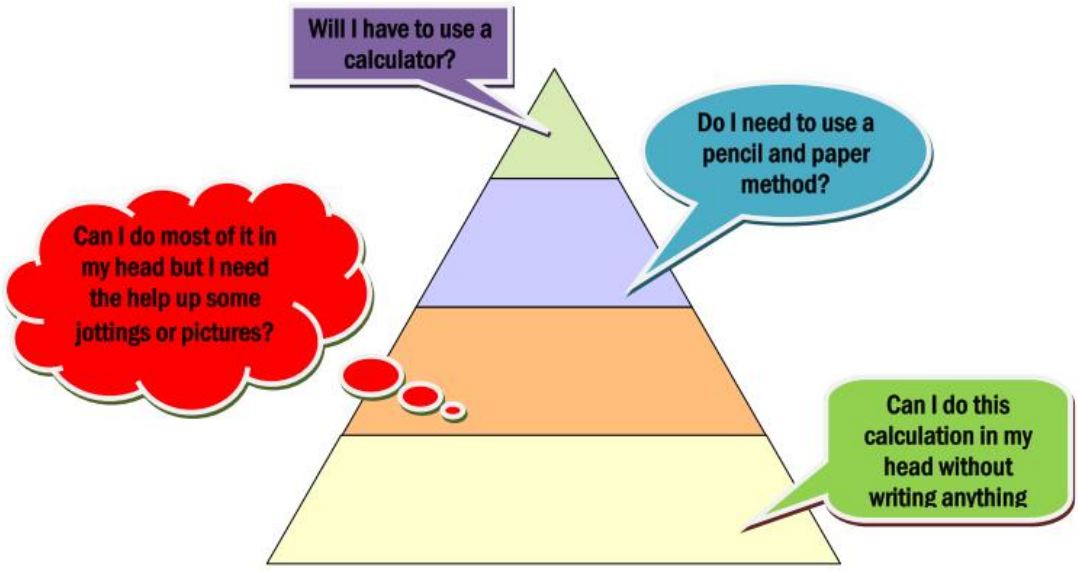
Headteacher: Miss K House

The Ilsleys and Hampstead Norreys

Calculations Policy

February 2016



This policy exemplifies a recommended progression through the four operations, beginning in Foundation Stage, carrying on to Year 6 including additional challenge for children working at a greater depth within the primary curriculum. This includes a selection of mental strategies.

Children will begin by using mental calculations and then will build up towards written calculations. Once written methods are introduced, mental skills must be kept sharp by continual development and application through daily mental maths in every classroom.

Children are ready to take on written calculations in addition and subtraction when:

- **Children know addition and subtraction facts to 20**
- **They understand place value and can partition numbers into hundreds, tens and units**
- **They use and apply commutative and associative laws of addition**
- **They can add at least three 1-digit numbers mentally**
- **They can add and subtract any pair of 2 digit numbers mentally**
- **They can explain their mental strategies orally and can record them using informal jottings**

Children are ready to take on written calculations in multiplication and division when:

- **They know 2,3,4,5 and 10 times tables**
- **They know the result of multiplying by 0 and 1**
- **They understand place value**
- **They understand 0 as a place holder**
- **They can multiply 2 and 3 digits mentally by 10 and 100**
- **Children can use their knowledge of tables to approximate**
- **They can find products using multiples of 10**
- **They use the commutative and associative laws of multiplication**
- **Children can halve and double 2-digit numbers mentally**
- **They can explain their mental strategies orally and record them using informal jottings**

By the end of year 6, the expectation is that our children are secondary ready. This means that they have the ability to select and choose the most efficient and appropriate method for the calculation they are presented with.

