Bernards Heath Junior School

Maths Calculation Policy March 2014

Contents

The Importance of mental maths.

While this policy focuses on the written calculations in maths, we recognise the importance of the mental strategies and known facts that form the basis of all calculations. The following list outlines the key skills and number facts that children are expected to develop throughout the school.

To add and subtract successfully, children should be able to:

- Recall all addition pairs to 9 + 9 and number bonds to 10
- Recognise addition and subtraction as inverse operations
- Add mentally a series of one digit numbers e.g. 5 + 8 + 4
- Add and subtract multiples of 10 or 100 using related addition facts and their knowledge of place value
  e.g. 600 + 700, 160 – 70
- Partition 2 and 3 digit numbers into multiples of 100, 10 and 1 in different ways
  e.g. partition 74 into 70 + 4 or 60 + 14
  Use estimation by rounding to check answers are reasonable.

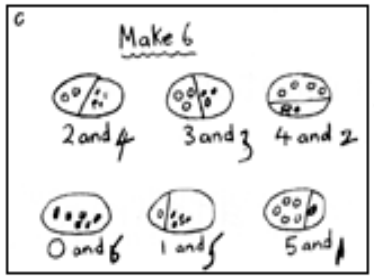
To multiply and divide successfully, children should be able to:

- Add and subtract accurately and efficiently
- Recall multiplication facts to 12 x 12 = 144 and division facts to 144 ÷ 12 = 12
- Use multiplication and division facts to estimate how many times one number divides into another etc.
- Know the outcome of multiplying by 0 and 1 and by dividing by 1
- Understand the effect of multiplying and dividing whole numbers by 10, 100 and later 1000
- Recognise factor pairs of numbers (15 = 3 x 5 or that 40 = 10 x 4) and become increasingly able to recognise common factors.
- Derive other results from multiplication and division facts and multiplication and division by 10, 100 and later 1000
- Notice and recall with fluency inverse facts
- Partition numbers into 100s, 10s and 1s or multiple groupings
- Understand how the principles of commutative, associative and distributive laws apply and do not apply to multiplication and division e.g. 5 x 3 can be written 3 x 5
- Understand the effects of scaling by whole and decimal numbers or fractions.
- Understand correspondence where n objects are related to m objects
- Investigate and learn the rules of divisibility.

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

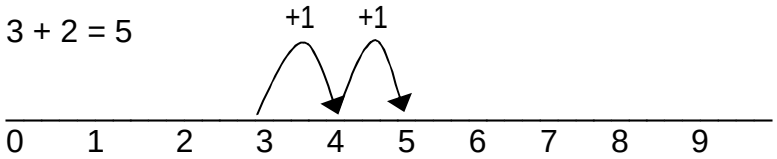
YR and Y1

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.



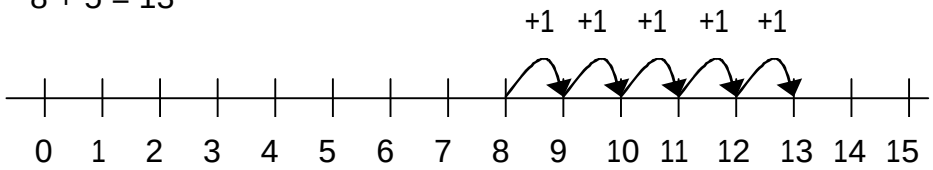
They use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line.

3 + 2 = 5

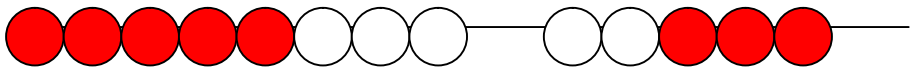


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

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.

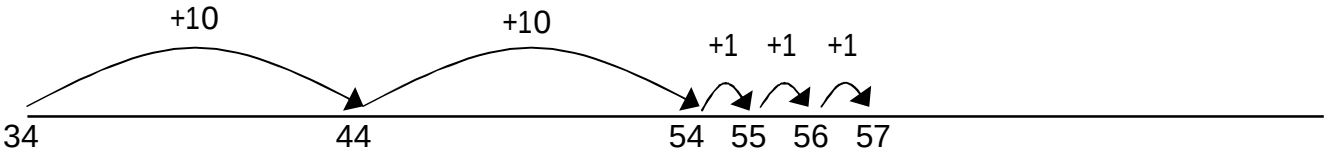


Y2

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

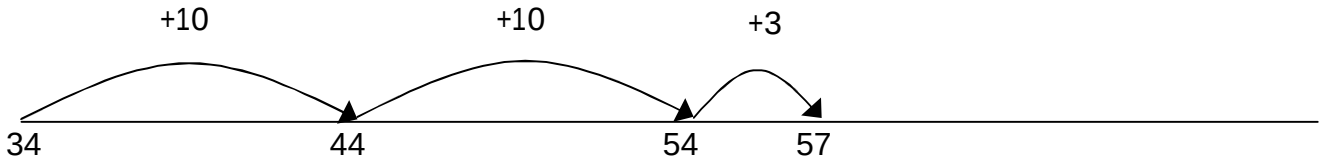
✓ First counting on in tens and ones.

34 + 23 = 57



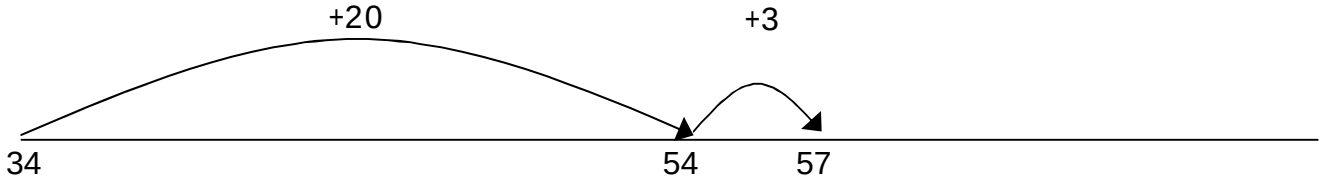
✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



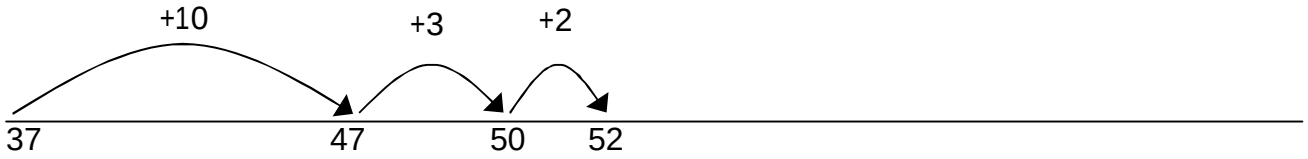
✓ Followed by adding the tens in one jump and the units in one jump.

