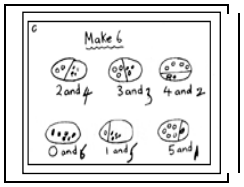
John Rankin Junior School
Calculation Policy

Review date: **January 2009**

Addition

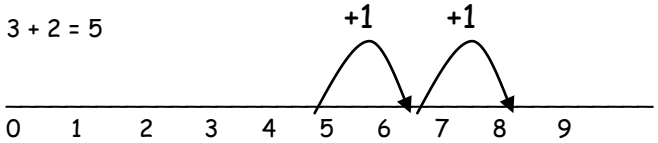
Year 1

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



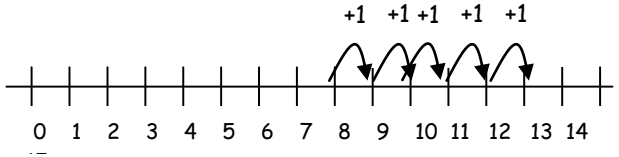
They use numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5

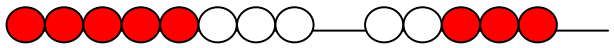


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



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

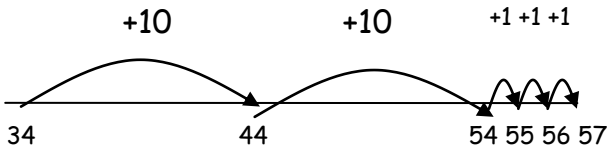


Year 2

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

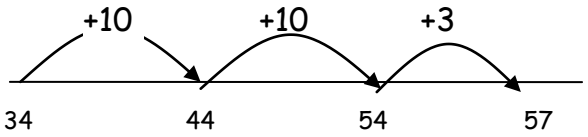
✓ First counting on in tens and ones.

34 + 23 = 57



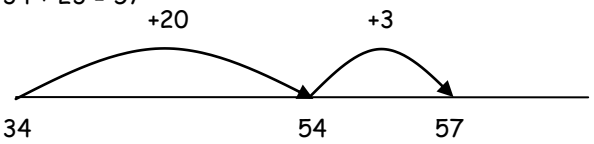
✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



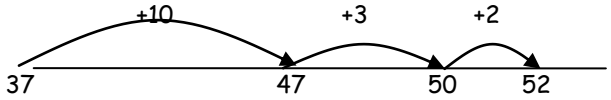
✓ Followed by adding the tens in one jump and the units in one jump

34 + 23 = 57



✓ Bridging through ten can help children become more efficient.

37 + 15 = 52

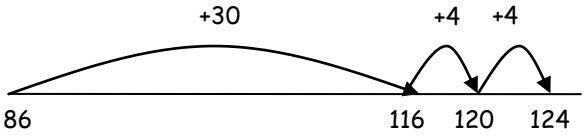


Year 3

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

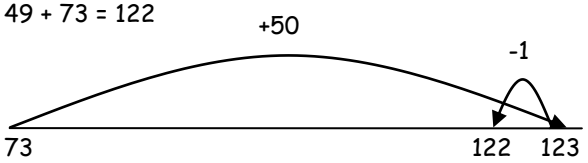
✓ Count on from the largest number irrespective of the order of the calculation.

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.

Adding the least significant digits first

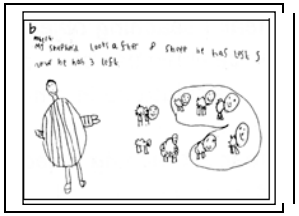
67		267
+ 24		+ 85
11	(7 + 4)	12 (7 + 5)
80	(60 + 20)	140 (60 + 80)
91		200
		352

Addition		
Year 4	Year 5	Year 6
Children will consolidate the above and move on to carrying below the line. 625 + 48 = 673 (1) 783 + 42 = 825 (1) 367 + 85 = 452 (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.*	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.*	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*

Subtraction

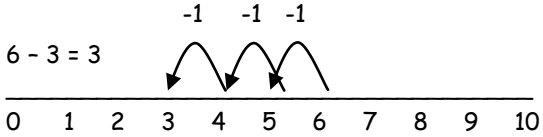
Year 1

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



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

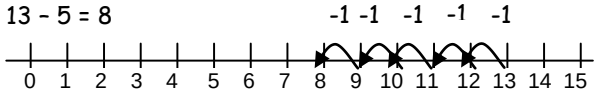
6 – 3 = 3



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

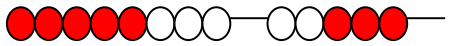
Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 – 5 = 8



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

13 – 5 = 8



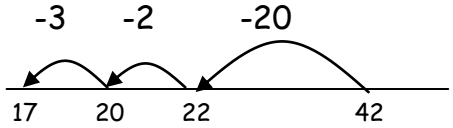
Year 2

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

Counting back

- ✓ Counting back in tens then ones.
- ✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).
- ✓ Subtracting the tens in one jump and the units in one jump.
- ✓ Bridging through ten can help children become more efficient.

42 – 25 = 17



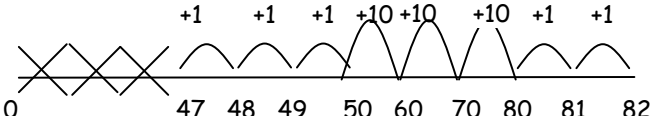
Counting on

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

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

Year 3

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

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

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

Step 1
70 + 1
- 40 + 6

Step 2
60
70 + 11
- 40 + 6
20 + 5 = 25

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

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

Subtraction

Year 4

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
~~7~~00 + ~~5~~0 + ^{1}4
- 80 + 6
600 + 60 + 8 = 668

Decomposition

When children are secure in the above method they move on to decomposition.