When teaching calculation children should be encouraged to:

- **to approximate their answers before calculating**
- **to check their answers after calculation using an appropriate strategy, e.g. inverse operation, rounding or estimation**
- **to consider if a mental calculation would be appropriate before using written methods**

Key vocabulary for each operation:

Addition – add, sum, and, plus, more, make, total, altogether, equals, equal to, count on

Subtraction – take away, less, minus, subtract, leaves, difference, fewer, count back

Multiplication – group of, lots of, array, multiple, times, altogether, factor, square number, multiply, total, count up in

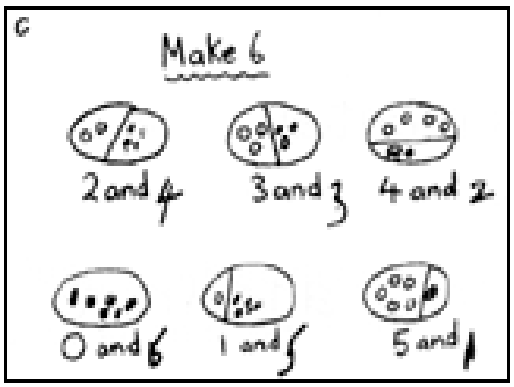
Division – share, share equally, group, groups of, divide, dividing, left over, remainder, quotient

YR and Y1

YR and Y1

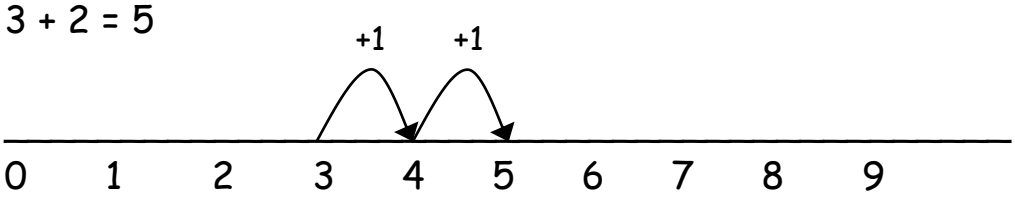
Addition

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.



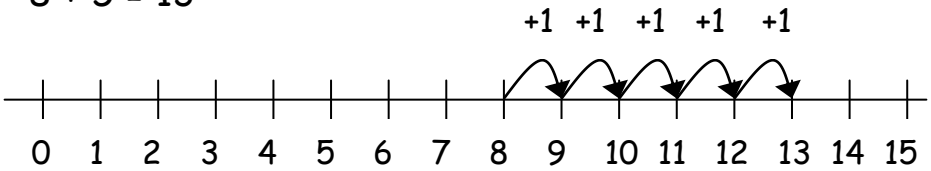
They use number lines and practical resources to support calculation and teachers *demonstrate* the use of the number line.

3 + 2 = 5

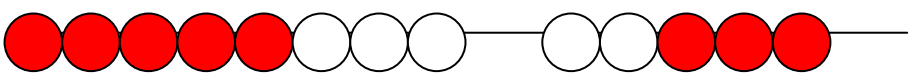


Children then begin to use number lines to support their own calculations to count on in ones.

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.

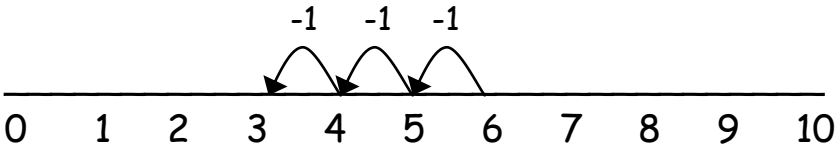


Subtraction

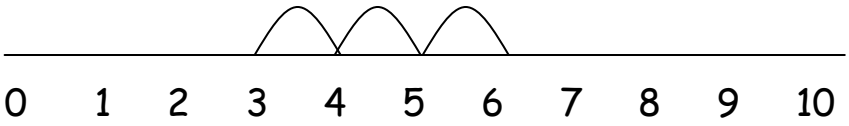
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

