# Maths

# Progression in Calculation

## Calculation methods

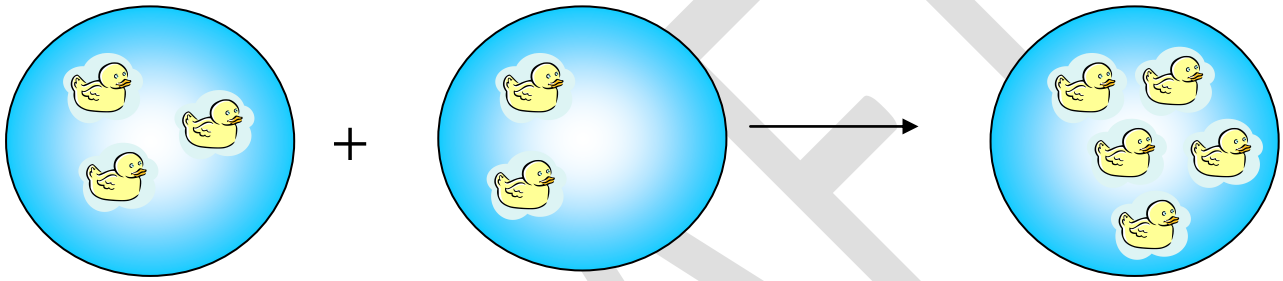
(Guidelines for progression in informal pencil and paper methods and standard written methods)

Year R to Year 6

# Addition

## Reception

- Children develop ways of recording calculations using pictures etc.
- Children use songs, rhymes, stories etc to support K&U
- Children add using practical objects/pictures etc.
- Children put objects/toys onto number tracks to count/add
- Children use number tracks as stepping stones to walk along and count/add
- Teacher demonstrates the use of the number line to count on

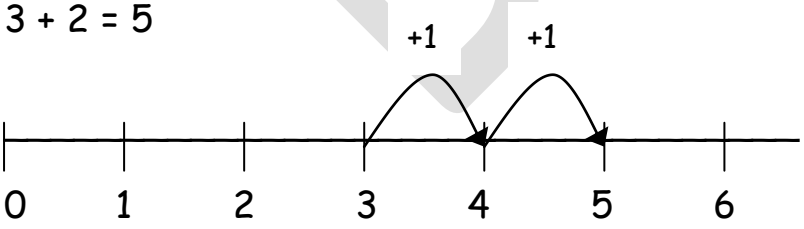


## Year 1

Children calculating through using concrete objects, pictoral representations and arrays. Children use bead strings, 100 squares, Dienes blocks etc to support K&U.

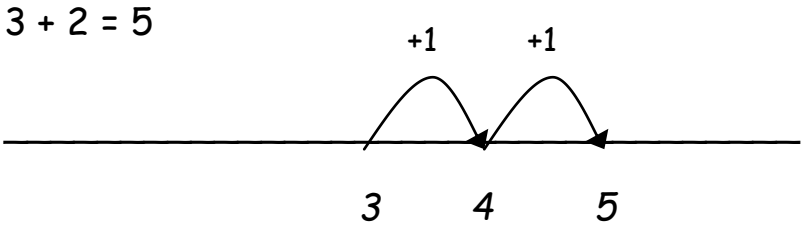
*Number lines (numbered)*

3 + 2 = 5



*Number lines (empty)*

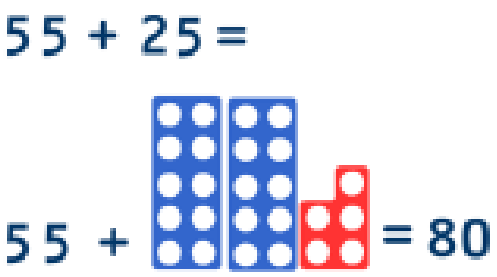
3 + 2 = 5



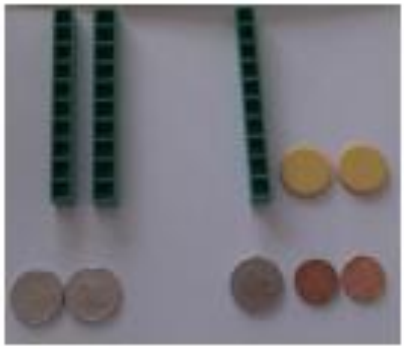

## Year 2

As above, and children continue to develop ways of recording calculations using tally marks etc.

