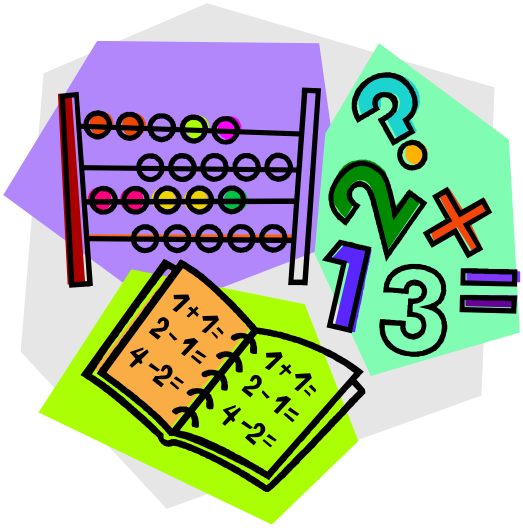
A Guide to the Progression through Calculations

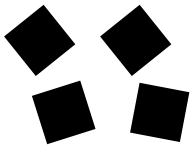


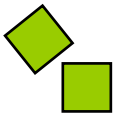
This leaflet is designed to show you the methods of calculation used in school to enable you to help your child with homework. To ensure you are using the correct method for your child, please check with your child or their teacher.
If you need any further advice, do not hesitate to contact school.

Progression through methods for addition

(1) Early addition

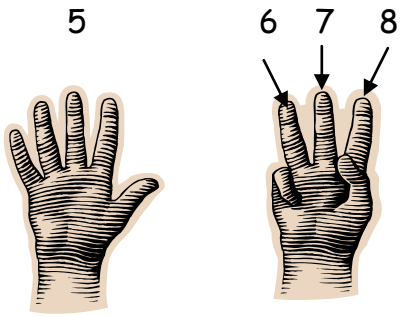
Children have practical experience of combining two groups. For example:





They should put the groups together and count how many are there.

From this, children will work in a practical context to count on. By this, we mean count the first group and then hold that number in their head whilst the second is counted. For example:



(2) Mental addition

Children will be taught a variety of methods to help them add numbers mentally. These will include:

- *Putting the larger number first*; e.g. in 3 + 9, it is easier to start at the 9 and count on 3
  than to start at the 3 and count on 9

- *Using doubles*; Children will be taught their doubles of numbers up to 10+10. They
  can then use these facts to help them add pairs of numbers.

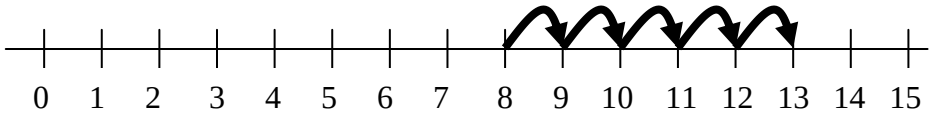
- *Using number bonds*; Children will be taught pairs of numbers that make all
  combinations from 2 up to 10 and beyond. This will help them throughout school, e.g.
  children should know that 5+0, 4+1, 3+2, 2+3, 1+4, 0+5 all make 5. This holds true when
  adding tens, hundreds, thousands etc also.

- *Partitioning*; e.g. when adding 23 + 46, children would add the 20 and 40 first to give them 60, then add the 3 then add the 6. When using hundreds they would also use this method.

(3) Using number lines

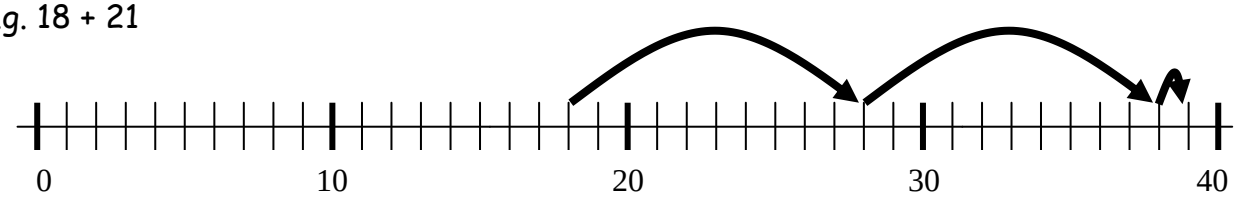
Use a numbered line to count on in ones.

e.g. 8 + 5



Children will then move on to counting on in tens and ones on a partly numbered line.