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

6 – 3 = 3

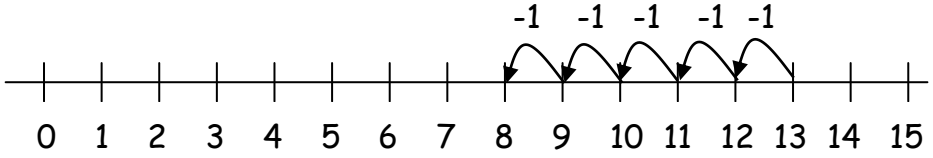


The number line should also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



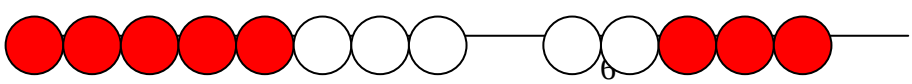
Children then begin to use number lines to support their own calculations by counting back in ones.

13 – 5 = 8



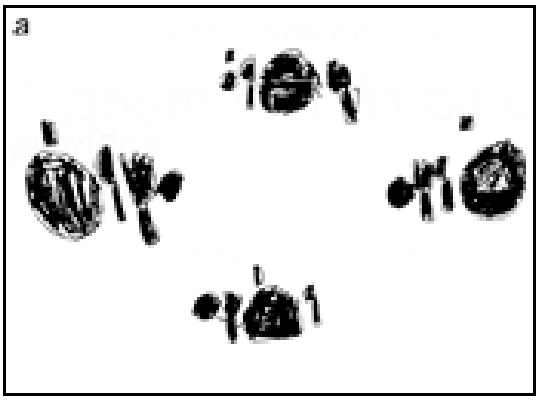
Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

13 – 5 = 8



Multiplication

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.



Division

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.

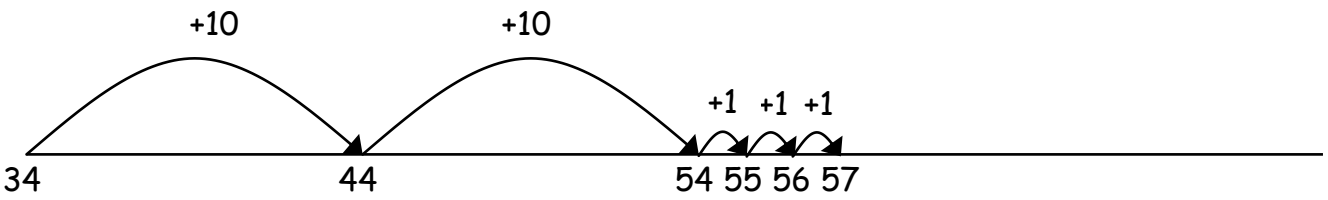
Y2

Y2

Addition

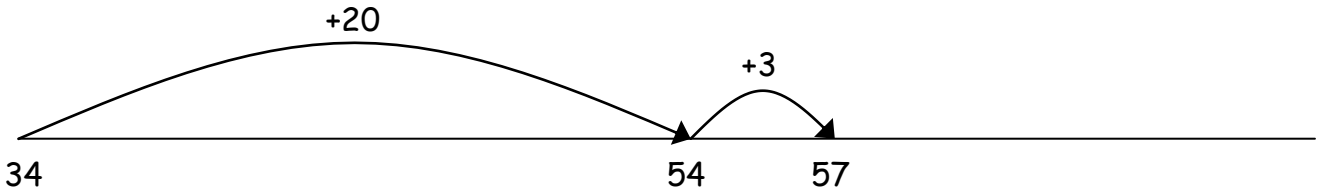
Children will begin to use 'empty number lines' independently starting with the larger number and counting on in ones and tens.

34 + 23 = 57



As children become more efficient, they use the number line to add the tens in one jump and then the units in one jump.