34 + 23 = 57



✓ Bridging through ten can help children become more efficient.

37 + 15 = 52

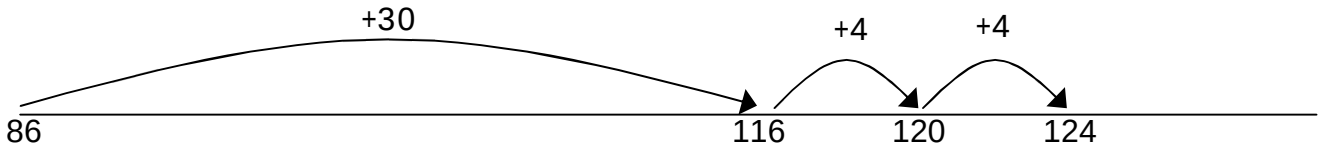


Y3

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

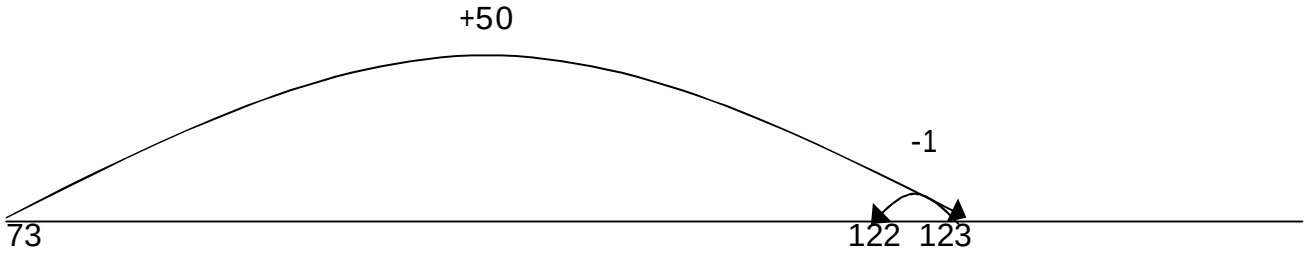
✓ Count on from the largest number irrespective of the order of the calculation.

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.

Option 1 – Adding most significant digits first, then moving to adding least significant digits.

	6	7
+	2	4
	8	0
	1	1
	9	1

	2	6	7
+		8	5
	2	0	0
	1	4	0
		1	2
	3	5	2

Moving to adding the least significant digits first in preparation for 'carrying'.

Option 2 - Adding the least significant digits first

	6	7
+	2	4
	1	1
	8	0
	9	1

	2	6	7
+		8	5
		1	2
	1	4	0
	2	0	0
	3	5	2

To include addition of HTO + HTO

Add fractions with the same denominator within one whole e.g.

⅛ + ⅛ = 2/8

Y4

From this, children will begin to carry below the line.

```
   6 2 5        7 8 3        3 6 7
+    4 8    +    4 2    +    8 5
-------      -------      -------
   6 7 3        8 2 5        4 5 2
-------      -------      -------
     1            1          1 1
```

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*.
- ✓ *Add fractions with the same denominator that add up to 1 whole*

Y5

Children should extend the carrying method to numbers with at least five digits.

```
   5 8 7
+  4 7 5
-------
 1 0 6 2
-------
   1 1
```

```
   3 5 8 7
+    6 7 5
---------
   4 2 6 2
---------
   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.*

Add fractions with different denominators and mixed numbers using the concept of equivalent fractions. E.g ½+1/8 = 5/8

Y6

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

```
   7 6 4 8
+  1 4 8 6
-----------
   9 1 3 4
-----------
     1 1 1
```

```
     6 5 8 4
+    5 8 4 8
-------------
   1 2 4 3 2
-------------
     1 1 1
```

```
         4 2
     6 4 3 2
       7 8 6
           3
+    4 6 8 1
-------------
   1 1 9 4 4
-------------
     1 2 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 four digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 401.2 + 26.85 + 0.71.*

Add fractions with different denominators and mixed numbers using the concept of equivalent fractions. E.g ½+1/8 = 5/8

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 not be made to go onto the next stage if:

1) **they are not ready.**
2) **they are not confident.**

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 methods.

PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

MENTAL CALCULATIONS
(Ongoing)
These are a **selection** of mental calculation strategies:

Mental recall of addition and 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

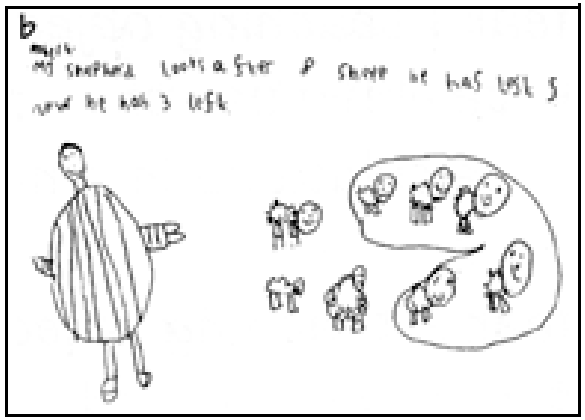
36 + 19 = 55	19 + 36 = 55
55 – 19 = 36	55 – 36 = 19

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

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

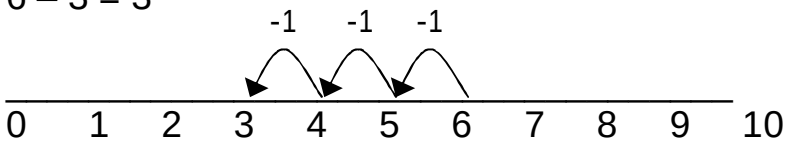
YR and Y1

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 number lines and practical resources to support calculation. Teachers *demonstrate* the use of the number line.