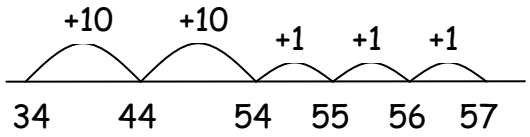
e.g. 18 + 21



They will then begin to use an empty number line (one that they draw for themselves with only the jumps marked on). This may be done in the following ways.

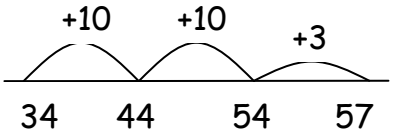
Count on in jumps of 10 and jumps of 1

e.g. 34 + 23



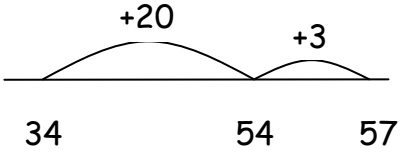
Adding the units in one jump.

e.g. 34 + 23



Adding the tens in one jump

e.g. 34 + 23



(4) Adding the least significant digits first in preparation for 'carrying'.

(The least significant digit is the number with the smallest value, in the example below, 67 + 24 you would add 7 and 4 first, then add the 60 and the 20).

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

Moving on to vertical addition with no carrying when the children are secure with their understanding of place value

```
  43
+ 25
  68
```

(5) Carrying below the line.

```
  625        3587          42
+ 48       + 675         6432
  673        4262         786
   1         111            3
                          + 4681
                          11944
                          121
```

Progression through methods for subtraction

(1) Early subtraction

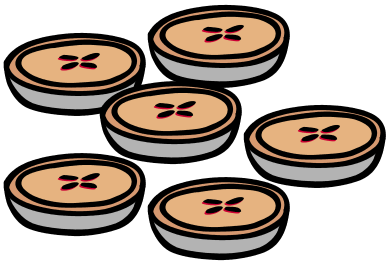
Children have practical experience of taking away and finding how many are left. For example:

We have 10 pennies, if we spend 3 how many are left?

Children would solve this by counting all ten pennies, counting 3, removing them and counting how many are left.

So 10 – 3 = 7

From this, children will work in a practical context to subtract by counting back from the larger number. For example:



We made 6 mince pies. We ate 2 of them. How many pies are left?

Children would solve this be counting back from 6, taking 1 away and saying 5, taking another one away and saying 4.

So 6 – 2 = 4

(2) Mental subtraction

Children will be taught a variety of methods to help them subtract numbers mentally. These will include:

- *Find a small difference by counting up* e.g. When two numbers are close together, e.g.
  82 – 79, it is easier to count up from 79 to 82 than to count back 79.

- *Using number bonds*; Children will be taught pairs of numbers that make all combinations from 2 up to 10 and beyond. They will also be taught about calculation families, e.g. if 3 + 2 = 5, then 2 + 3 = 5, 5 – 3 = 2 and 5 – 2 = 3. This will help them throughout school, e.g. This also holds true when subtracting tens, hundreds, thousands etc

- *Making adjustments*; Children will be taught that where a number to be subtracted is close to 10, then it is easier to subtract 10 and adjust. For example, to solve 36 – 9, you

do the calculation 36 – 10 and then add 1 because you took away to many. Similarly, to

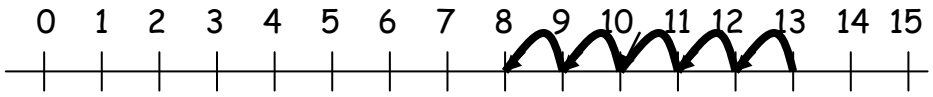
solve 45 – 21, you would do the calculation 45 – 20 and then take away another 1 because

you did not subtract enough.