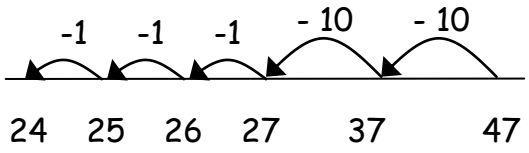
34 + 23 = 57



Subtraction

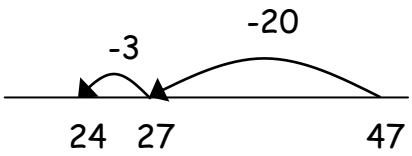
Children will begin to use empty number lines to support calculations by counting back in tens and ones.

47 – 23 = 24



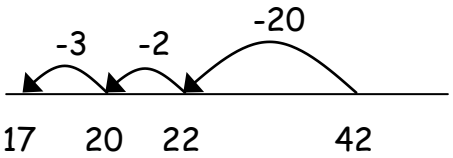
As children become more efficient, they will be able to subtract the tens in one jump followed by the units in one jump.

47 – 23 = 24



Children should be encouraged to bridge through tens to help them to reduce the chance of errors.

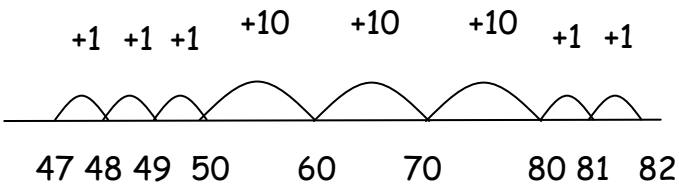
42 – 25 = 17



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.

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

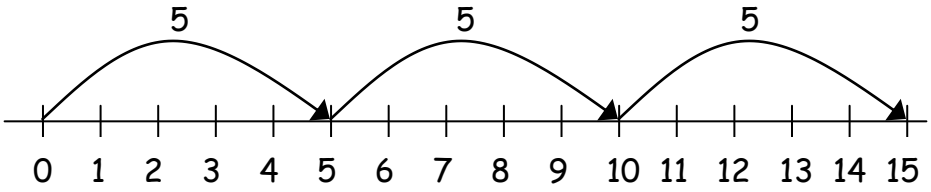
Multiplication

Children will develop their understanding of multiplication through the use of repeated addition.

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

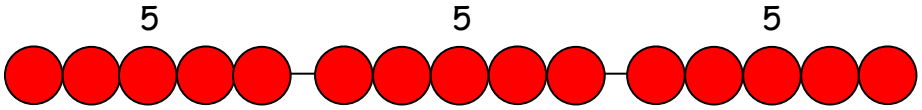
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5

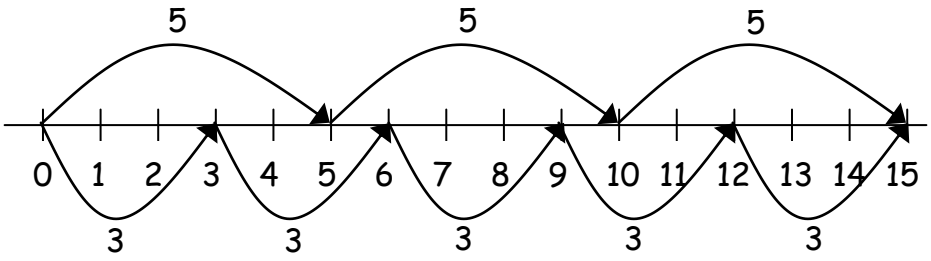


It can also be demonstrated on a bead bar:

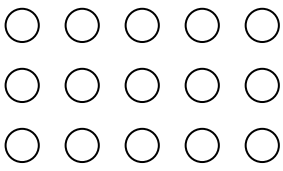
5 x 3 = 5 + 5 + 5



Children should be taught the rules of commutativity which means knowing that 3 x 5 has the same answer as 5 x 3. This can also be modelled on the number line.



