulty.
Extend to up to two places of decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

```
  72.8
+ 54.6
 127.4
  1  1
```

+ = signs and missing numbers
Continue using a range of equations as in Year 1 and 2 but with appropriate numbers.

Pencil and paper procedures
Extend to numbers with any number of digits and decimals with 1, 2 and/or 3 decimal places.
$13.86 + 9.481 = 23.341$

```
  13.860
+  9.481
  23.341
   1 1 1
```

Revert to expanded methods if the children experience any difficulty.

There is an expectation that children will continue to practise and use **the formal written method for larger numbers and decimals** and use these methods when solving problems, when appropriate (see previous year's guidance for methods). Our aim is that by the end of Y6, children use an efficient **formal written method** accurately and with confidence.

leading to formal written method, up to 4, 5 digit numbers. The digits that have been carried should be recorded under the line in the correct column.

```
  367
 +185
  552
  1 1
```

Extend to decimals in the context of money, decimals up to 3 decimal places.

SUBTRACTION GUIDELINES

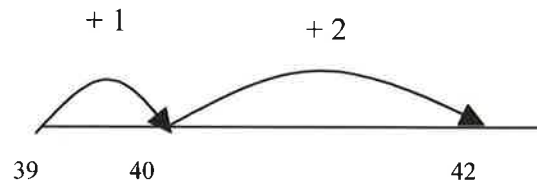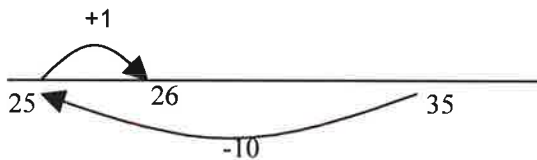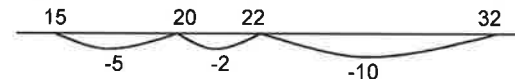| Year One	Year Two	Year Three
- = signs and missing numbers 7 - 3 = ☐ ☐ = 7 - 3 7 - ☐ = 4 4 = ☐ - 3 ☐ - 3 = 4 4 = 7 - ☐ ☐ - ∇ = 4 4 = ☐ - ∇ • Understand subtraction as 'take away' • Find a 'difference' by counting up; I have saved 5p. The socks that I want to buy cost 11p. How much more do I need in order to buy the socks? • Use practical and informal written methods to support the subtraction of a one-digit number from a one digit or two-digit number and a multiple of 10 from a two-digit number. I have 11 toy cars. There are 5 cars too many to fit in the garage. How many cars fit in the garage? Use the vocabulary related to addition and subtraction and symbols to describe and record addition and subtraction number sentences Recording by - drawing jumps on prepared lines - constructing own lines	**- = signs and missing numbers** Continue using a range of equations as in Year 1 but with appropriate numbers. Extend to 14 + 5 = 20 - ☐ <u>Find a small difference by counting up to the next 10 number and then count on.</u> 42 – 39 = 3 **Subtract 9 or 11. Begin to add/subtract 19 or 21** 35 – 9 = 26 **Use known number facts and place value to subtract** (partition second number only) 37 – 12 = 37 – 10 = 27 27 – 2 = 25 **Bridge through 10 where necessary** 32 - 17 	**- = signs and missing numbers** Continue using a range of equations as in Year 1 and 2 but with appropriate numbers. **Find a small difference by counting up** Continue as in Year 2 but with appropriate numbers e.g. 102 – 97 = 5 **Subtract mentally a 'near multiple of 10' to or from a two-digit number** Continue as in Year 2 but with appropriate numbers e.g. 78 – 49 is the same as 78 – 50 + 1 **Use known number facts and place value to subtract** Continue as in Year 2 but with appropriate numbers e.g.**97 – 15 = 72** With practice, children will need to record less information and decide whether to count back or forward. It is useful to ask children whether counting up or back is the more efficient for calculations such as 57 – 12, 86 – 77 or 43 – 28. **Pencil and paper procedures** Complementary addition 84 – 56 = 28
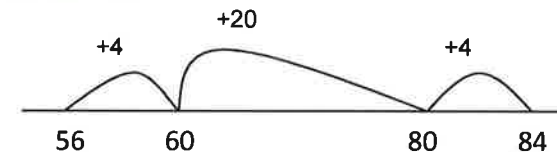
Introduce the **expanded written method.**