(3) Using number lines

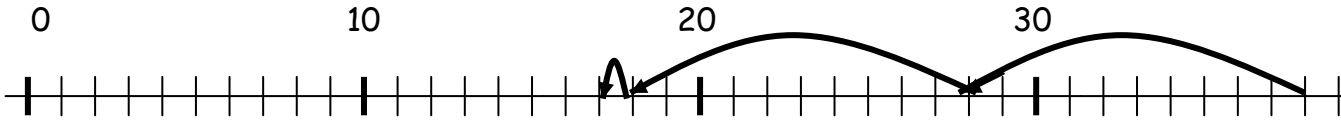
Use a numbered line to count back in ones.

e.g. 13 – 5



Children will then move on to counting back in tens and ones on a partly numbered line.

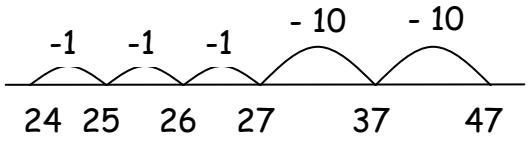
e.g. 38 – 21



They will then begin to use an empty number line (one that they draw for themselves with only the jumps marked on). This may be done in the following ways.

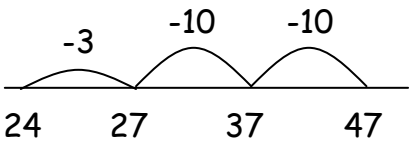
Count back in jumps of 10 and jumps of 1

e.g. 47 - 23



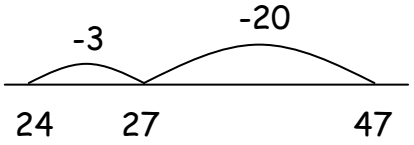
Subtracting the units in one jump.

e.g. 47 - 23

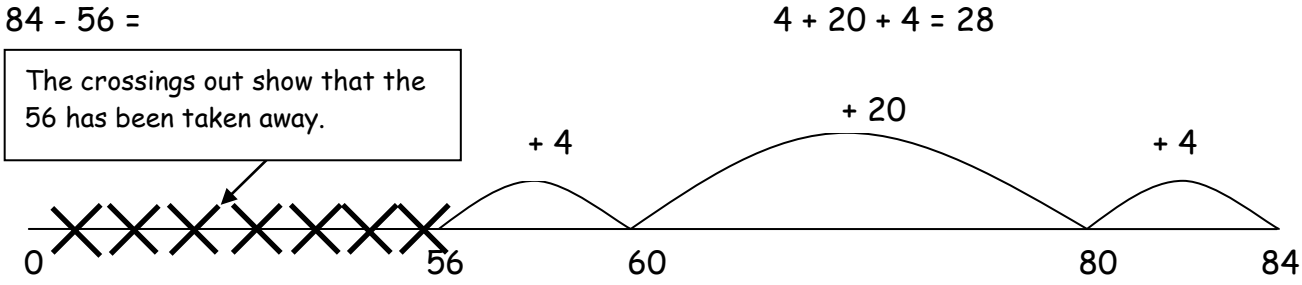


Subtracting the tens in one jump

e.g. 47 - 23



(4) Counting up from the smaller to the larger number using a number line



(When children are confident, their number line can just show from one number to the other).

(5) Partitioning and decomposition (tens and units)

(Partitioning means splitting the number into its parts. E.g. tens and units. You then subtract the units from the units, and the tens from the tens).

89	=	80	→	9			(without exchange)
- 57		50	→	7			
		30	→	2	=	32	

(In the example below, you cannot subtract 6 from 1, so you have to change 70 + 1 into 60 + 11. You are exchanging one ten for ten ones)

71	=	70	→	1	=	60	→	11		(with exchange)
- 46		40	→	6		40	→	6		
						20	→	5	=	25

(6) Partitioning and decomposition (hundreds, tens and units)

754		700	→	50	→	4
- 286	-	200	→	80	→	6

=	700	→	40	→	14	*(adjust from T to U)*
-	200	→	80	→	6	
=	600	→	140	→	14	*(adjust from H to T)*
-	200	→	80	→	6	
	400	→	60	→	8	= 468