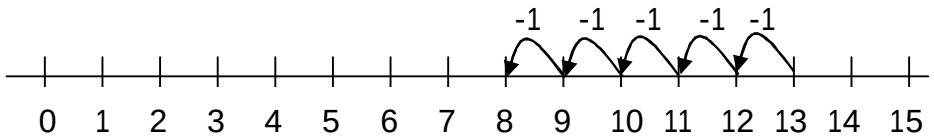
6 – 3 = 3



The number line 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.

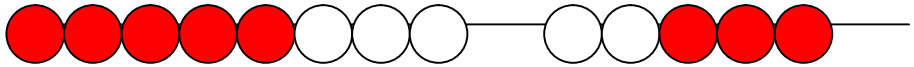
Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

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



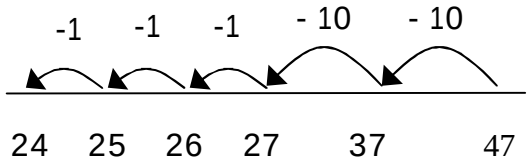
Y2

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

Counting back

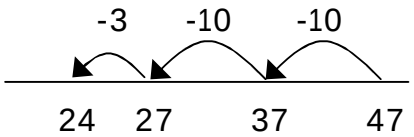
✓ First counting back in tens and ones.

47 – 23 = 24



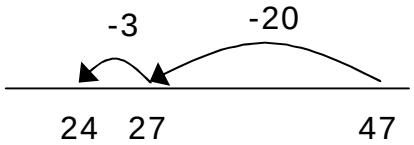
✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).

47 – 23 = 24



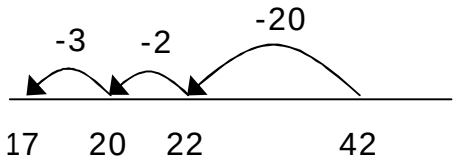
✓ Subtracting the tens in one jump and the units in one jump.

47 – 23 = 24



✓ Bridging through ten can help children become more efficient.

42 – 25 = 17



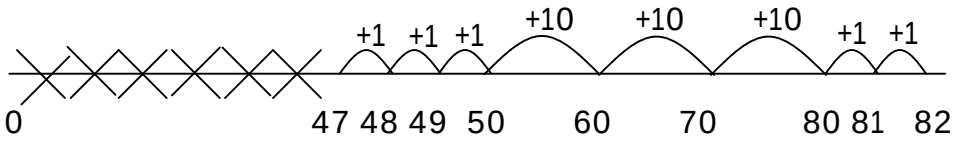
Counting on

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on.

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

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away'.

82 - 47



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.

Y3

Children will continue to use empty number lines with increasingly large numbers.

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

Partitioning and decomposition

This process should be demonstrated using arrow cards to show the partitioning and base 10 materials to show the decomposition of the number.

NOTE When solving the calculation 89 – 57, children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89.

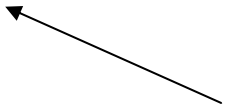
89	=	80	+	9	
- 57		50	+	7	
		30	+	2	= 32

Initially, the children will be taught using examples that do not need the children to exchange.

From this the children will begin to exchange.

71	=	=
- 46		

Step 1	70	1
	- 40	6



The calculation should be read as e.g. 1 take away 6

Step 2

	60	11		
-	40	6		
	20	5	=	25

This would be recorded by the children as

	60		
	~~70~~	$^{1}1$	
-	40	6	
	20	5	= 25

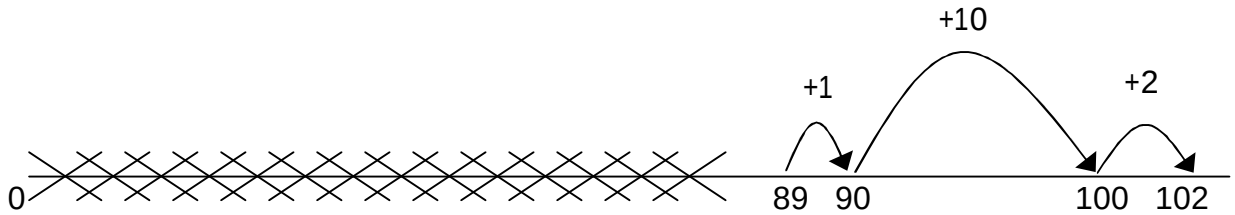
Children should know that units line up under units, tens under tens, and so on.

If we feel that the use of addition signs within a subtraction calculation will cause confusion, then they can be replaced with arrows, as in the example below. This will need to be agreed as part of the whole school policy and applied consistently throughout the school.

89	=	80	→	9	
- 57		50	→	7	
		30	→	2	= 32

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

102 – 89 = 13



To include subtraction of HTO – HTO

Subtract fractions with the same denominator within one whole e.g. 5/7 - 1/7 = 4/7

Y4

Partitioning and decomposition

754 =
- 86

Step 1 700 50 4
- 80 6

Step 2 700 40 14 *(adjust from T to U)*
- 80 6

Step 3 600 140 14 *(adjust from H to T)*
- 80 6
600 60 8 = 668

This would be recorded by the children as

600 140
~~700~~ + ~~50~~ + $^{1}4$
- 80 + 6
600 + 60 + 8 = 668

Decomposition

614 1
~~7~~5~~4~~
- 86
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.*

For example:

£8.95	=	8	0.9	0.05		leading to
-£4.38		- 4	0.3	0.08		
	=	8	0.8	0.15	*(adjust from T to U)*	$8.\overset{7}{\not{8}}\overset{1}{5}$
		- 4	0.3	0.08		- 4.38
		4	0.5	0.07		

