

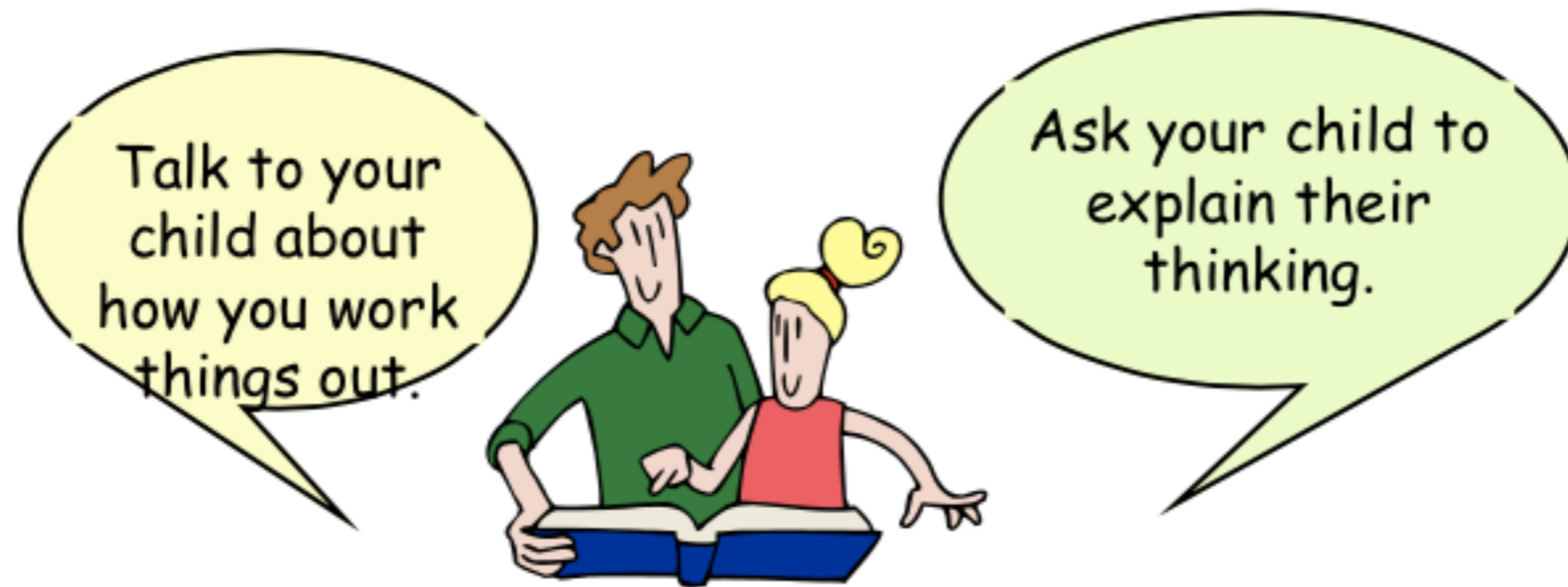


DOVER COURT INTERNATIONAL  
SCHOOL, Singapore  
A NORD ANGLIA EDUCATION SCHOOL

# How We Learn What We Learn Parent Workshops

## Primary Mathematics

Dr Neil Hopkin



**The children would greatly benefit from knowing key number facts by heart and recalling them instantly (*e.g. number bonds to 20, tables*).**

*For example, a child who knows the 3x table well would be able to answer questions like these with very little hesitation:*




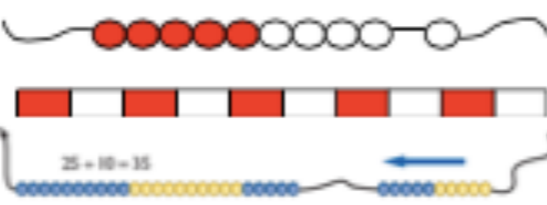
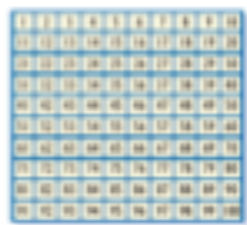

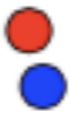


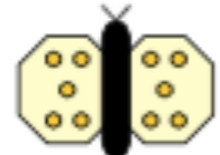
*9x3, 7 lots of 3, 3x4, 18÷3, how many 3s in 24?*

*e.g. I know 5x3 is 15, so I can work out 50x3, 5x30, 150 ÷5, 500x3, 50x30, 5x0.3, 150 ÷30...*