(7) <u>Decomposition</u>

6 14 1	5 13 1
7 ~~5~~ 4	6 ~~4~~ 7
- 286	- 2684
468	3783

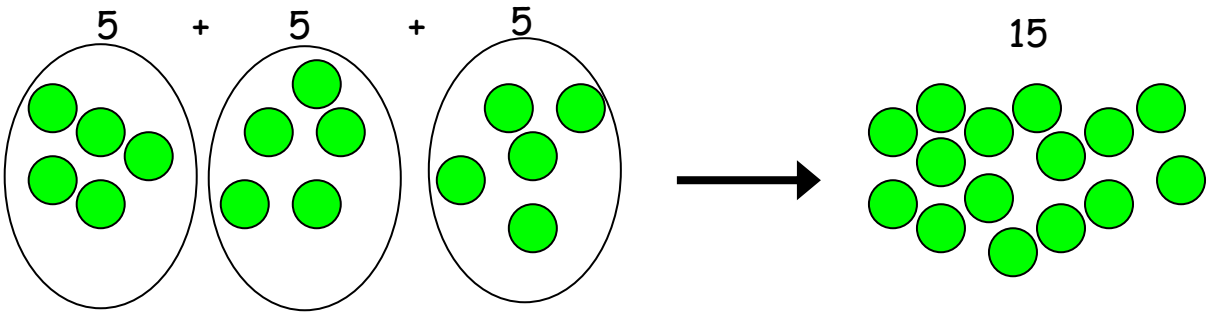
Progression through methods for multiplication

Children do not formally start work upon multiplication prior to Year 2. Before this, they will have some experiences, as they will work on doubling numbers and may refer to multiplication in other contexts, e.g. in PE if a pair of children need 3 hoops each, how many will they need?

(1) Repeated addition

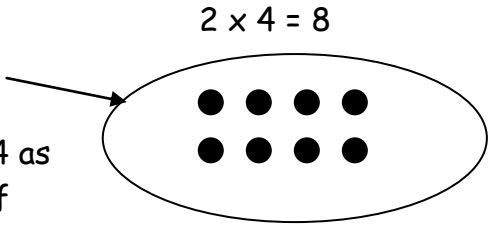
5 + 5 + 5 = 3 lots of 5 = 3 x 5

This may be done using practical equipment, e.g.



(2) Arrays

This is an array. It shows 2 x 4 as two rows of four or four columns of two.

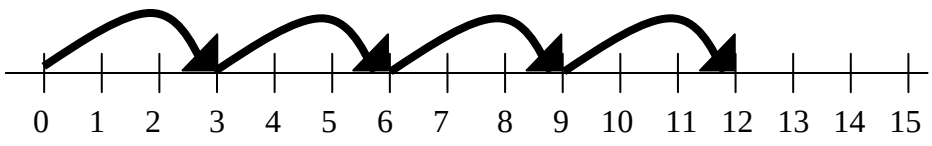


4 x 2 = 8

(3) Using a number line

Children can also show multiplication using a number line.

e.g. 3 x 4



3 + 3 + 3 + 3 = 12 (3 multiplied 4 times) 3 X 4 = 12

(4) <u>Partitioning</u>

(Splitting the two-digit number into tens and units and then multiplying each of them by the single digit number. The children can use their knowledge of tables to do this. If they know 3 x 7 = 21, then they should know that 30 x 7 = 210).

Vertically: 38 x 7 = (30 x 7) + (8 x 7)
= 210 + 56
= 266

Using the grid method **TU x U**

38 x 7

x	30	8	
7	210	56	= 266

(The grid and vertical methods are the same process, but the vertical method is linked to working mentally, and the grid method is a written method).