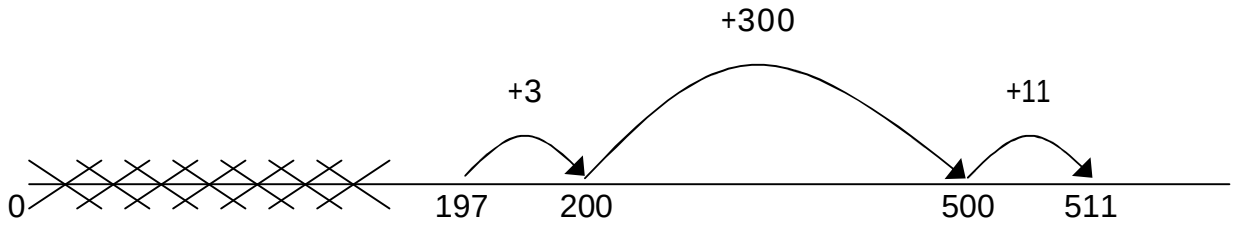
= £4.57

Alternatively, children can set the amounts to whole numbers, i.e. 895 – 438 and convert to pounds after the calculation.

NB If your children have reached the concise stage they will then continue this method through into years 5 and 6. They will not go back to using the expanded methods.

Where the numbers 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



✓ *Subtract fractions with the same denominator that add up to 1 whole*

Y5

Partitioning and decomposition

Step 1

	754	=	700	50	4	
	- 286		- 200	80	6	

Step 2

	700	40	14	*(adjust from T to O)*
	-200	80	6	

Step 3

	600	140	14	*(adjust from H to T)*		
-	200	80	6			
	400	60	8	=	468	

This would be recorded by the children as

	600	140			
	~~700~~	~~50~~	$^{1}4$		
-	200	80	6		
	400	60	8	=	468

Decomposition

	614 1		
	~~7~~ 6	~~1~~ 5	4
-	2	8	6
	4	6	8

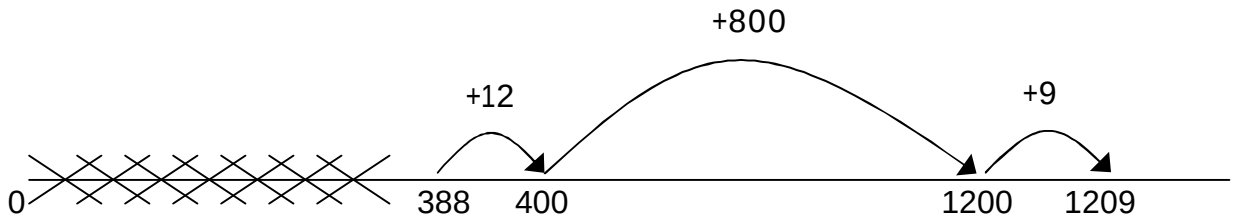
Children should:

- ✓ *be able to subtract numbers with different numbers of digits up to five 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.*

NB If your children have reached the concise stage they will then continue this method through into year 6. They will not go back to using the expanded methods.

Where the numbers 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



Subtract fractions with different denominators and mixed numbers using the concept of equivalent fractions. E.g. 5/8 – ½ = 1/8

Y6

Decomposition

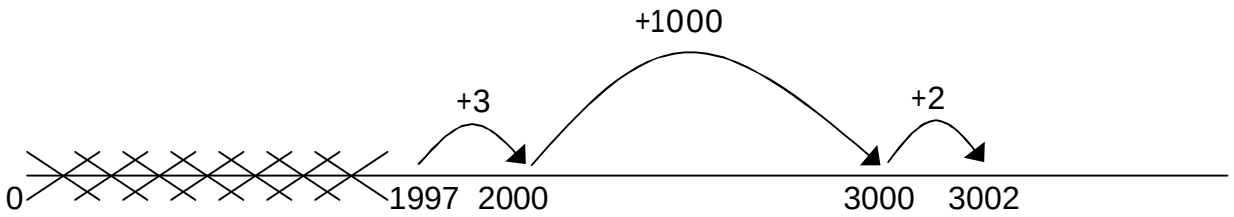
$$\begin{array}{r} {\scriptstyle 5\,1\,3\,1} \\ 6\not{4}\not{6}7 \\ -\ 2684 \\ \hline 3783 \end{array}$$

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

3002 – 1997 = 1005



Subtract fractions with different denominators and mixed numbers using the concept of equivalent fractions. E.g. 5/8 – ½ = 1/8

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 not be made to go onto the next stage if:

3) **they are not ready.**
4) **they are not confident.**

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 methods.

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS
(ongoing)
These are a **selection** of mental calculation strategies:

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

Tables should be taught everyday 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 all multiplication facts up to 12 x 12
Years 5 & 6	Derive and recall quickly all multiplication facts up to 12 x 12.