*Using physical resources*



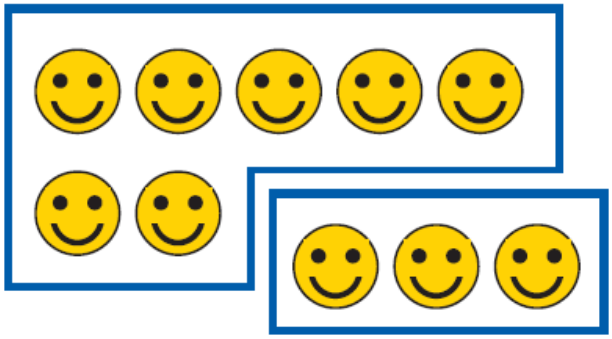




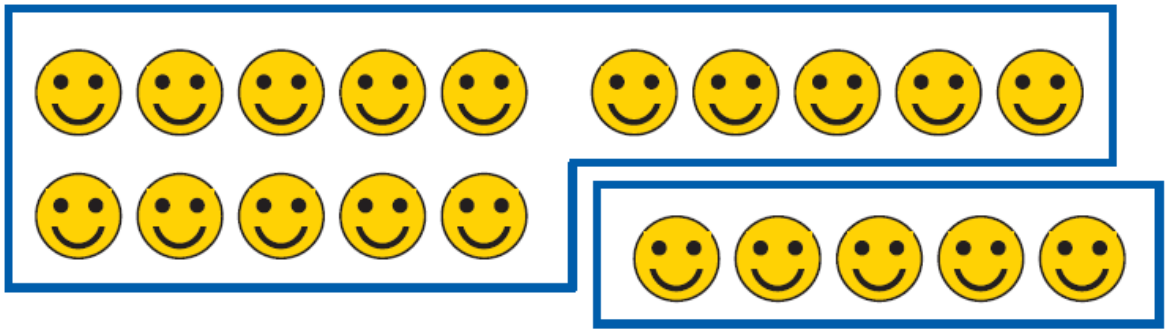
*Bar modelling*

8 + ? = 10

$$7 + ? = 10$$



$$7 + 3 = 10$$

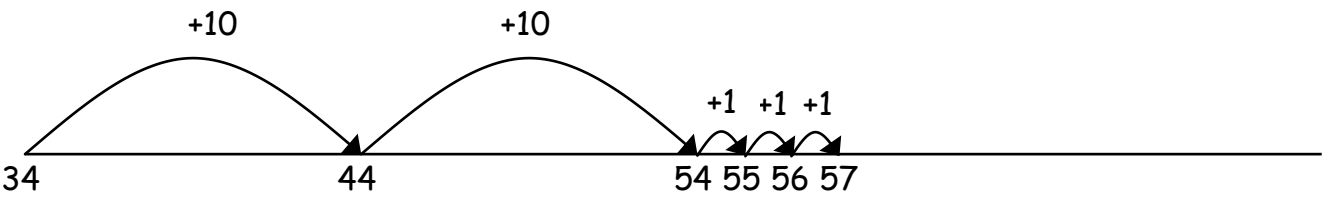


$$15 + 5 = 20$$

*Empty number lines*

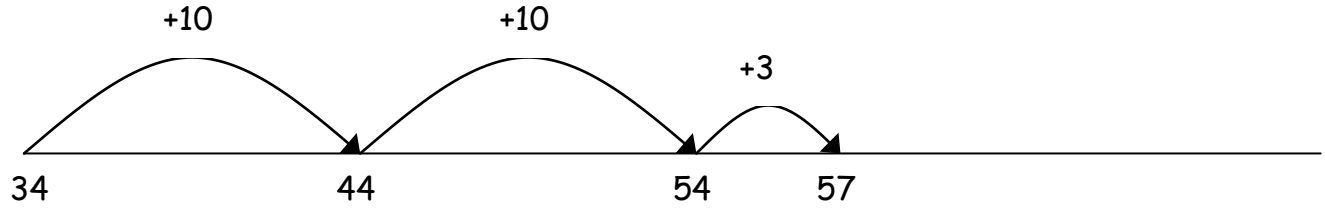
*Counting on in tens and ones*

34 + 23 = 57



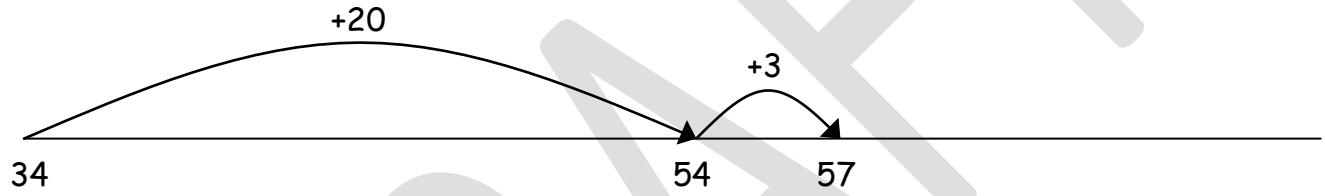
## *Adding the ones in one jump*

34 + 23 = 57



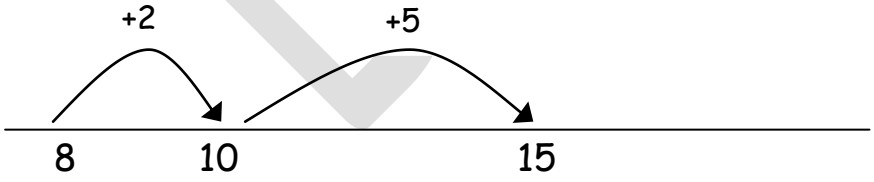

## *Adding the tens and ones in one jump*

34 + 23 = 57

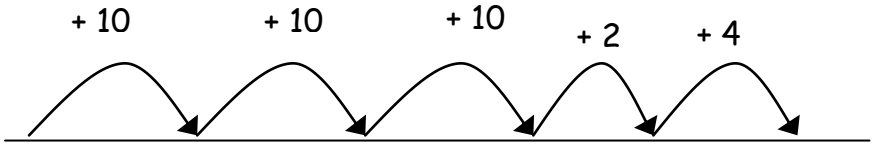



## *Using known facts to bridge through ten*

8 + 7 = 15

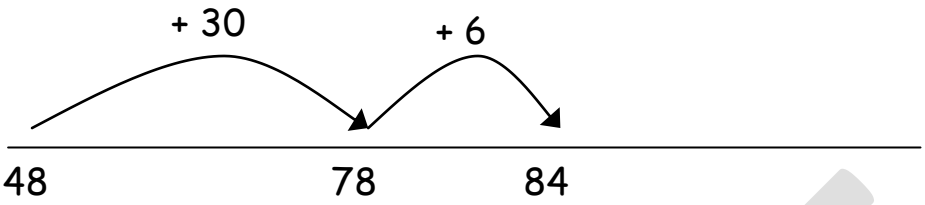



48 + 36 = 84



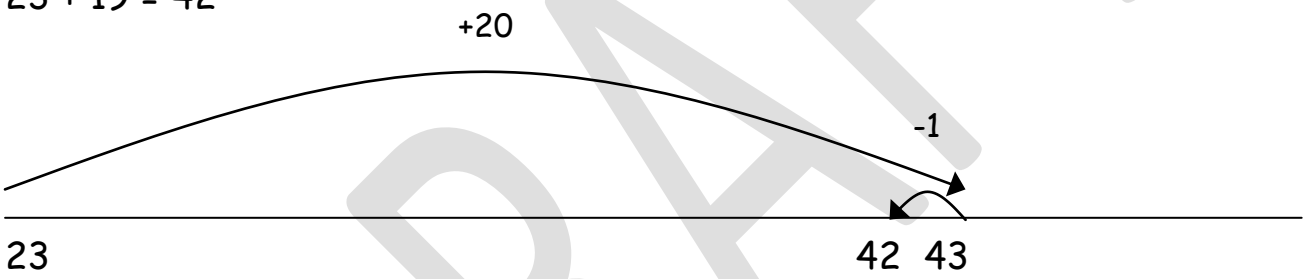
48 58 68 78 80 84

48 + 36 = 84




*Add near multiples of ten by adding multiples of ten and adjusting*

23 + 19 = 42

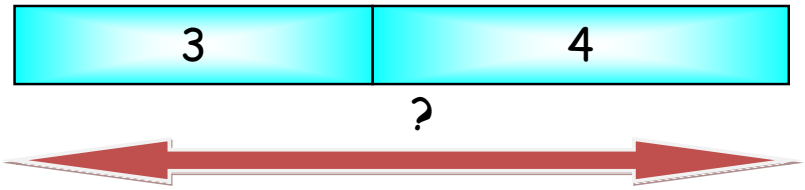



## Year 3

As above, including and using number lines with increasingly large numbers.

Bar modelling

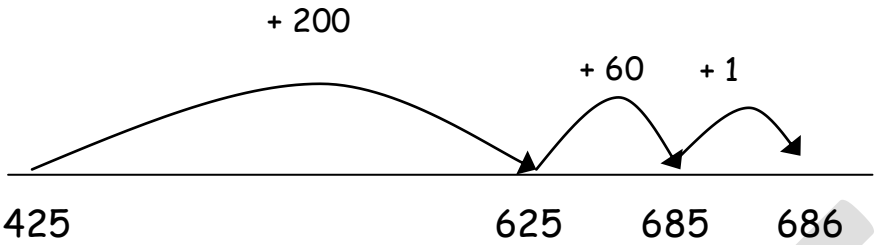
Add… Plus … Sum of




3 + 4 = ?

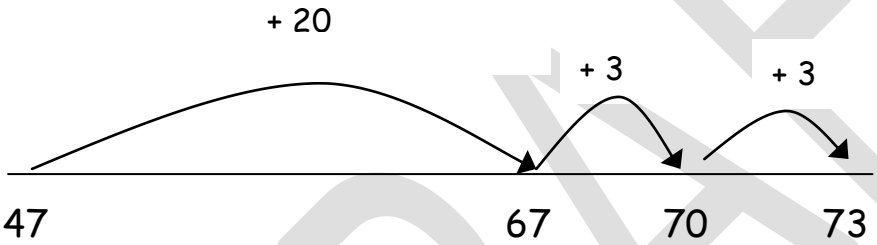
*Children start with largest number irrespective of the order that the calculation is presented*

261 + 425 = 686