When this is understood, children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



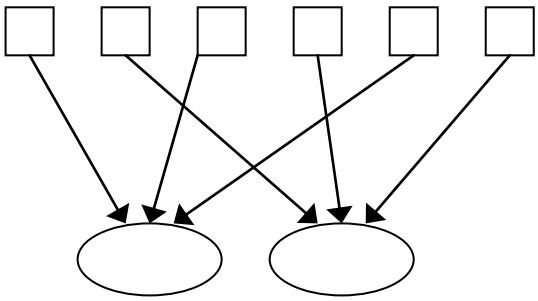
5 x 3 = 15

3 x 5 = 15

Division

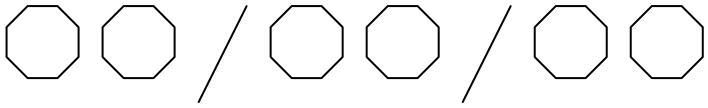
Children will develop their understanding of division and use jottings to support calculation by sharing equally.

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



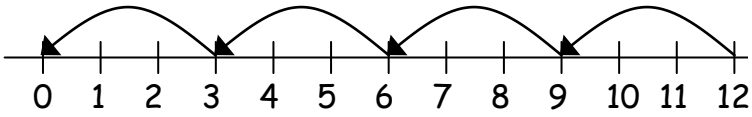
They should also be taught that division can be solved using grouping.

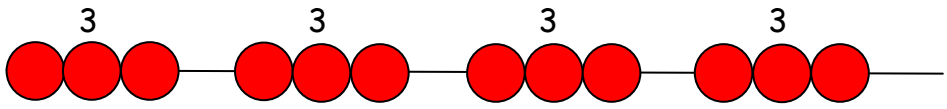
There are 6 sweets, how many people can have 2 sweets each?



Repeated subtraction using a number line or bead bar can then be taught.

12 ÷ 3 = 4





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

Missing number problems can be introduced when children have secured the use of these methods to provide further challenge.

□ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4

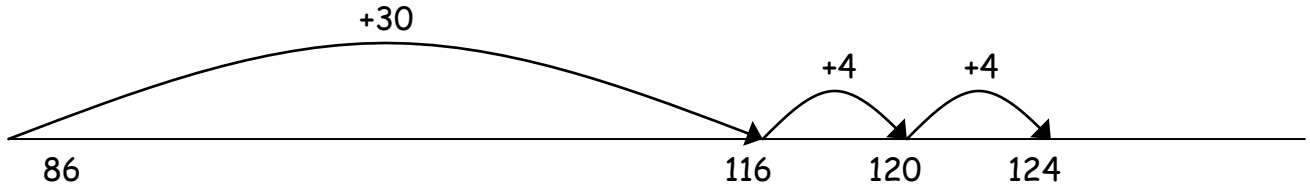
Y3

Y3

Addition

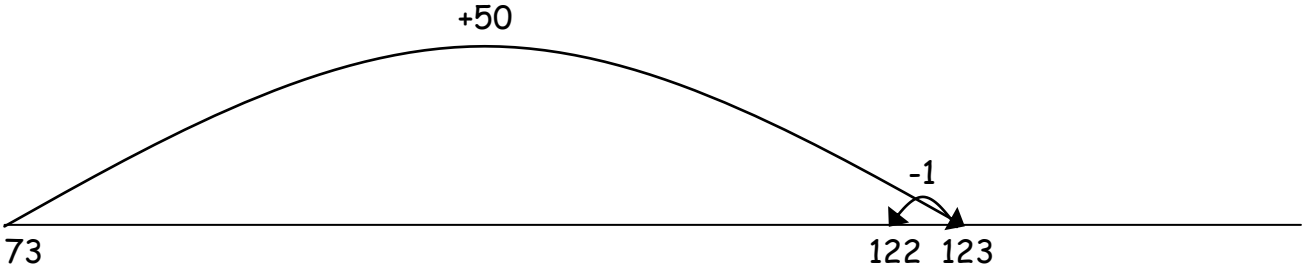
Children will continue to use empty number lines with increasingly large numbers. They should be taught to count on from the largest number irrespective of the order of the calculation.

38 + 86 = 124



They should also be taught to use compensation (where appropriate).