78 – 23 =55
  70 + 8
- 20 + 3
_____
 50 + 5 = 55

This will lead into the **formal written method:**

78	Introduce the expanded
-23	written method where
___	exchange/decomposition
55	is required.
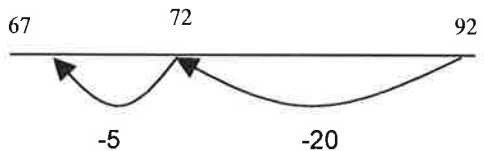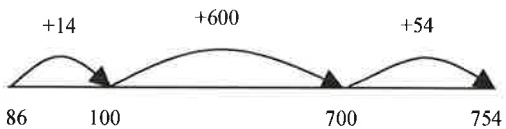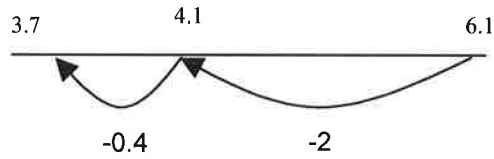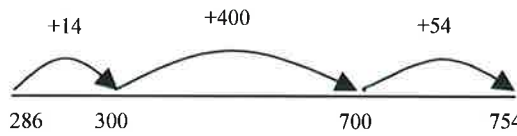
 70 + 3   becomes 60 + 13
-20 + 7   - 20 + 7
_____
          40 + 6 = 46

When children are confident with the expanded method introduce the **formal written method**, involving decomposition/exchange.
Then progress to numbers over 100

SUBTRACTION GUIDELINES
(- = signs and missing numbers: Continue using a range of equations as in Year 1 and 2 but with appropriate numbers.)

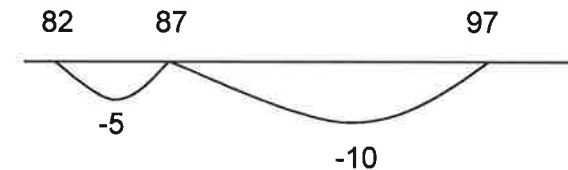| Year Four	Year Five	Year Six

Find a small difference by counting up
e.g. 5003 – 4996 = 7
This can be modelled on an empty number line (see complementary addition below). Children should be encouraged to use known number facts to reduce the number of steps.
 	
Subtract the nearest multiple of 10, then adjust.
Continue as in Year 2 and 3 but with appropriate numbers.
 	
Use known number facts and place value to subtract
92 – 25 = 67
 	
67   72   92
 	
-5   -20
 	
## Pencil and paper procedures 	
Complementary addition
754 – 86 = 668
 	
+14   +600   +54
 	
86 100   700 754
 	
## For those children with a secure mental image of the number line they could record the jumps only: 	
 	
754 – 86 = 668
 	
  14 (100)
600 (700)
  54 (754)
668
	Find a difference by counting up
	e.g. 8006 – 2993 = 5013
	This can be modelled on an empty number line (see complementary addition below).
	
	Subtract the nearest multiple of 10 or 100, then adjust.
	Continue as in Year 2, 3 and 4 but with appropriate numbers.
	
	Use known number facts and place value to subtract
	6.1 – 2.4 = 3.7
	
	3.7 4.1 6.1
	
	-0.4 -2
	
	## Pencil and paper procedures
	Complementary addition
	754 – 286 = 468
	
	+14 +400 +54
	
	286 300 700 754
	
	This leads into the **formal written method.**
	
	  4 9 1
	  5 0 3
	– 2 7 8
	___
	  2 2 5
		There is an expectation that children will continue to practise and use the **formal written method for larger numbers and decimals** and use these methods when solving problems, when appropriate (see previous year's guidance for methods).
		Our aim is that by the end of Y6 children use an efficient **formal written method** accurately and with confidence.

Continue to develop the **formal written method of subtraction** by revisiting the expanded method first.