*Crossing the tens/hundreds boundary*

26 + 47 = 73




*Partitioning*

56 + 37 = 93

50 + 30 = 80
6 + 7 = 1 3
80 + 13 = 93

76 + 47 =

| | | | |
|---|---|---|---|
| 47 | = | 40 | + 7 |
| + 76 | | 70 | + 6 |
| | | 110 | + 13 = 123 |

76 + 47 = 123

*Add least significant digits first (with brackets then without)*

```
    76
+   47
    13   (7 + 6)
+  110   (70 + 40)
   123
```

```
    76
+   47
    13
+  110
   123
```

*Decomposition method*

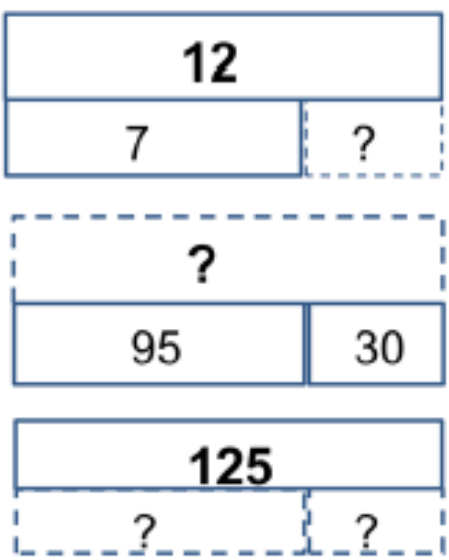
769 + 472 =

```
    472
+   769
   1241
    11
```

## Year 4

As above, including formal written methods with up to 4 digits

Bar modelling




12 = 7 + ?
7 + ? = 12

? = 95+ 30

125 = ?+?

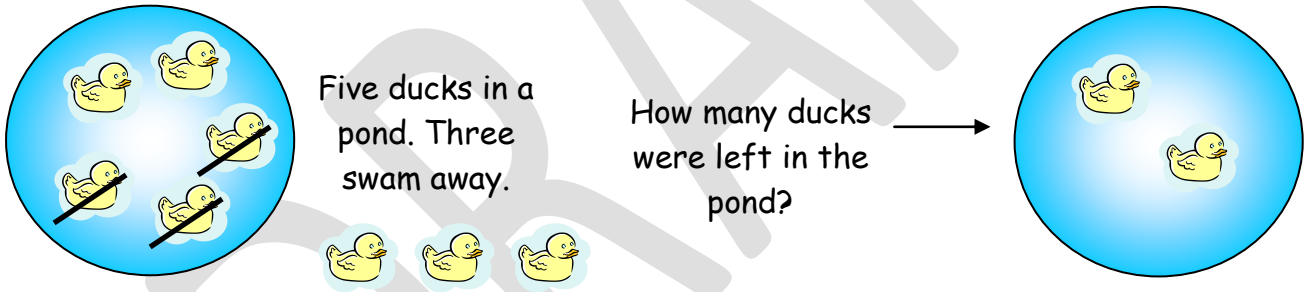
## Year 5/6

As above including formal written methods with any number digits and decimals

# Subtraction

## Reception

- Children develop ways of recording calculations using pictures etc.
- Children use songs, rhymes, stories etc to support K&U
- Children take away using practical objects/pictures etc.
- Children put objects/toys onto number tracks to count/take away
- Children use number tracks as stepping stones to walk along and back
- Teacher demonstrates the use of the number line to count back