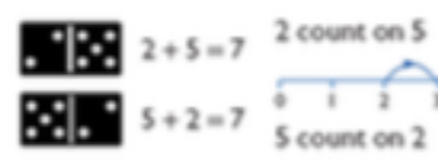
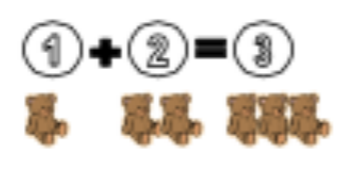
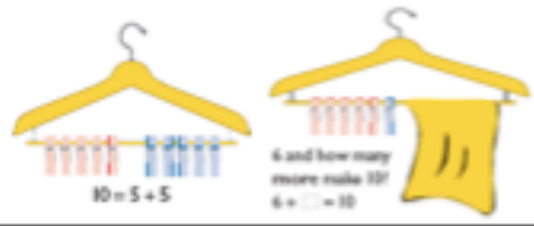
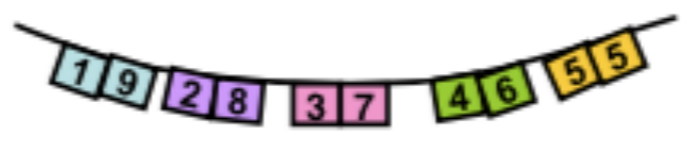
A suggested order for learning tables:

2x, 10x, 5x, 4x (double 2x), 3x, 6x (double 3x), 9x, 8x, 7x

# Addition

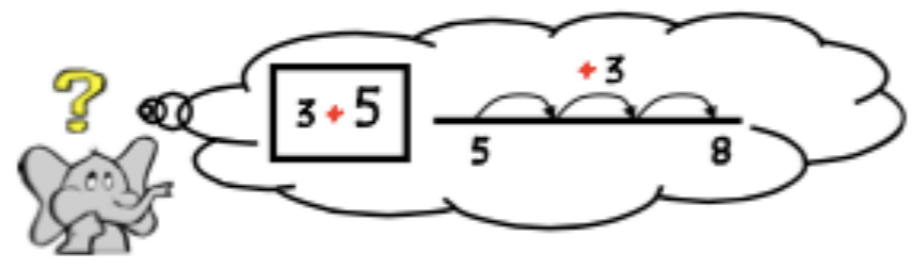
Recognise numbers 0 to 10	0 1 2 3 4 5 6 7 8 9 10
 1, 2, 3, 4, 5, 6 ... there are 6 teddies	Count reliably up to 10 everyday objects
Find one more than a number	 One more than three is four 
 $25 + 10 = 35$	 Count in ones and tens
Begin to relate addition to combining two groups of objects	 and  makes 5
$3 + 2 = 5$	 Count along a number line to add numbers together
Begin to use the + and = signs to record mental calculations in a number sentence	$6 + 4 = 10$ 
 $5 + 5 = 10$	Know doubles of numbers