(5) <u>HTU X U</u> (short multiplication)

346 x 9

x	300	40	6	
9	2700	360	54	= 3114

(6) <u>TU x TU</u> (long multiplication)

72 x 38

x	70	2	
30	2100	60	2160
8	560	16	576
			2736

(7) ThHTU x U (short multiplication)

4346 x 8

x	4000	300	40	6	
8	32000	2400	320	48	34768

(8) Multiplication of decimals

42.6 X 8

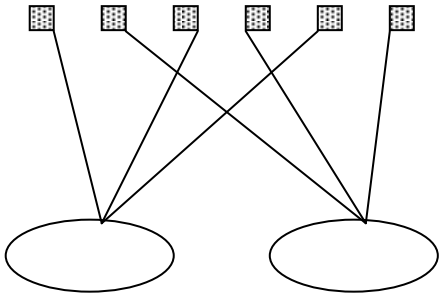
x	40	2	0.6	
8	320	16	4.8	340.8

Progression through methods for division

Children do not formally start work upon division prior to Year 2. Before this, they will have some knowledge, as they will have had practical experiences of sharing. For example, sharing their sweets between themselves and a friend.

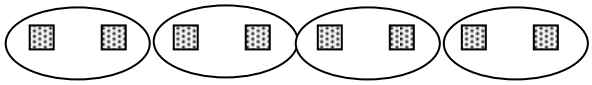
(1) Sharing equally

6 ÷ 2 = 3 6 sweets are shared equally between 2 people



(2) Grouping

(Or repeated subtraction)

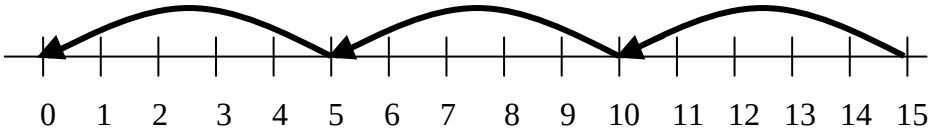


Interpret 8 ÷ 2 as 'how many 2s make 8'

(3) Using a number line

Grouping can be shown more efficiently by using a number line.

e.g. 15 ÷ 5



In this method, they are jumping back in groups of 5. To find the answer, they will count the number of jumps.

(4) Repeated subtraction using known multiples

(The children will start by subtracting one group each time, i.e. to solve 96 ÷ 6, the children will subtract 6 each time until there are none left, or an amount less then 6 which will then form a remainder. As this is a lengthy procedure, they will quickly move on to subtracting 10 lots each time, as in the example below).

Short division TU ÷ U

96 ÷ 6

```
6 )  96
   - 60      10   x 6        OR   10 lots of 6
     36
   - 36       6   x 6             6 lots of 6
     0
Answer :      16                  16 lots of 6
```

Short division HTU ÷ U

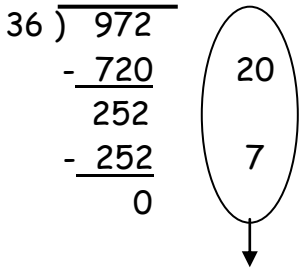
(When the children are confident subtracting 10 lots of the divisor, they will move on to higher multiples of 10, i.e. 30, as in the example below.

196 ÷ 6

```
6 )  196
   - 180     30   x 6        OR   30 lots of 6
     16
   -  12      2   x 6             2 lots of 6
      4
                                  32 lots of 6
Answer :      32  remainder 4  or  32 R 4
```

Long division HTU ÷ TU

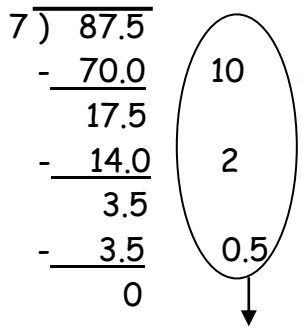
972 ÷ 36



36) 972				
- 720	20	x 36	OR	20 lots of 6
252				
- 252	7	x 36		7 lots of 6
0				
Answer :	27			27 lots of 6

(This strategy also works with decimal numbers as in the example below).

87.5 ÷ 7



7) 87.5				
- 70.0	10	x 7	OR	10 lots of 7
17.5				
- 14.0	2	x 7		2 lots of 7
3.5				
- 3.5	0.5	x 7		0.5 lots of 7
0				
Answer :	12.5			12.5 lots of 7