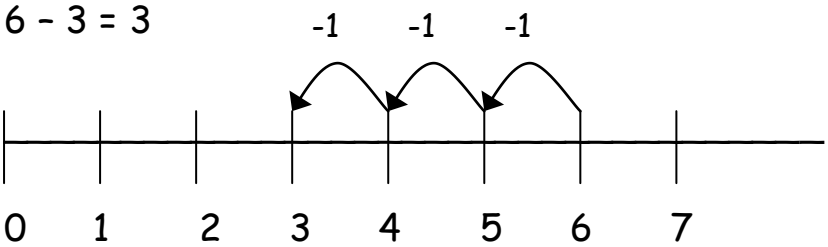

## Year 1

As above, including:

*Number lines (numbered)*

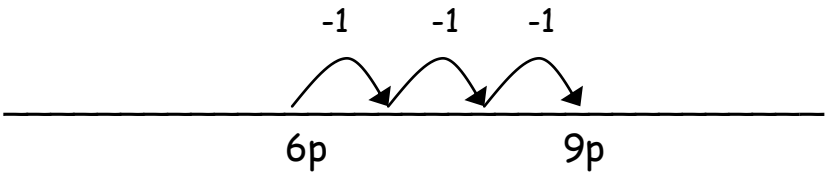
*Counting back in ones*

6 – 3 = 3

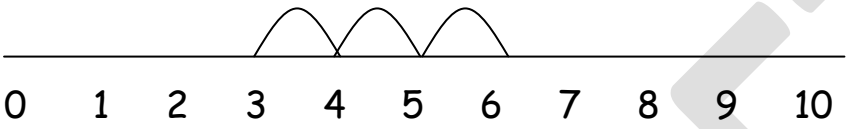


## *Number lines (empty)*
## *Counting on to find the difference*

I have 6p but I need 9p. How much more do I need?



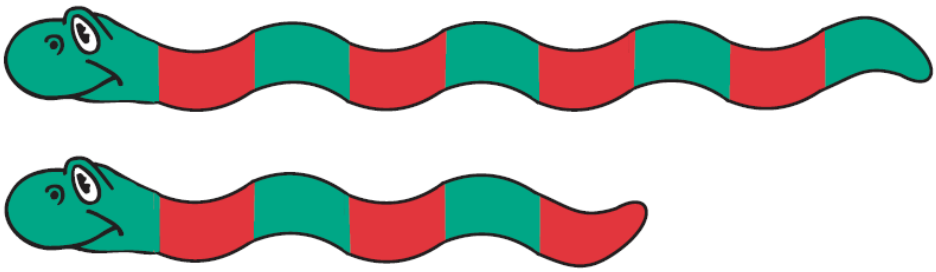

*The number line should be used as an image to show that 6 - 3 = 3 also means the 'difference between 3 and 6'.*



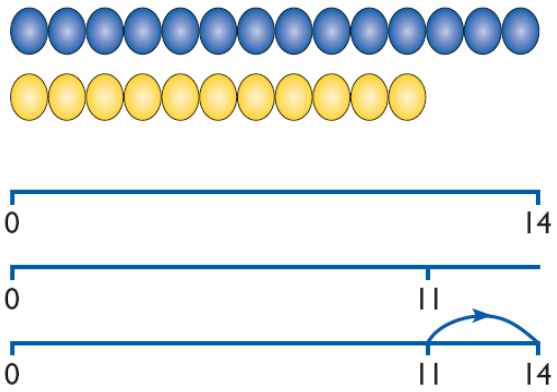

## Year 2

As above, including:

## *Bar modelling*



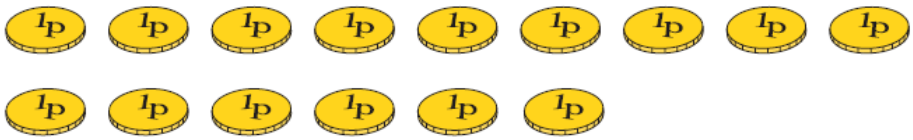
The difference is?




The difference between 11 and 14 is 3.

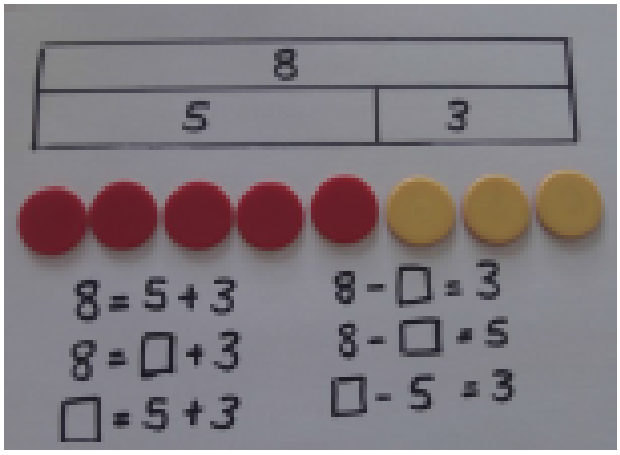
$14 - 11 = 3$

$11 + \square = 14$



Which line has **most** money?

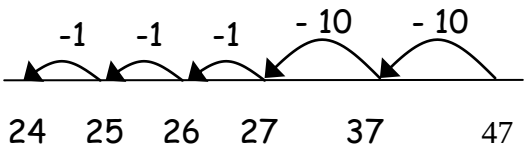
How much **more**?