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.

Children should be taught to add the largest digits first.

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

Children should then move on to adding the smallest digits first to prepare them for using a more formal column method.

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

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

Subtraction

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.

Children should be taught to use partitioning and decomposition. This process should be demonstrated using arrow cards to show the partitioning and base 10 materials (dienes) to show the decomposition of the number. Initially, the children must be taught using examples that do not need the children to exchange.

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

When children are secure, they should move on to using amounts that require exchanging.

```
  71   =         =
- 46
```

```
Step 1     70  +  1
         - 40  +  6

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

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

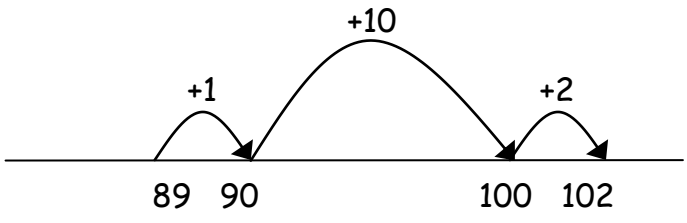
This would be recorded by the children as

```
          60
          7̸0  +  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.

102 – 89 = 13

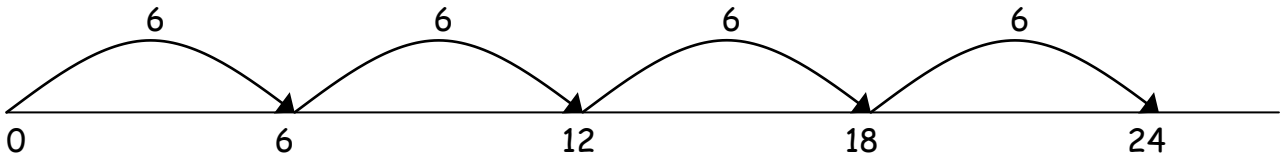


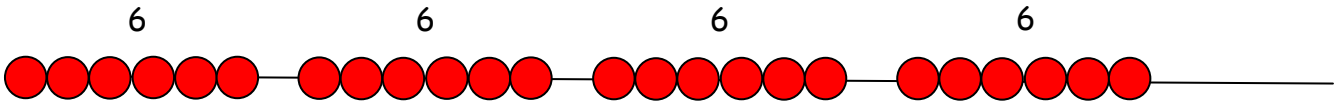
Multiplication

Throughout Year 3, children will continue to use repeated addition to consolidate previous year's learning.

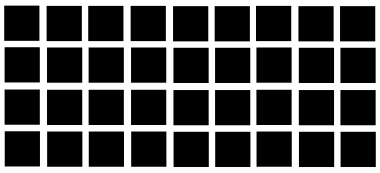
4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4

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





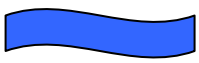
Children should be able to model a multiplication calculation using an array. This knowledge will prepare the children for using the grid method to solve multiplications.



9 x 4 = 36

9 x 4 = 36

Children will also develop a basic understanding of scaling.
e.g Find a ribbon that is 4 times as long as the blue ribbon



5

cm 20 cm

Children will be able to use symbols to stand for unknown numbers to complete equations when using inverse operations

□ x 5 = 20 3 x △ = 18 □ x O = 32

Children will continue to use partitioning to solve more complex multiplication problems.

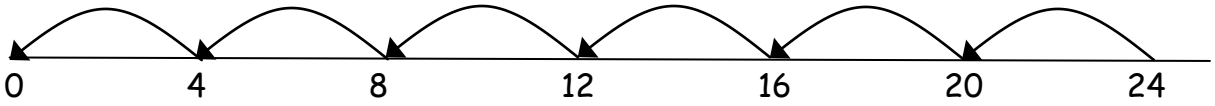
38 x 5 = (30 x 5) + (8 x 5)
= 150 + 40
= 190

Division

During Y3, teachers should ensure that the emphasis is on grouping rather than sharing.