614 1
~~7~~ ~~1~~ ~~4~~
- 86
668

Children should:

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

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

Year 5

Continue with Year 4 strategies and move on to decomposition when ready.

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.*

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

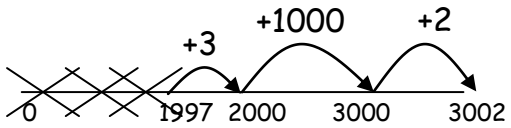
Year 6

Children should:

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

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

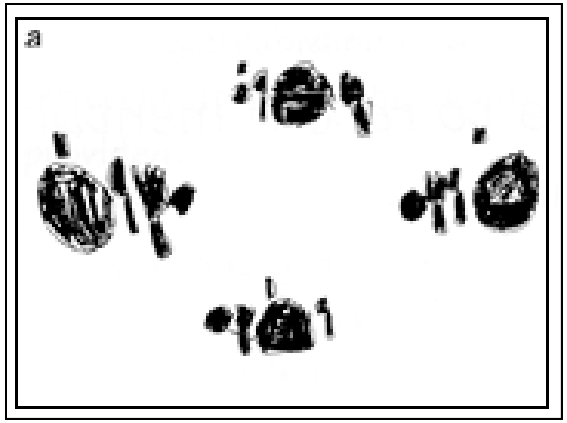
3002 – 1997 = 1005



Multiplication

Year 1

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.



Year 2

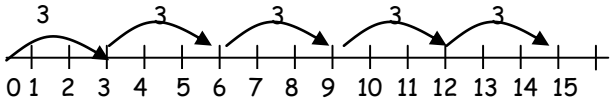
Children will develop their understanding of multiplication and use jottings to support calculation:

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 = 3+3+3+3+3



✓ **Commutativity**

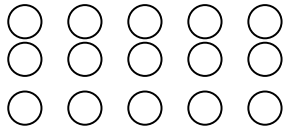
Show on bead bar or on a number line:

3 x 5 = 5 + 5 + 5

✓ **Arrays**

Which is the same as 5 x 3

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

Year 3

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

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

5cm 20 cm

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

☐ x 5 = 20 3 x △ = 18 ☐ x O = 32

✓ **Partitioning**

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

Multiplication

Year 4

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

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

Year 5

Grid method
HTU x U
(Short multiplication – multiplication by a single digit)
346 x 9
Children will approximate first
346 x 9 is approximately 350 x 10 = 3500

x	300	40	6
9	2700	360	54

2700
+ 360
+ 54
31 1 4
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

x	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.

Year 6

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

HTU x TU
(Long multiplication – multiplication by more than a single digit)
372 x 24

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

x	4	0.9	0.02
3	12	2.7	0.06

12
+ 0.7
+0.06
12.76

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

They then move on to the vertical expanded method:

38
X 7
56 (8 x 7)
210 (8 x 30)
266

Lastly on to compact work

38
X 7
266
2 5

Division

Year 1

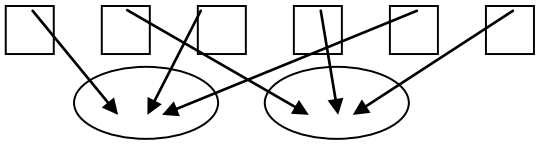
Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

Year 2

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

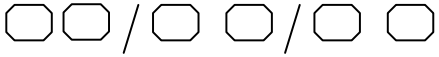
✓ **Sharing equally**

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



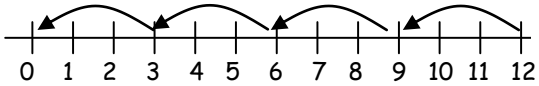
✓ **Grouping or repeated subtraction**

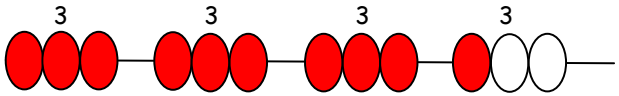
There are 6 sweets, how many people can have 2 sweets each?



✓ **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

Year 3

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

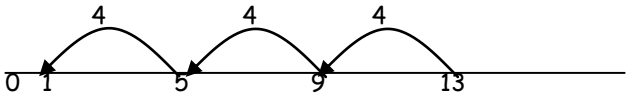
Children will continue to use:

✓ **Repeated subtraction using a number line**

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

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

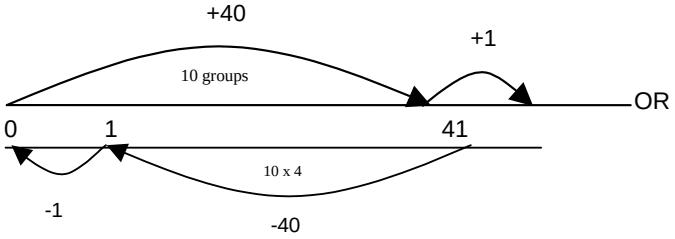
Division

Year 4

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

Moving onto:

Remainders
41 ÷ 4 = 10 r1



OR 41 = (10 x 4) + 1

Then onto the vertical method:

Short division TU ÷ U

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

72
- 50 (10 groups) or (10 x 5)
22
- 20 (4 groups) or (4 x 5)
2

Answer : 14 remainder 2

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.

Year 5

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

```
   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.

Year 6

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

Long division HTU ÷ TU
972 ÷ 36

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