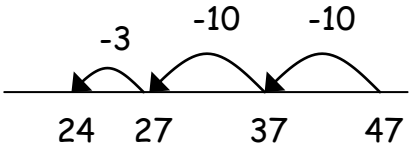

*<u>Counting on/back in tens and ones</u>*

47 - 23 = 24



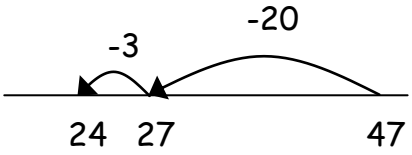
## *Counting on/back in tens*

47 – 23 = 24



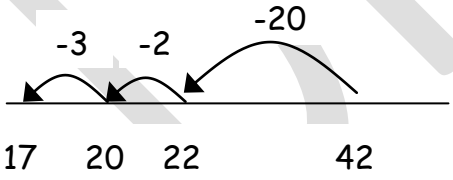

## *Counting on/back in tens and ones in one jump*

47 – 23 = 24

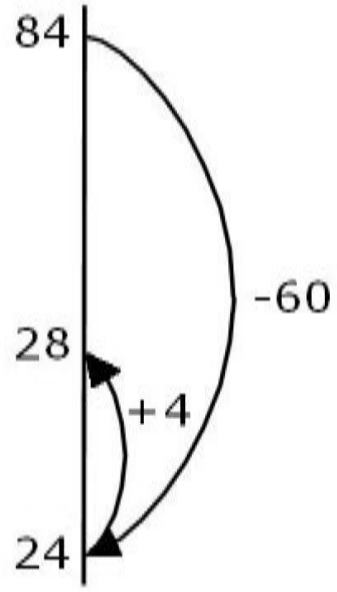



## *Counting on/back across tens boundary*

42 – 25 = 17



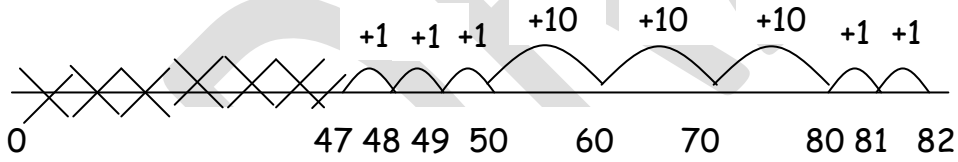
## *Using the numberline from a different perspective (e.g. thermometer scales)*



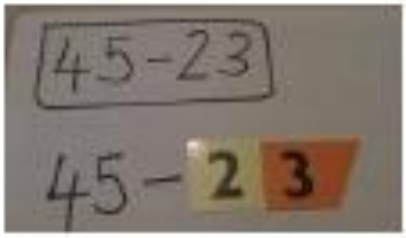

## *Counting on using '0' on the numberline*

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




## Using physical resources

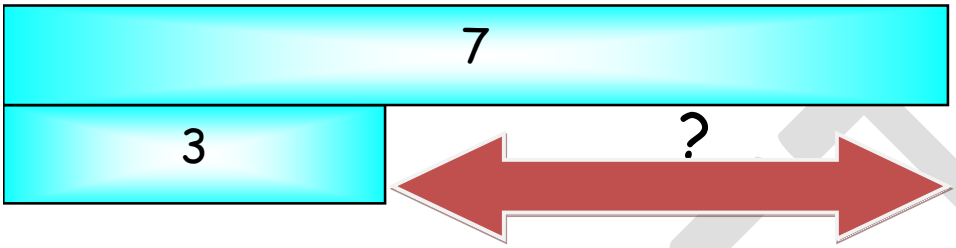



## Year 3

As above, including:

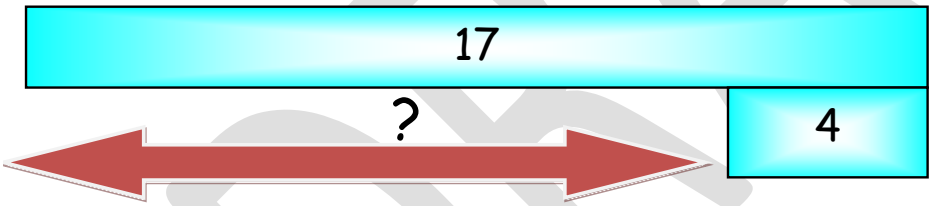
### Bar modelling

**Finding the difference**




7 – 3 = ?

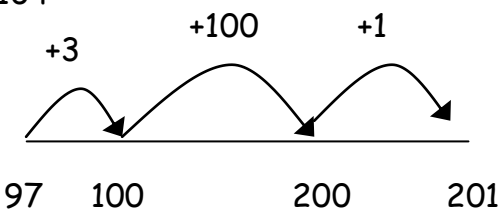
**Subtract.. Less than… Take away …Minus**




17- 4 = ?

*Continue to use numberlines to count on/back where numbers are close together or close to near multiples of 10, 100 etc*