Know by heart all pairs of numbers with a total of 10 and 20

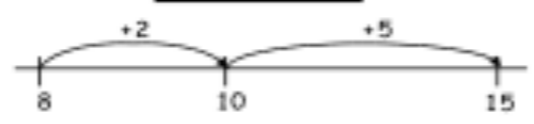


Know that addition can be done in any order

Put the biggest number first and count on



$8 + 7 = 15$

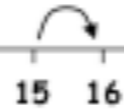


Add two single-digit numbers that bridge 10

Begin to partition numbers in order to add



Know which digit changes when adding 1s or 10s to any number



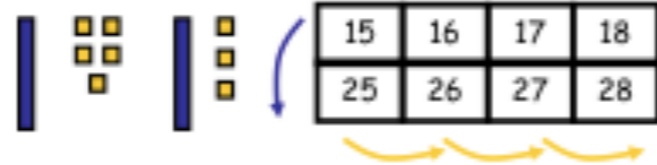
$$15 + 1 = 16$$



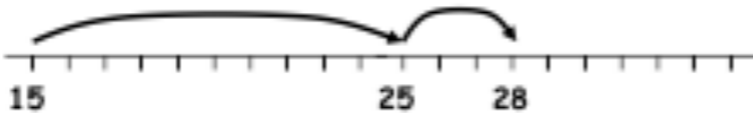
$$15 + 10 = 25$$



$$15 + 20 = 35$$

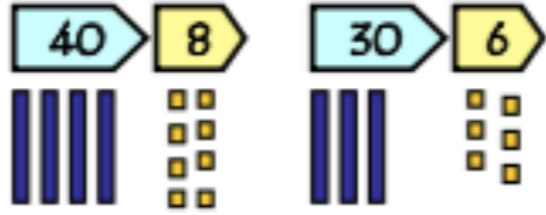
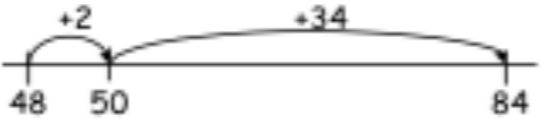
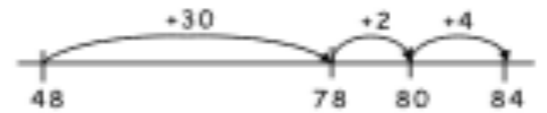


Adding two two-digit numbers (without bridging)  
Counting in tens and ones  
Partitioning and recombining



$$15 + 13 = 28$$

Adding two two-digit numbers (bridging through tens boundary)  
Using a number line  
OR  
Using place value cards and place value apparatus to partition numbers and recombine



$$48 + 36 = 84$$

$$40 + 30 + 8 + 6$$


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$$40 + 30 = 70$$

$$8 + 6 = 14$$

$$70 + 14 = 84$$

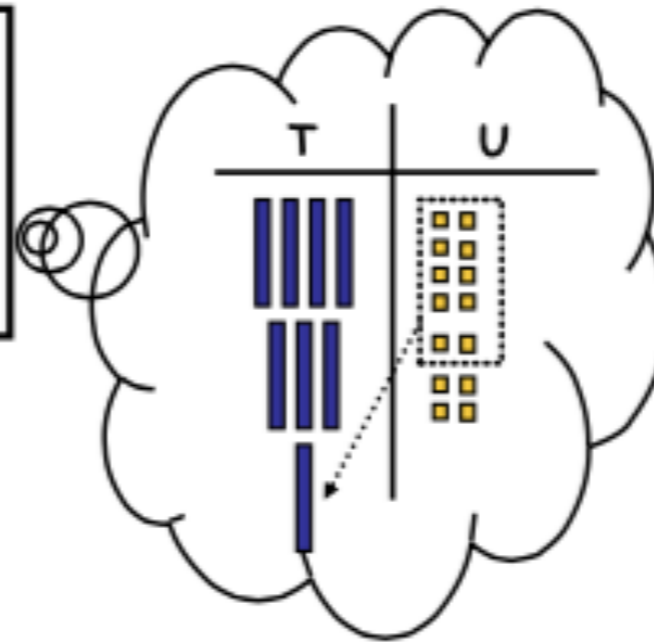


**Expanded method**

It is important that the children have a good understanding of place value and partitioning using concrete resources and visual images to support calculations. The expanded method enables children to see what happens to numbers in the standard written method.

$$48 + 36$$

$$\begin{array}{r} 48 \\ + 36 \\ \hline \end{array}$$



$$\begin{array}{r} \text{T} \quad \text{U} \\ 40 + 8 \\ 30 + 6 \\ 80 + 4 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 48 \\ + 36 \\ \hline 84 \\ 1 \end{array}$$

**Standard written method**


The previous stages reinforce what happens to the numbers when they are added together using more formal written methods.




# Subtraction

Begin to count backwards in familiar contexts such as number rhymes or stories

Five fat sausages frying in a pan ...




Ten green bottles hanging on the wall ...



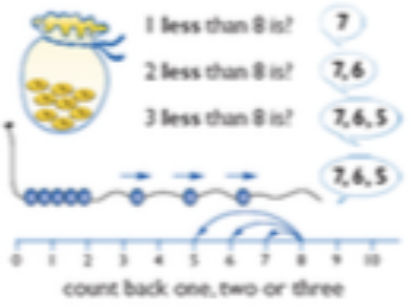
10, 9, 8, 7, ...