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

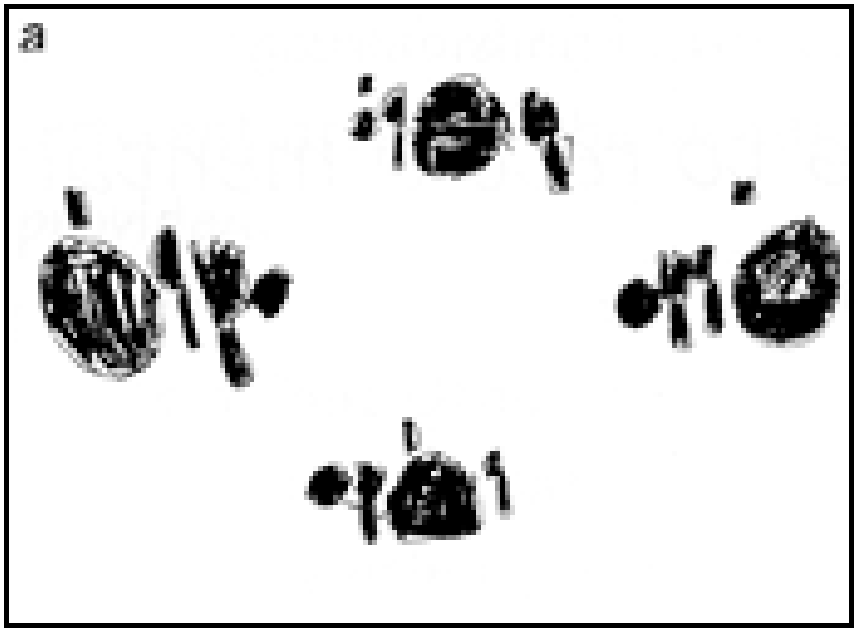
Use of factors
8 x 12 = 8 x 4 x 3

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

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

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

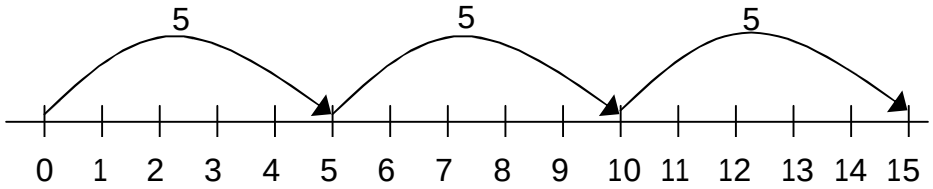
Children will develop their understanding of multiplication and use jottings to support calculation:

✓ **Repeated addition**

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

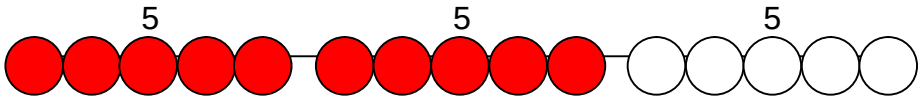
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5



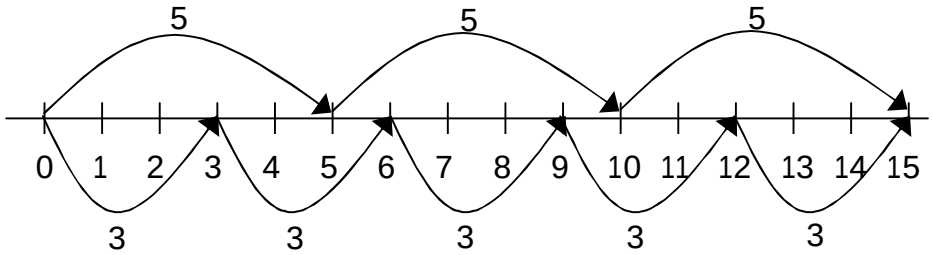
and on a bead bar:

5 x 3 = 5 + 5 + 5



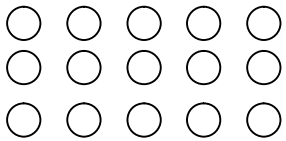
✓ **Commutativity**

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

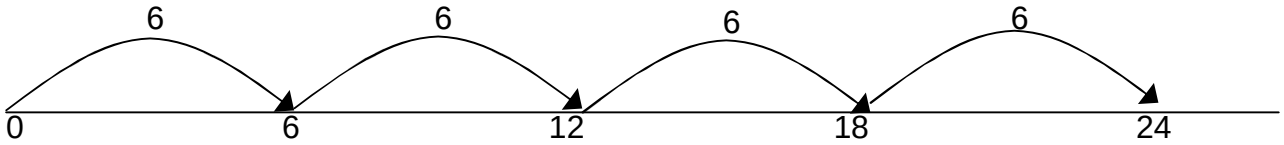
Y3

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.



✓ **Arrays**

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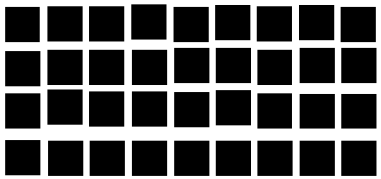


9 x 4 = 36

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

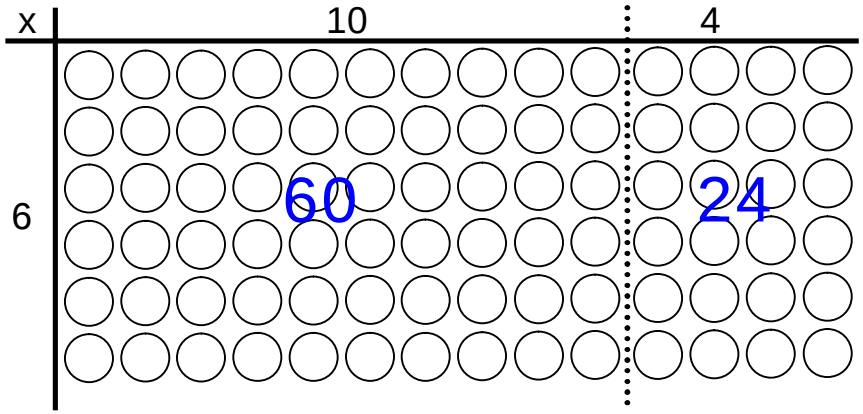
✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

☐ x 5 = 20 3 x △ = 18 ☐ x O = 32

✓ **Partitioning**

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

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



(6 x 10) + (6 x 4)

60 + 24

84

Y4

Grid method

TO x O and HTO x O
(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

160
+ 24
184

Y5

Grid method

ThHTO x O (and TO)
(Short multiplication – multiplication by a single digit)

346 x 9

Children will approximate first
346 x 9 is approximately 350 x 10 = 3500

x	6000	300	40	6
9	54000	2700	360	54

54000
2700
+ 360
+ 54
57114
1 1

TO x TO
(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

2100
+ 560
+ 60
+ 16
2736

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

x	4	0.9
3	12.0	2.7

$$\begin{array}{r} 12.0 \\ +\ 2.7 \\ \hline 14.7 \end{array}$$

Multiplying fraction and mixed numbers by whole numbers

e.g. 4 x 2/3 = 8/3 = 2 2/3 supported by diagrams etc

Y6

ThHTO x O
(Short multiplication – multiplication by a single digit)

4346 x 8

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

x	4000	300	40	6
8	32000	2400	320	48

32000
+ 2400
+ 320
+ 48
34768

HTO x TO
(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

$$
\begin{array}{r}
6000 \\
+\ 1400 \\
+\ 1200 \\
+\ 280 \\
+\ 40 \\
+\ 8 \\
\hline
8928 \\
{\scriptstyle 1}
\end{array}
$$

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

12
+ 0.7
+ 0.06
12.76

Multiply simple pairs of proper fractions writing the answer in its simplest form e.g. ¼ x ½ = 1/8

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 not be made to go onto the next stage if:

5) **they are not ready.**
6) **they are not confident.**

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.