201 – 97 = 104



## *Partitioning hundreds/tens/units & 'exchange' (working towards the decomposition method)*

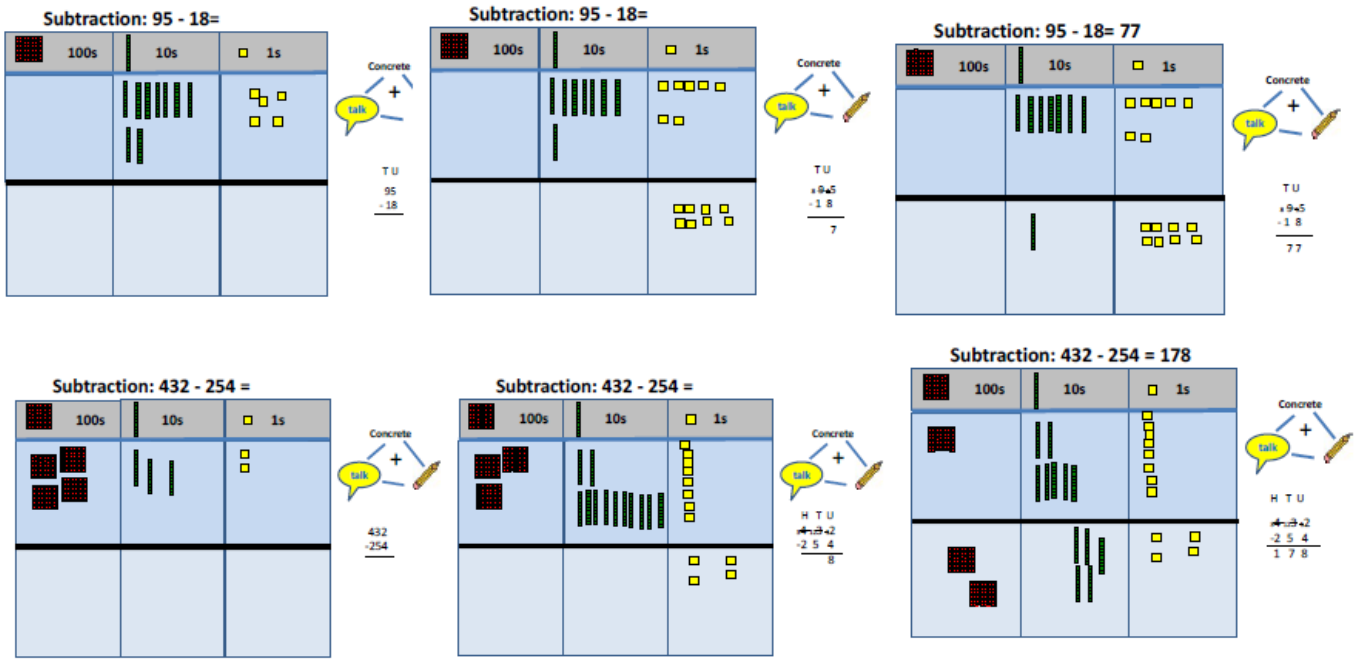
754 – 86 =

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

## *Decomposition Method*

$$\begin{array}{r} 6\ \ 14 \\ \cancel{7}\cancel{5}\cancel{4}^{1} \\ -\ \ 86 \\ \hline 668 \end{array}$$

## Including modelling formal calculation recording



## Year 4

As above, including using formal written methods for numbers up to 4 digits

## Year 5/6

As above, including formal written methods with any number digits and decimals

# Multiplication

## Reception

- Children develop ways of recording calculations using pictures etc.
- Children use songs, rhymes, stories etc to support K&U
- Children group using practical objects/pictures etc.

How many legs do we need to draw if there are three dogs?

## Year 1

Using concrete objects, pictorial representations and arrays:

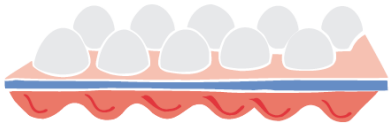
*Arrays*

○ ○ ○ ○ ○

○ ○ ○ ○ ○ 5 x 3 = 15

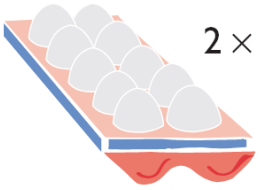
○ ○ ○ ○ ○

3 x 5 = 15



$5 \times 2 = 10$

$2 \times 5 = 10$



$2 \times 5 = 10$

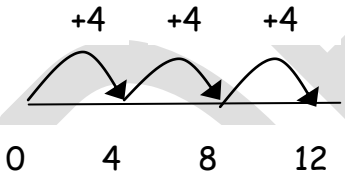
$5 \times 2 = 10$

## *Groupings/Lots of*

**** **** ****

## *Teacher modelling using a number line*

If there were three dogs, how many legs would there be altogether?

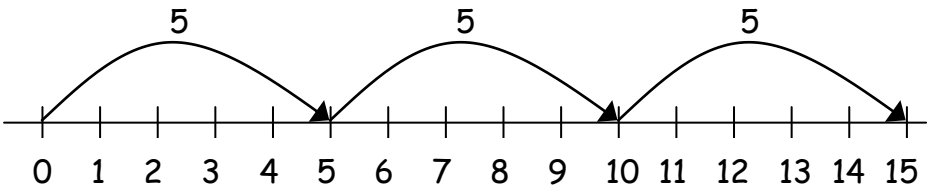



# Year 2

As above, including:

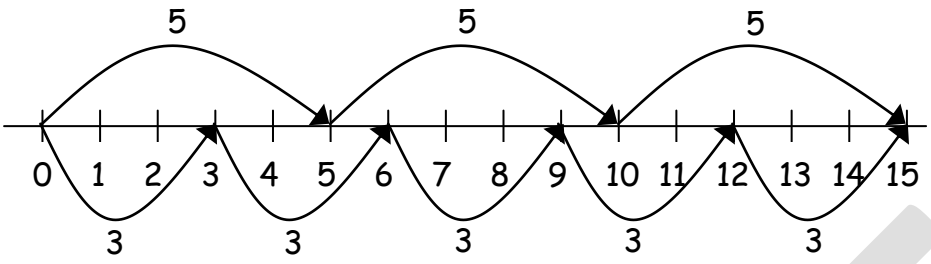
## *Repeated addition on a numbered number line*

5 x 3 = 5 + 5 + 5

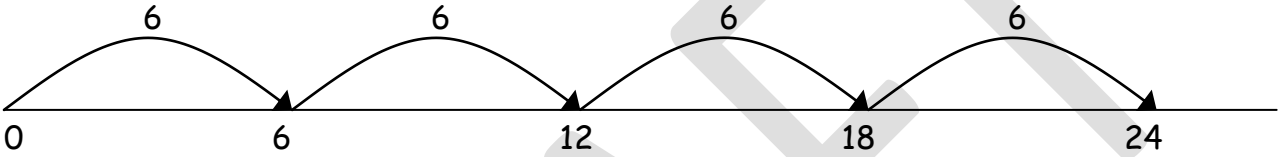


*Teacher modelling that the numbers being multiplied together can be switch around, but the answer remains the same*

Children should know that 3 x 5 has the same answer as 5 x 3.