Continue the count back in ones from any given number

Begin to relate subtraction to 'taking away'




Three teddies take away two teddies leaves one teddy




1 less than 8 is? 7  
2 less than 8 is? 7, 6  
3 less than 8 is? 7, 6, 5

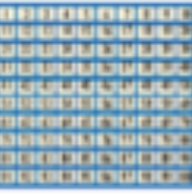
count back one, two or three


Find one less than a number




Count back in tens







If I take away four shells there are six left



Count backwards along a number line to 'take away'

Begin to use the - and = signs to record mental calculations in a number sentence

Maria had six sweets and she ate four. How many did she have left?



$$6 - 4 = 2$$



$$6 + ? = 10$$

$$10 - 6 = ?$$

$$? + 6 = 10$$

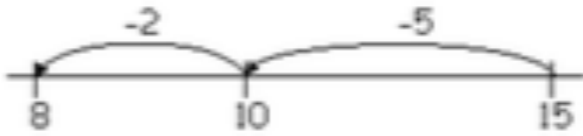
$$10 - 4 = 6$$

		$20 = 12 + 8$	$8 + 12 = 20$
		$20 - 8 = 12$	$20 - 12 = 8$

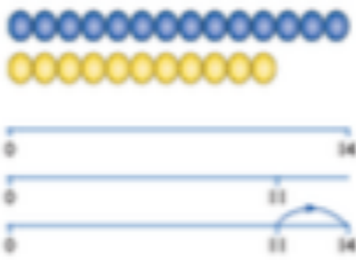
Know by heart subtraction facts for numbers up to 10 and 20

Subtract single digit numbers often bridging through 10

$$15 - 7 = 8$$



The difference is?

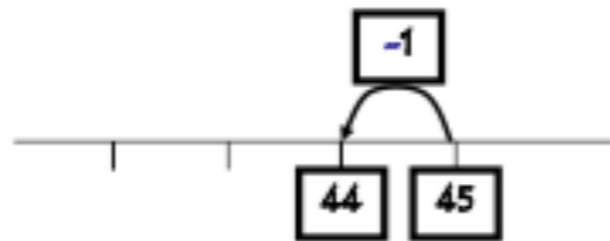
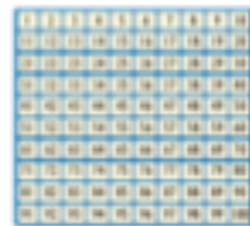


The difference between 11 and 14 is 3.  
 $14 - 11 = 3$   
 $11 + \square = 14$

Begin to find the difference by counting up from the smallest number

Begin to partition numbers in order to take away



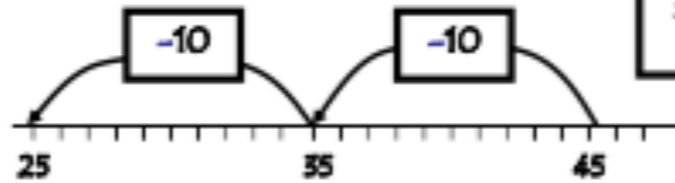
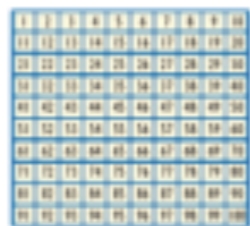
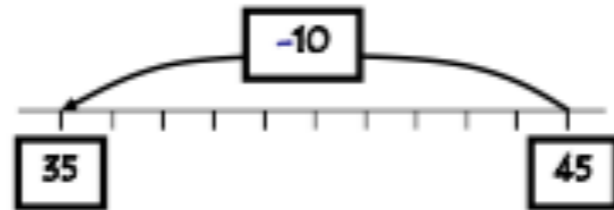
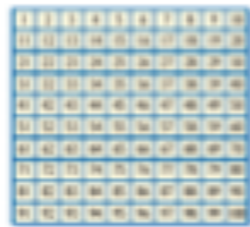


Subtract 1 from a two-digit number

$$45 - 1$$

Subtract 10 from a two-digit number

$$45 - 10$$



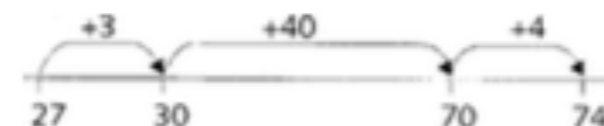
Subtract multiples of 10 from any number

$$45 - 20$$

Partition the number to be subtracted (no exchanging)



$43 - 23$   
 $43 - 20 = 23$   
 $23 - 3 = 20$



Decide whether to count on or count back

$$74 - 27 = 47$$

Now what's the answer?