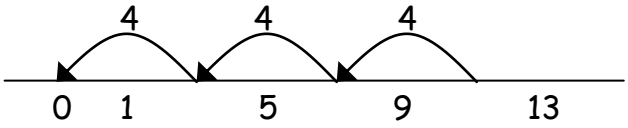
Children will continue to use repeated subtraction using an empty number line

24 ÷ 4 = 6



Children should also move onto calculations involving remainders.

13 ÷ 4 = 3 r 1



Children will be able to use symbols to stand for unknown numbers to complete equations when using inverse operations

26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

Y4

Y4

Addition

Children will begin to carry below the line.

625	783	367
+ 48	+ 42	+ 85
673	825	452
1	1	1 1

Using similar methods, children will:

- add several numbers with different amounts 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.

Subtraction

Partitioning and decomposition should be taught.

754 =
- 86

Step 1
700 + 50 + 4
- 80 + 6

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

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

This would be recorded by the children as

600 140
7~~0~~0 + 5~~0~~ + ^{1}4
- 80 + 6
600 + 60 + 8 = 668

An alternative method that should be taught is decomposition:

614 1
7~~5~~4
- 86
668

Children should:

- be able to subtract numbers with different numbers of digits
- by 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	=	8 + 0.9 + 0.05		leading to	
-£4.38		- 4 + 0.3 + 0.08			
	=	8 + 0.8 + 0.15	*(adjust from T to U)*	^{1} 8.85	
		- 4 + 0.3 + 0.08		- 4.38	
		4 + 0.5 + 0.07			

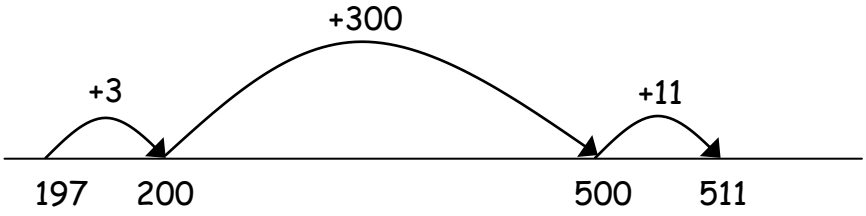
= £4.57

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

NB. Once your child has mastered the efficient ways of calculating, they will continue with this method throughout upper KS2. Children will not need to refer back to the expanded methods.

If the numbers within 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



Multiplication

Children will be introduced to the grid method in year 4. They will also be encouraged to approximate their answer first enabling them to check the reliability of their answer.

23 x 8 (approximation: 25 x 8 = 200)