258 – 73 =185

200 + 50 + 8	becomes	100 + 150 + 8
-		-
70 + 3		70 + 3
		100 + 80 + 5 = 185

This leads to the **formal written method**, involving decomposition.

$$\begin{array}{r} 1\ 1 \\ \cancel{2}58 \\ -\ \ 73 \\ \hline 185 \end{array}$$

Further develop by subtracting a 3 digit number from a 3 digit number by using the **formal written method of subtraction** and then leading on to the formal written method.
When children are confident, develop with 4 digit numbers.

When children are confident extend with larger numbers (and decimal numbers)
12731 – 1367 = 11364

$$\begin{array}{r} 6\ 2\ 1 \\ 1\ 2\ 7\ 3\ 1 \\ -\ 1\ 3\ 6\ 7 \\ \hline 1\ 1\ 3\ 6\ 4 \end{array}$$

Introduce subtraction of decimals, initially in the context of money and measures.
£166.25 - £83.72 = £82.53

MULTIPLICATION GUIDELINES

Year One	Year Two	Year Three

Year One

Multiplication is related to doubling and counting groups of the same size.

Looking at columns	Looking at rows
2 + 2 + 2	3 + 3
3 groups of 2	2 groups of 3

Counting using a variety of practical resources
Counting in 2s e.g. counting socks, shoes, animal's legs…
Counting in 5s e.g. counting fingers, fingers in gloves, toes…
Counting in 10s e.g. fingers, toes…

Pictures / marks

There are 3 sweets in one bag.
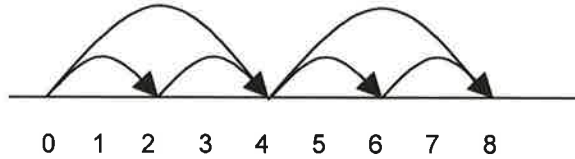How many sweets are there in 5 bags?

Year Two

x = signs and missing numbers

7 x 2 = □	□ = 2 x 7
7 x □ = 14	14 = □ x 7
□ x 2 = 14	14 = 2 x □
□ x ∇ = 14	14 = □ x ∇

Arrays and repeated addition

4 x 2 or 4 + 4

2 x 4 or 2 + 2 + 2 + 2

0 1 2 3 4 5 6 7 8

Show that multiplication of 2 numbers can be done in any order (commutative).

3x4
4x3

Doubling multiples of 5 up to 50
15 x 2 = 30

Partition
Children need to be secure with partitioning numbers into 10s and 1s and partitioning in different ways: 6 = 5 + 1 so e.g. Double 6 is the same as double five add double one.

AND double 15
10 + 5
↓ ↓
20 + 10 = 30

Year Three

x = signs and missing numbers
Continue using a range of equations as in Year 2 but with appropriate numbers.

Arrays and repeated addition
Continue to understand multiplication as repeated addition and continue to use arrays (as in Year 2).

Doubling multiples of 5 up to 50
35 x 2 = 70

Partition

X	30	5
2	60	10

60 + 10 = 70

Use known facts and place value to carry out simple multiplications

Use the same method as above (partitioning), e.g.

32 x 3 = 96

x	30	2
3	90	6

90 + 6 = 96

MULTIPLICATION GUIDELINES

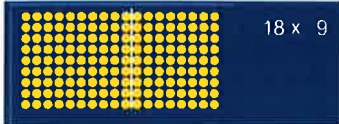| Year Four	Year Five	Year Six

Year Four

x = signs and missing numbers
Continue using a range of equations as in Year 2 but with appropriate numbers

Partition
Continue to use arrays:

18 x 9

$18 \times 9 = 162$

$18 \times 9 = (10 \times 9) + (8 \times 9) = 162$

OR

Use the grid method of multiplication (as below)

Pencil and paper procedures

Further develop the grid method
23×7 is approximately $20 \times 10 = 200$

x	20	3
7	140	21

$140 + 21 = 161$

Expanded short multiplication

```
   36
X   4
_____
+  24 (6x4)
 120 (30x4)
_____
 144
```