*Open number line*

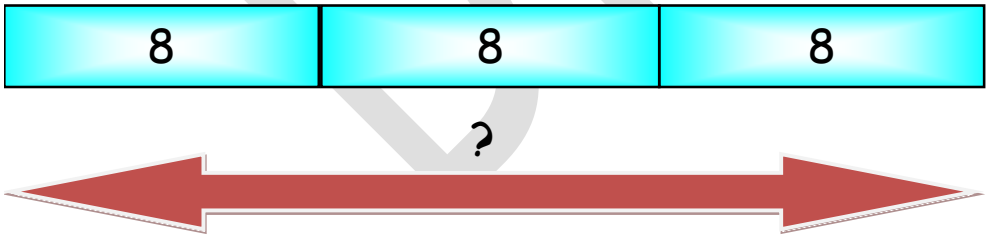



Year 3

As above, including:

Bar modelling

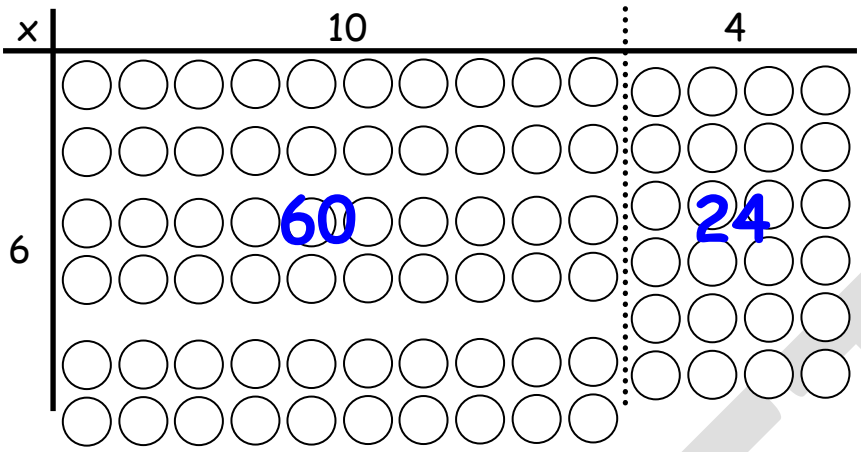
Multiply.. Times ....Product .... Lots of




3 x 8 = ?

## *Arrays inside a grid*

To be used as a visual image to bridge arrays with grid method multiplication:




(6 x 10) + (6 x 4)

60 + 24

84

## *Grid Method*

| x | 20 | 3 | |
|---|---|---|---|
| 8 | 160 | 24 | 184 |

## *Larger numbers*

| x | 200 | 30 | 4 | |
|---|---|---|---|---|
| 8 | 1600 | 240 | 32 | 1872 |

| x | 50 | 6 | |
|---|---|---|---|
| 20 | 1000 | 120 | 1120 |
| 7 | 350 | 42 | 392 |
| | | | 1512 |

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

Short multiplication for one digit numbers:

38 x 7 =

```
   3 8
   x 7
   5 6      (7 x 8)
+ 2 1 0      (7 x 30)
  2 6 6
```

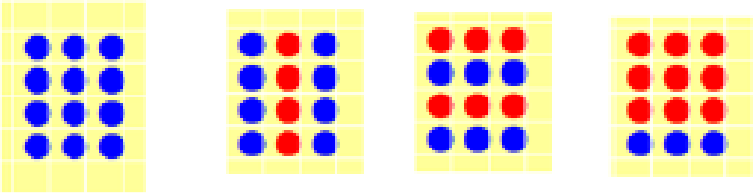
27 x 5 =

```
   2 7
   x 5
  1 3 5
  3
```

## Year 4

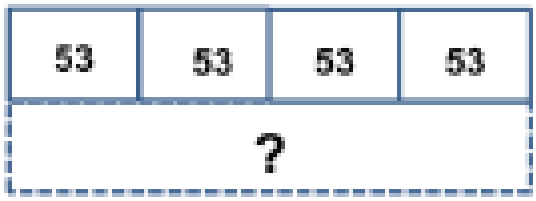
As above and:

### Using arrays



| | | |
|---|---|---|
| 3 x 4 = 12 | 1/2 of 12 = 6 | 1/3 of 12 = 4 |
| 4 x 3 = 12 | 1/4 of 12 = 3 | 2/3 of 12 = 8 |
| 12 ÷ 3 = 4 | 2/4 of 12 = 6 | 3/3 of 12 = 12 |
| 12 ÷ 4 = 3 | 3/4 of 12 = 8 | |

### Bar modelling




53 x 4 = ?

? ÷ 4 = 53

## Year 5/6

Multiplying up to four digit numbers by one or two digits, including long multiplication for two digit numbers. Multiply decimals:

24 x 16

```
      2
     2 4
   x 1 6
   -----
   1 4 4
   2 4 0
   -----
   3 8 4
   -----
```

4.92 X 3

4.00 X 3 = 12.00
0.90 X 3 = 2.70
0.02 X 3 = 0.06
14.76

$$\begin{array}{r} 4.92 \\ \times \quad 3 \\ \hline 1\,4^{2}.76 \end{array}$$

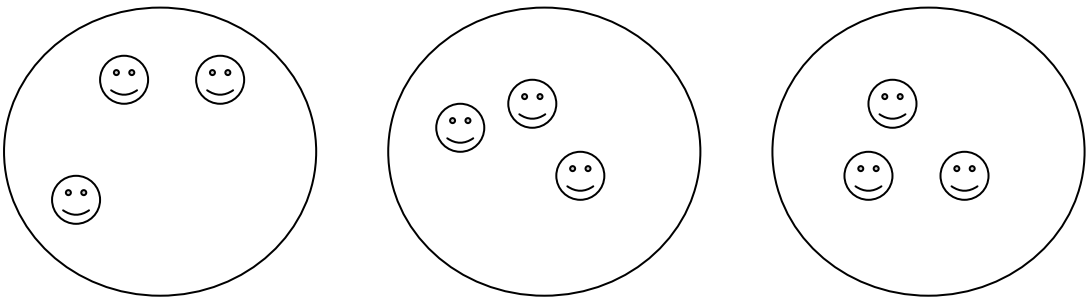
# Division

YR
Children group/share objects practically.