Partitioning number to be subtracted - with exchanging (links to counting back on number line)

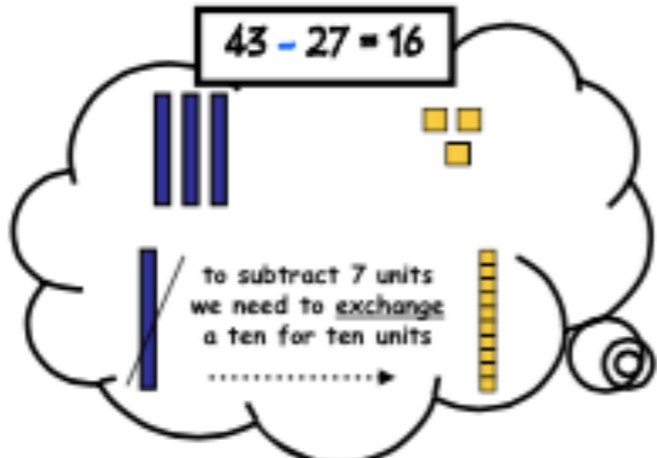
$$43 - 27 = 16$$

$$43$$

$$20 \quad 7$$

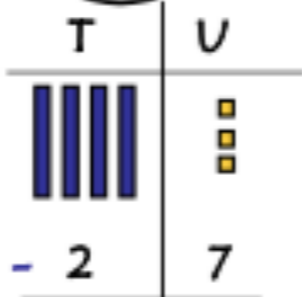
$$43 - 20 = 23$$

$$23 - 7 = 16$$



**Expanded method**  
It is important that the children have a good understanding of place value and partitioning using concrete resources and visual images to support calculations. The expanded method enables children to see what happens to numbers in the standard written method.

*NOTE: the correct language is 'exchange' not 'borrow'*



$$\begin{array}{r} 30 \quad 40 \\ - 20 \\ \hline 10 \end{array} \quad + \begin{array}{r} 10 + 3 \\ + 7 \\ \hline 6 \end{array}$$

**Standard written method**  
The previous stages reinforce what happens to numbers when they are subtracted using more formal written methods. It is important that the children have a good understanding of place value and partitioning.

$$\begin{array}{r} 3 \quad 4 \quad 13 \\ - 27 \\ \hline 16 \end{array}$$

# Multiplication

Count in tens from zero

0 10 20 30 40 50

Count in twos from zero

0 2 4 6 8 10

Count in fives from zero

0 5 10 15 20 25 30

Know doubles and corresponding halves

half of 8 is 4  $8 \div 2 = 4$   
double 4 is 8  $4 \times 2 = 8$

Know multiplication tables to  $10 \times 10$

$2 \times 5 = 10$   $3 \times 5 = 15$   $4 \times 5 = 20$   $5 \times 5 = 25$   $6 \times 5 = 30$   $7 \times 5 = 35$   $8 \times 5 = 40$   $9 \times 5 = 45$   $10 \times 5 = 50$

$\times 5$

Twice as many

Use known facts to work out new ones

0 3 4 5 12 15 18 21 24 27 30  
0 6 12 18 24 30 36 42 48 54 60

$12 \times 2 = 24$

Understand that ...