Year Five

Partition
$47 \times 6 = 282$

$47 \times 6 = (40 \times 6) + (7 \times 6) = 282$

OR

Use the grid method of multiplication (as below)

Pencil and paper procedures
Grid method
72×38 is approximately $70 \times 40 = 2800$

x	70	2
30	2100	60
8	560	16

$2100 + 60 = 2160$
$560 + 16 = 576$

```
   2160
+   576
_____
   2736
```

Expanded short Multiplication

Children should describe what they do by referring to the actual values of the digits in the columns. For example, the first step in 38×7 is 'thirty multiplied by seven', not 'three times seven', although the relationship 3×7 should be stressed.

```
 30 + 8
x    7
_____
    56   (8 x 7 = 56)
   210   (30 x 7 = 210)
   266
```

Year Six

Partition
$87 \times 6 = 522$

$87 \times 6 = (80 \times 6) + (7 \times 6) = 522$

OR

Use the grid method of multiplication (as below)

Pencil and paper procedures
Grid method
372×24 is approximately $400 \times 20 = 8000$

Extend to decimals with up to two decimal places.

Short Multiplication

The recording is reduced further, with carry digits recorded below the line.

```
    38
x    7
_____
   266
    5
```

Children who are already secure with multiplication for TU × U and TU × TU should have little difficulty in using the same method for HTU × TU or applying decimals.

```
   286
x   29
_____
  2574   (9 x 286 = 2574)
  5720   (20 x 286 = 5720)
  8294
  1
```

This leads **to short multiplication (formal method)** of a 2 digit number x 1 digit number.

36 x 4 = 144

```
  36
X 4
___
144
___
 2
```

Ensure that the digit carried over is written under the line in the correct column.

If children are confident, continue to develop short multiplication with 3 digit numbers multiplied by a 1 digit number.

This leads **to short multiplication (formal method)** of a 2 digit number x 1 digit number.

36 x 4 = 144

```
  36
X 4
___
144
___
 2
```

Ensure that the digit carried over is written under the line in the correct column.

This leads to compact long multiplication

23 x 13 = 299

```
     23
  x  13
   ____
+  69     (3x23)
   230    (10x23)
   ____
   299
```

DIVISION GUIDELINES

Year One	Year Two	Year Three

Year One

Sharing
Requires secure counting skills
-see counting and understanding number strand
Develops importance of one-to-one correspondence
See appendix for additional information on x and ÷ and aspects of number

Sharing – 6 sweets are shared between 2 people. How many do they have each?

Practical activities involving sharing, distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

Grouping
Sorting objects into 2s / 3s/ 4s etc
How many pairs of socks are there?

There are 12 crocus bulbs. Plant 3 in each pot. How many pots are there?
Jo has 12 Lego wheels. How many cars can she make?

Year Two

÷ = signs and missing numbers

$6 ÷ 2 = \square$ $\qquad$ $\square = 6 ÷ 2$
$6 ÷ \square = 3$ $\qquad$ $3 = 6 ÷ \square$
$\square ÷ 2 = 3$ $\qquad$ $3 = \square ÷ 2$
$\square ÷ \nabla = 3$ $\qquad$ $3 = \square ÷ \nabla$

Grouping
Link to counting and understanding number strand
Count up to 100 objects by grouping them and counting in tens, fives or twos;…
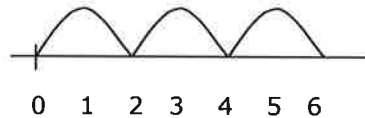Find one half, one quarter and three quarters of shapes and sets of objects
6 ÷ 2 can be modelled as:
There are 6 strawberries.
How many people can have 2 each? How many 2s make 6?

6 ÷ 2 can be modelled as:

0 1 2 3 4 5 6

In the context of money count forwards and backwards using 2p, 5p and 10p coins

Practical grouping e.g. in PE

12 children get into teams of 4 to play a game. How many teams are there?

Year Three

÷ = signs and missing numbers
Continue using a range of equations as in Year 2 but with appropriate numbers.

Understand division as sharing and grouping
18 ÷ 3 can be modelled as:
Sharing – 18 shared between 3 (see Year 1 diagram)

OR

Grouping - How many 3's make 18?