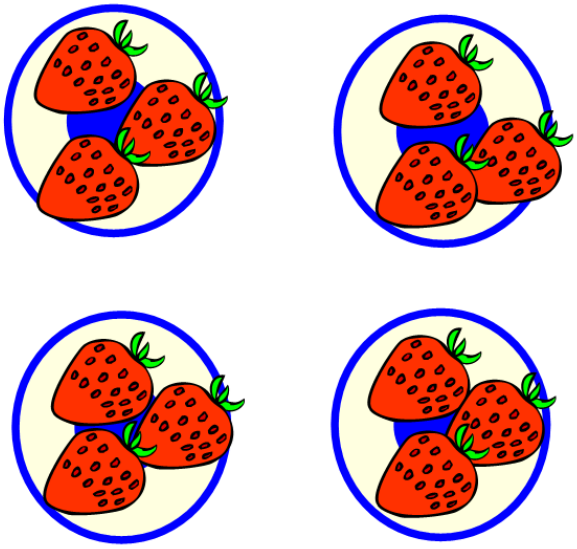
Year 1
As above, including:

Grouping

9 ÷ 3 = 3



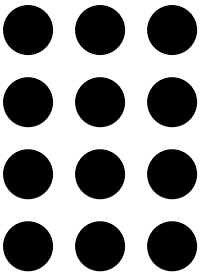
Sharing



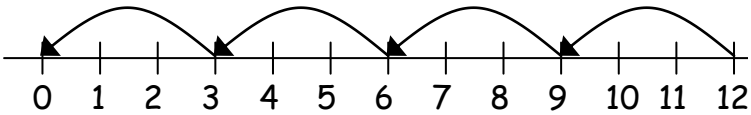
Share 12 strawberries between four plates

Arrays

12 ÷ 3 = 4
12 ÷ 4 = 3



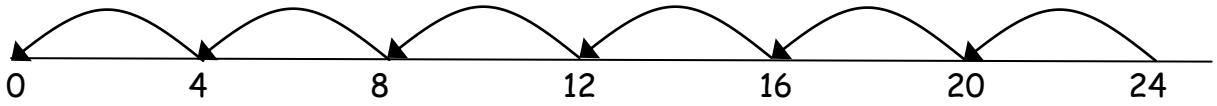
12 ÷ 3 = 4



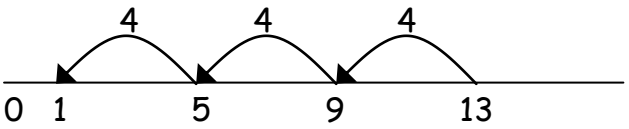
Year 2

As above, including:

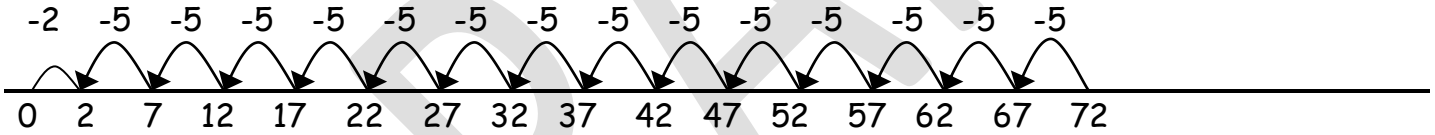
24 ÷ 4 = 6



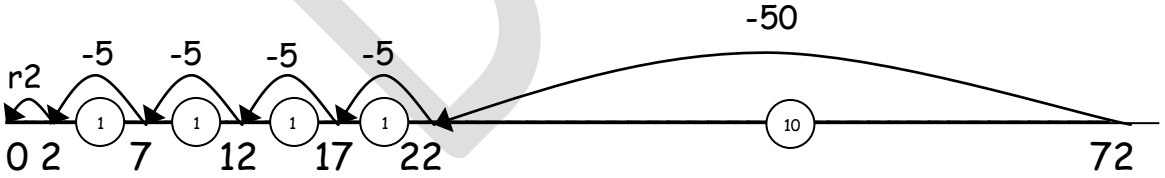

13 ÷ 4 = 3 r 1




72 ÷ 5




72 ÷ 5

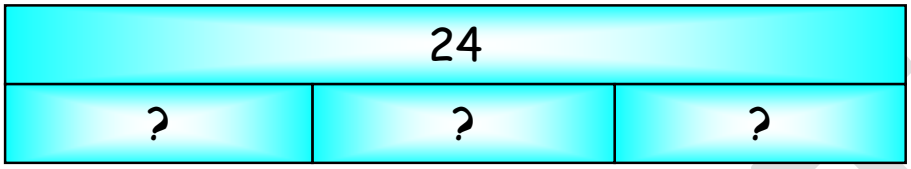


Year 3

As above, including:

Bar modelling

Divide .. Share … Equal groups of




24 ÷ 3 = ?

Number line work

15 ÷ 5 =

15 ÷ ___ = 5

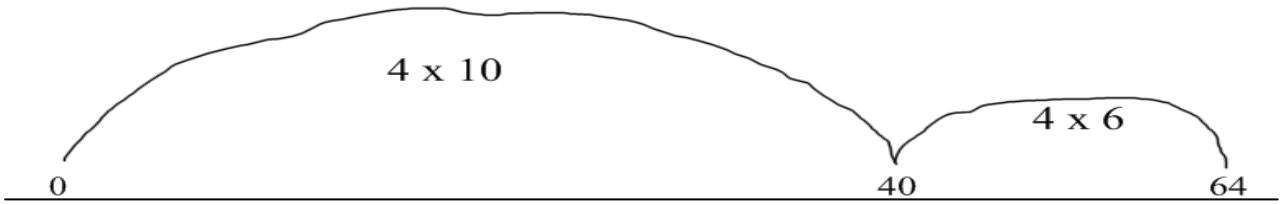
5 x ___ = 15

___ x 5 = 15


64 ÷ 4 = 16

40 (4 x 10)

24 (4 x 6)



Subtraction method

96 ÷ 6

```
6 | 96
  - 60        (10 x 6)
    ---
    36
  - 36        (6 x 6)
    ---
    0
```

Answer: 16

and short division

```
      9 7
3 ) 2 9 2 1
```

Year 4

As above

Year 5/6

As above, including larger numbers and decimals.

```
6 | 87.6
  60.0      6 x10
  ------
  27.6
  24.0      6 x4
  ------
   3.6
   3.6      6 x0.6
  ------
  Ans:      14.6m
```