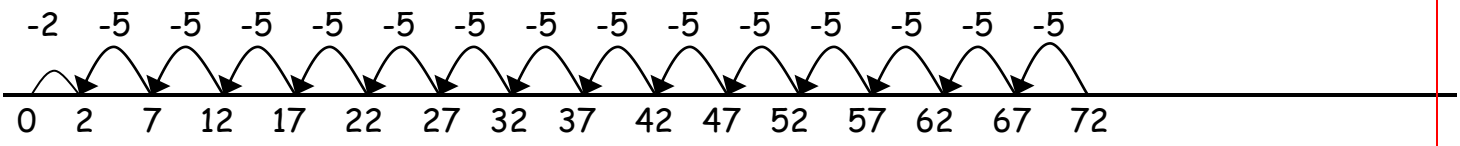
x	20	3
8	160	24

160
+ 24
184

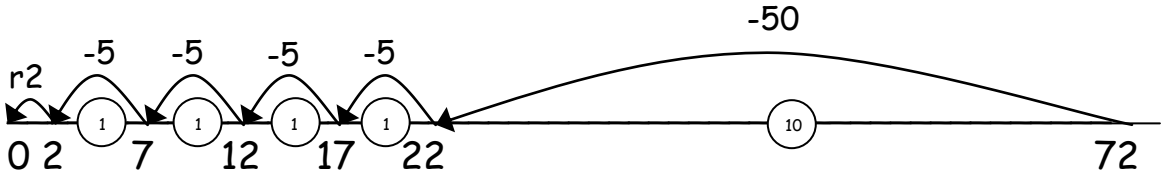
Division

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

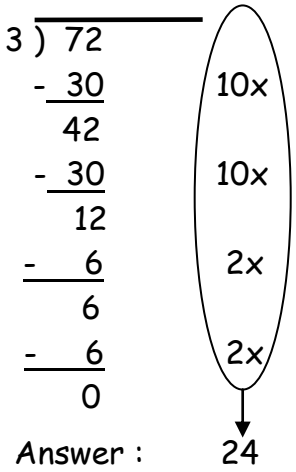


Moving onto:



As children progress, they should then be taught chunking, where children use subtraction and multiplication to find the answer:

72 ÷ 3



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. 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

Y5

Addition

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

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

Using similar methods, children will:

- add several numbers with different numbers of digits;
- begin to add two or more decimal fractions with up to three digits and the same number of decimal places;
- know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m – 280 cm.

Subtraction

Children will continue to develop their skills that they have learnt in previous years mostly focusing on decomposition.

```
   614 1
   7 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.

Multiplication

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

122 x 3

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

Calculations should be recorded like this:

```
  122
x   3
-----
 366
```

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

```
   72
x  31
 -----
   72
2160
-----
2232
 1                                                    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.

Division

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 ) 19¹6
```

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.

Children will use long division with more complex questions, e.g. 1428 ÷ 14

```
     102
14)  1428
   - 1400      100x
     ----
   -   28      2x
     ----
       0
       ↓
Answer :  102
```

Y6

Y6
Addition

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

```
   7648        6584          42
 + 1486      + 5848        6432
  9134        12432         786
  1 1 1       1 1 1           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

Decomposition

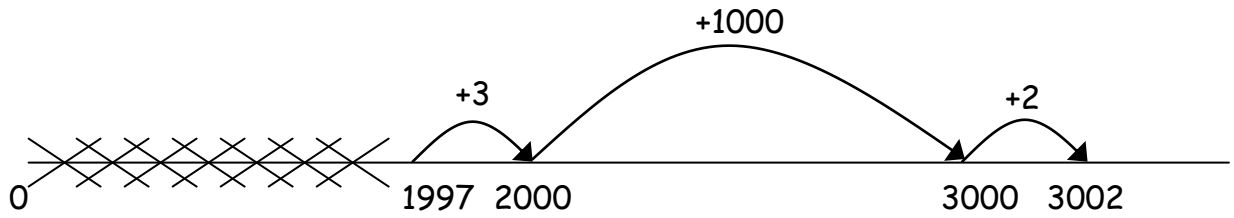
```
    5 13 1
    6 4 6 7
  - 2 6 8 4
    3 7 8 3
```

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. Children should always complete these calculations mentally if they can.

3002 – 1997 = 1005



Multiplication

ThHTU x U
(Short multiplication – multiplication by a single digit) following the strategy used in Year 5

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) following the strategy used in Year 5

372 x 24

Children will approximate first
372 x 24 is approximately 400 x 25 = 10000

1

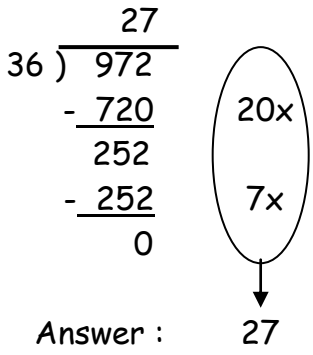
Using similar methods, they will be able to multiply decimals with up to two decimal places by a single digit number and then two digit numbers, approximating first. They should know that the decimal points line up under each other.
For example:
4.92 x 3
Children will approximate first
4.92 x 3 is approximately 5 x 3 = 15

Division

Children will continue to use written methods to solve long 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