PROGRESSION THROUGH CALCULATIONS FOR DIVISION

MENTAL CALCULATIONS
(Ongoing)
These are a **selection** of mental calculation strategies:

Doubling and halving
Knowing that halving is dividing by 2

Deriving and recalling division facts

Tables should be taught everyday 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 12 x 12
Year 5 & 6	Derive and recall quickly division facts for all tables up to 12 x 12

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

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.

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

YR and Y1

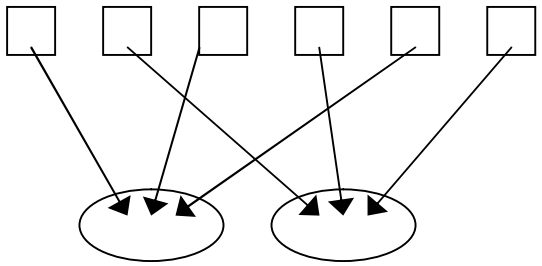
Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

Y2

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

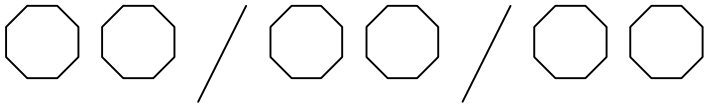
✓ **Sharing equally**

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



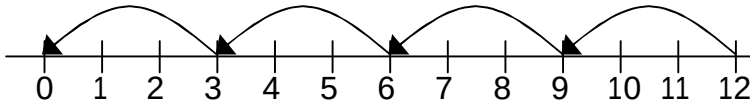
✓ **Grouping or repeated subtraction**

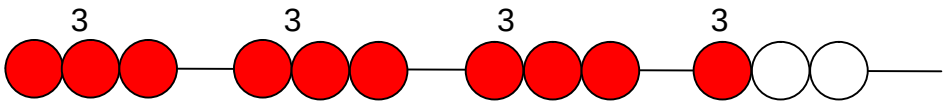
There are 6 sweets, how many people can have 2 sweets each?



✓ **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

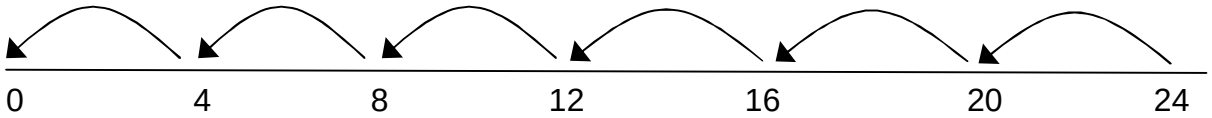
Ensure that the emphasis in Y3 is on grouping rather than sharing.

Children will continue to use:

✓ **Repeated subtraction using a number line**

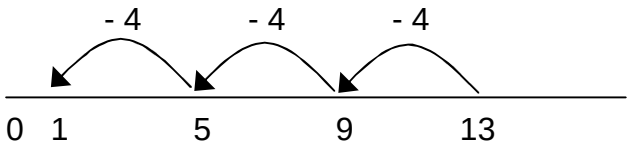
Children will use an empty number line to support their calculation.

24 ÷ 4 = 6



Children should also move onto calculations involving remainders.

13 ÷ 4 = 3 r 1



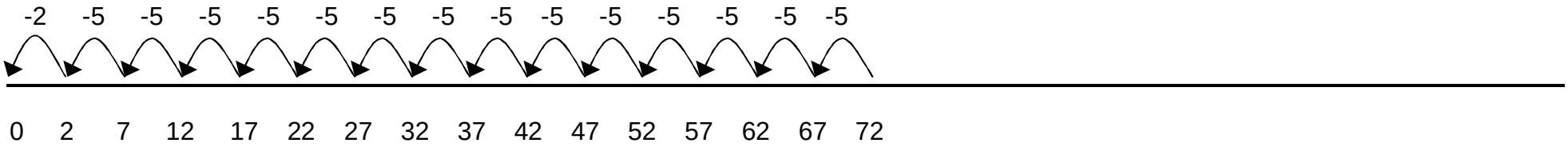
✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

26 ÷ 2 = ☐ 24 ÷ △ = 12 ☐ ÷ 10 = 8

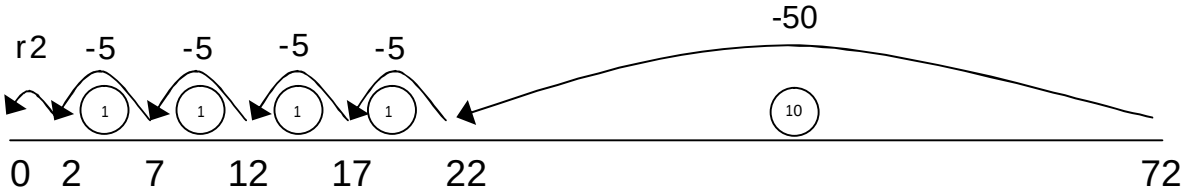
Y4

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.