0   3   6   9   12   15   18

Remainders
16 ÷ 3 = 5 r1
Sharing - 16 shared between 3, how many left over?
Grouping – How many 3's make 16, how many left over?
e.g.

0   3   6   9   12   15 16

Introduce the formal layout using multiplication/division facts that the children know:
24 ÷ 3 = 8
This can also be recorded as ……

$$3 \overline{)\, 24}^{\,8}$$

DIVISION GUIDELINES

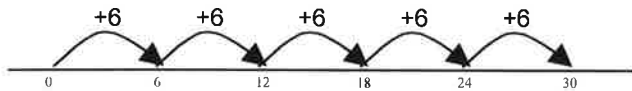| Year Four	Year Five	Year Six

Year Four

÷ = signs and missing numbers
Continue using a range of equations as in Year 2 but with appropriate numbers.

Sharing and grouping
30 ÷ 6 can be modelled as:
grouping – groups of 6 placed on no. line and the number of groups counted e.g.

sharing – sharing among 6, the number given to each person

Remainders
41 ÷ 4 = 10 r1

$41 = (10 \times 4) + 1$

Pencil and paper procedures- Chunking.

72 ÷ 5 lies between 50 ÷ 5 = 10 and 100 ÷ 5 = 20

* Partition the dividend into multiples of the divisor:
e.g   72 = 50 + 22
           50 ÷ 5 = 10
           22 ÷ 5 = 4r2 → 10 + 4r2 = 14 r 2
                OR

```
        72
    -   50    (10 groups)
        22
    -   20    (4 groups)
         2
Answer : 14 remainder 2
```

Year Five

Short Division

Continue to practise the formal written method of short division with whole number answers….

$$5 \overline{)8^34^27}$$ quotient 16

…. and with remainders:

$$5 \overline{)432}$$ $86r2$

The remainder can also be expressed as a fraction, 2/5
$432 \div 5 = 86\ 2/5$

Year Six

Revise Pencil and paper procedures- Chunking
977 ÷ 36 is approximately 1000 ÷ 40 = 25

* Partition the dividend into multiples of the divisor:
e.g.   977 = 720 + 180 + 77
            720 ÷ 36 = 20
            180 ÷ 36 = 5
            77 ÷ 36 = 2r5 → 20 + 5 + 2r5 = 27r5
                OR

```
           977
    -      720    (20 groups)
           257
    -      180    (5 groups)
           77
    -      72     (2 groups)
           5
```

Answer: $27\ ^5/_{36}$

Pencil and Paper procedures- Short Division Method

$$\text{divisor}\ 5 \overline{)847}\ \text{dividend}$$ quotient

Write down how many times your divisor goes into the first number of the dividend. If there is a remainder, that's okay. Write down your remainder to the left of the next digit in the dividend.
Continue. Repeat steps 1-3 until you are done.

$$5 \overline{)8^34^47}$$ $169r2$

Both methods above are necessary at this stage, to deal with the wide range of problems experienced at Year Six.

Continue using the **formal written layout.**

$$\overset{\quad 4}{8 \,\overline{)32}}$$

continue using the formal written layout, Introducing remainders.

This will then lead into the formal written method of short division:

$98 \div 7 = 14$

$$\overset{\quad 14}{7 \,\overline{)98}}$$

If children are confident develop further, by dividing 3 digit numbers by a 1 digit number using the formal method of short division with whole number answers (no remainders)

The following calculation can be solved using long division.
$144 \div 16 = 9$

```
            9
  16   144
     -  64    (4 x 16)
      _____
        80
      -  64    (4 x 16)
      _____
        16
       -16    (1 x 16)
      _____
         0      There is no remainder
```

$432 \div 15 = 28 \text{ r}12$

```
           28 r12
   15   432
      -  300    (20 x 15)
      _____
        132
      -  120    (8 x 15)
      _____
         12     (remainder)
```

The remainder can also be expressed as a fraction, 12/15 or as a decimal, 0.8
The answer is: 28 12/15 or 28.8