72 ÷ 5



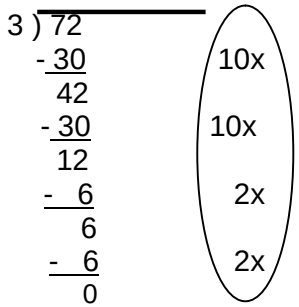
Moving onto:



Then onto the vertical method:

Short division TO ÷ O

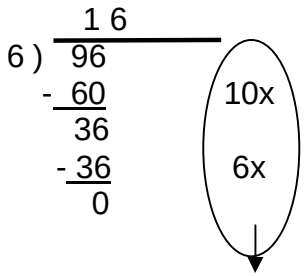
72 ÷ 3



Answer = 24

Leading to subtraction of other multiples.

96 ÷ 6



Answer : 16

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 ThHTO ÷ TO (TO >= 12)

196 ÷ 6

```
  32 r 4
 ------
6 ) 196
  - 180      30x
 ------
    16
  -  12      2x
 ------
     4
```

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.

Remainders expressed as fractions.

Y6

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

Long division HTO ÷ TO

972 ÷ 36

```
      27
36 ) 972
   - 720      20x
     252
   - 252       7x
       0
```

Answer : 27

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 it's 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

```
     12.5
7 ) 87.5
  -  70.0     10x
     17.5
  -  14.0      2x
      3.5
  -   3.5     0.5x
      0
```

Answer : 12.5

Divide proper fractions by whole numbers e.g. 1/3 divided by 2 = 1/6

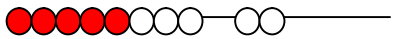
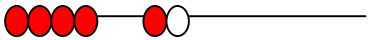
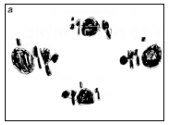
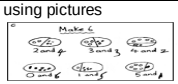
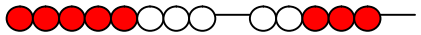
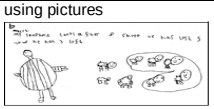
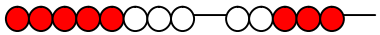
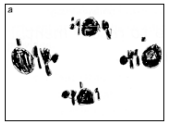
By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

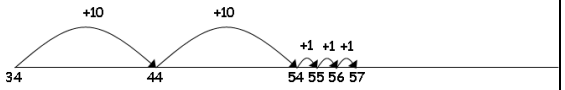
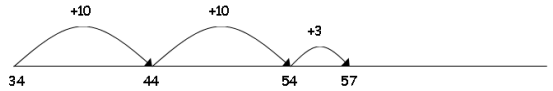
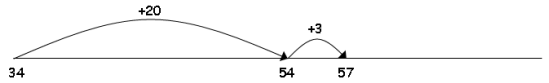
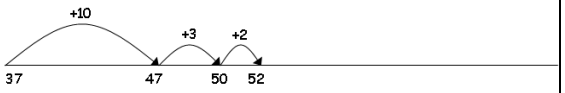
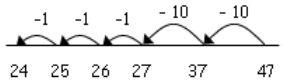
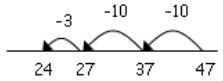
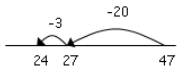
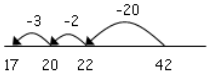
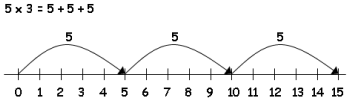
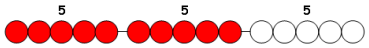
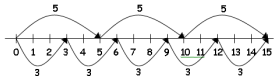
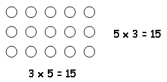
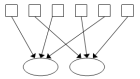
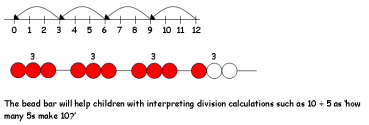
Children should not be made to go onto the next stage if:

7) **they are not ready.**
8) **they are not confident.**

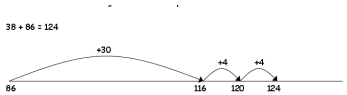
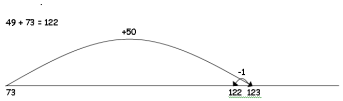
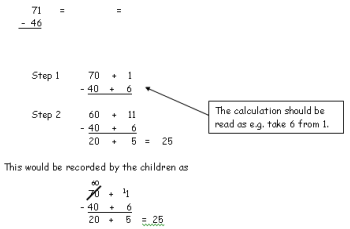
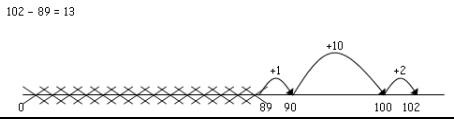
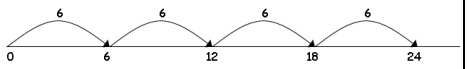
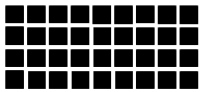
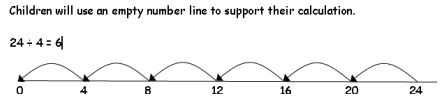
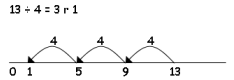
Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy.
Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

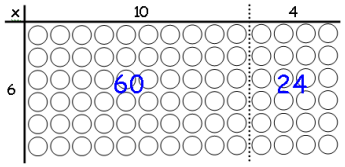
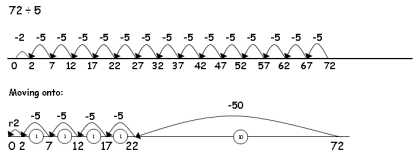
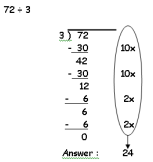
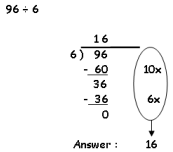
Summary of Calculations in Year R to Year 2

	Addition	Subtraction	Multiplication	Division
YR	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.  Bead strings or bead bars can be used to illustrate addition  8+2=10 They use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line.	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.  Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.  6 They use number lines and practical resources to support calculation. Teachers *demonstrate* the use of the number line.	Children will experience equal groups of objects. They 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. 	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. 
Y1	using pictures  Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.  They use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line. Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.	using pictures  Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.  13 Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones. The number line 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 will experience equal groups of objects. They 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. 	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. 

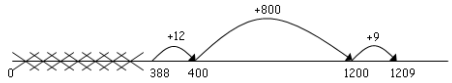
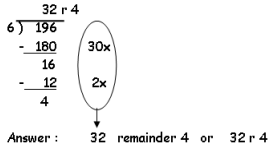
	Addition	Subtraction	Multiplication	Division
Y2	Children will begin to use 'empty number lines' themselves starting with the larger number and counting on. ✓ First counting on in tens and ones. 34 + 23 = 57  ✓ Then helping children to become more efficient by adding the units in one jump (by using the 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  	Children will begin to use empty number lines to support calculations. **Counting back:** ✓ First counting back in tens and ones. 47 – 23 = 24  ✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4). 47 – 23 = 24  ✓ Subtracting the tens in one jump and the units in one jump. 47 – 23 = 24  ✓ Bridging through ten can help children become more efficient. 42 – 25 = 17  Counting on: The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away'.	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 x3 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.  	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  ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations** ☐ ÷ 2 = 4 20 ÷ △ = 4 ☐ ÷ △ = 4

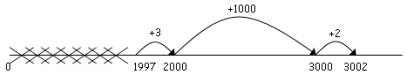
Summary of Calculations in Year 3 to Year 4

	Addition	Subtraction	Multiplication	Division
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.  ✓ Compensation  Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies. Adding the least significant digits first 67 + 24 11 (7 + 4) 80 (60 + 20) 91 267 + 85 12 (7 + 5) 140 (60 + 80) 200 352	Children will continue to use empty number lines with increasingly large numbers. Children will begin to use informal pencil and paper methods (jottings). ✓ **Partitioning and decomposition** • Partitioning – demonstrated using arrow cards • Decomposition - base 10 materials **NOTE** When solving the calculation 89 – 57, children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89. 89 = 80 + 9 - 57 50 + 7 30 + 2 = 32 ✓ **Begin to exchange.**  Where the numbers involved in the calculation are close together or near to multiples of 10, 100 etc. counting on using a number line should be used.  	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.   ✓ **Arrays** Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.  9 x 4 = 36 ✓ **Scaling** e.g. Find a ribbon that is 4 times as long as the blue ribbon  ✓ **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	Ensure that the emphasis in Y3 is on grouping rather than sharing. Children will continue to use: ✓ **Repeated subtraction using a number line**  Children should also move onto calculations involving remainders.  ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations** 26 ÷ 2 = ☐ 24 ÷ △ = 12 ☐ ÷ 10 = 8

	Addition	Subtraction	Multiplication	Division
Y4	✓ Carry below the line. 625 + 48 = 673 (1) 783 + 42 = 825 (1) *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.*	✓ **Partitioning and decomposition** 754 − 86 = Step 1: 700 + 50 + 4 − 80 + 6 Step 2: 700 + 40 + 14 − 80 + 6 *(adjust from T to U)* Step 3: 600 + 140 + 14 − 80 + 6 *(adjust from H to T)* 600 + 60 + 8 = 668 This would be recorded by the children as 600 140 14 700 + 50 + 4 − 80 + 6 600 + 60 + 8 = 668 ✓ **Decomposition** 614 1 754 − 86 668 *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.* £8.95 − £4.38 = 8 + 0.9 + 0.05 − 4 + 0.3 + 0.08 = 8 + 0.8 + 0.15 − 4 + 0.3 + 0.08 *(adjust from T to U)* 4 + 0.5 + 0.07 = £4.57 leading to 1 8.95 − 4.38	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 24 160 + 24 184	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.  Then onto the vertical method: **Short division TU ÷ U**  Leading to subtraction of other multiples.  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.

Summary of Calculations in Year 5 to Year 6

	Addition	Subtraction	Multiplication	Division
Y5	Children should extend the carrying method to numbers with at least four digits. 587 + 475 = 1062 (1 1) 3587 + 675 = 4262 (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.*	**Partitioning and decomposition** Step 1: 754 = 700 + 50 + 4; − 286 = − 200 + 80 + 6 Step 2: 700 + 40 + 14 − 200 + 80 + 6 *(adjust from T to U)* Step 3: 600 + 140 + 14 − 200 + 80 + 6 *(adjust from H to T)* 400 + 60 + 8 = 468 This would be recorded by the children as 600 140 ~~700~~ + ~~50~~ + 14 − 200 + 80 + 6 400 + 60 + 8 = 468 **Decomposition** 614 1 ~~7~~6~~5~~4 − 286 468 *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 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 	**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 × 300 40 6 9 2700 360 54 2700 + 360 + 54 = 3114 (1 1) **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 × 70 2 30 2100 60 8 560 16 2100 + 560 + 60 + 16 = 2736 (1) *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 12 + 2.7 = 14.7	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.

	Addition	Subtraction	Multiplication	Division
Y6	Children should extend the carrying method to number with any number of digits. 7648 + 1486 = 9134 (1 1 1) 6584 + 5848 = 12432 (1 1 1) 42 + 6432 + 786 + 3 + 4681 = 11944 (1 2 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 four digits and either one or two decimal places;* ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 401.2 + 26.85 + 0.71.*	**Decomposition** 5 13 1 6467 - 2684 3783 *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 involved in the calculation are close together or near to multiples of 10, 100 etc. counting on using a number line should be used. 3002 – 1997 = 1005  	**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 x 4000 300 40 6 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 12 + 0.7 + 0.06 = 12.76	Children will continue to use written methods to solve short division TU ÷ U and HTU ÷ U. **Long division HTU ÷ TU** 972 ÷ 36 27 36) 972 - 720 (20x) 252 - 252 (7x) 0 Answer: 27 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 it's 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 12.5 7) 87.5 - 70.0 (10x) 17.5 - 14.0 (2x) 3.5 - 3.5 (0.5x) 0 Answer : 12.5

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 not be made to go onto the next stage if:
they are not ready.
they are not confident.
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.
Use knowledge of the order of operations to carry out calculations involving the four operations e.g. 2+(1X3) = 5 and (2+1)x3=9