$$24 \times 20 = 24 \times 2 \times 10$$

$$24 \times 50 = 24 \times 5 \times 10$$

Use factors to multiply

Understand multiplication  
as repeated addition


$$2 + 2 + 2 + 2$$

$$2 + 2 + 2 + 2 = 8$$

$$4 \times 2 = 8$$

2 multiplied by 4

4 lots of 2



$$2 \times 4$$



$$4 \times 2 = 8$$

$$2 \times 4 = 8$$



$$4 \times 2$$

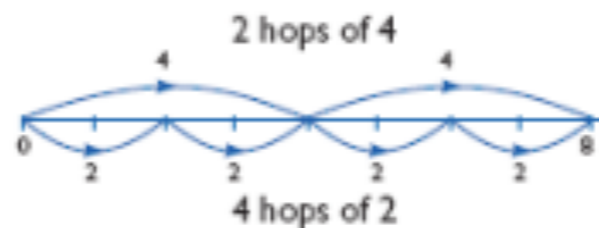


$$2 \times 4 = 8$$

$$4 \times 2 = 8$$

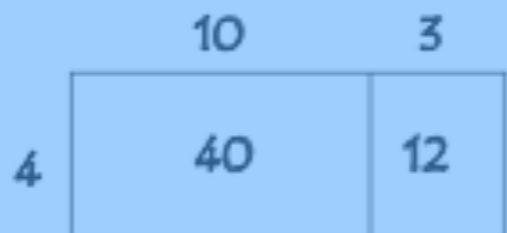
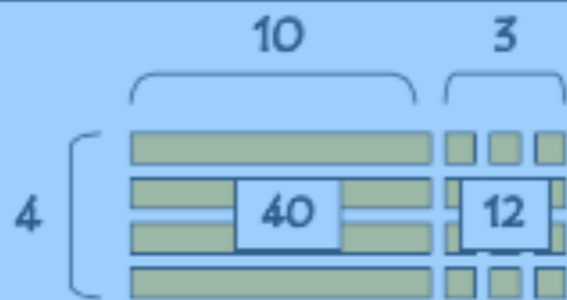
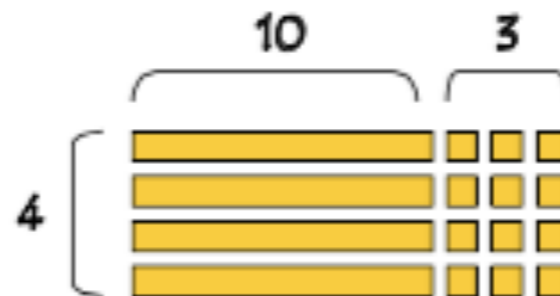
Understand  
multiplication  
as an array

Understand how to  
represent arrays  
on a number line



Use place value apparatus to support the multiplication of U x TU

$$4 \times 13$$



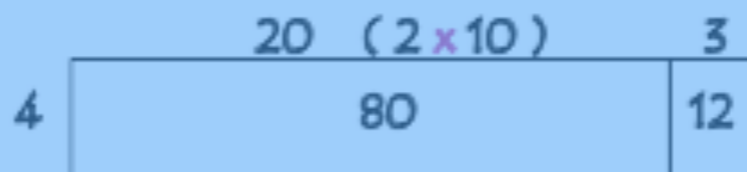
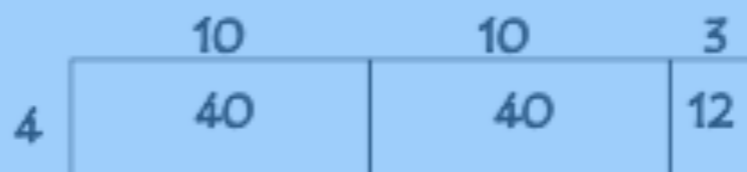
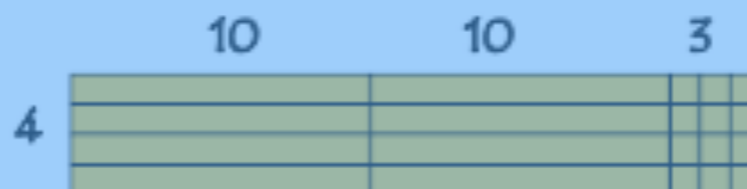
$$40 + 12 = 52$$

Use place value apparatus to support the multiplication of U x TU alongside the grid method

$$4 \times 13$$

Use place value apparatus to represent the multiplication of U x TU alongside the grid method

$$4 \times 23$$



$$80 + 12 = 92$$



Multiplying TU x TU

$14 \times 33$

	30	3	
10	300	30	= 330 +
4	120	12	= 132

462

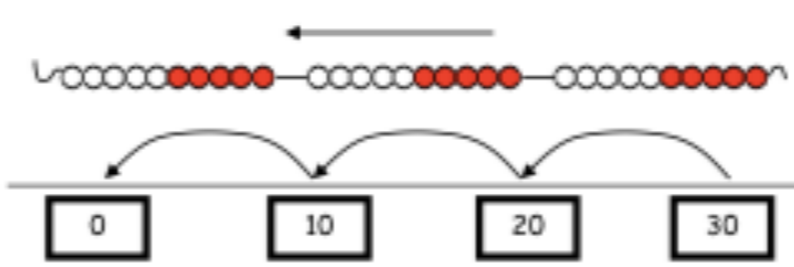
$$\begin{array}{r} 300 \\ 120 \\ 30 \\ + 12 \\ \hline 462 \end{array}$$

$$\begin{array}{r} 56 \\ \times \quad 27 \\ \hline 392 \\ 1120 \\ \hline 1512 \end{array} \quad \begin{array}{l} (56 \times 20) \\ (56 \times 7) \end{array}$$

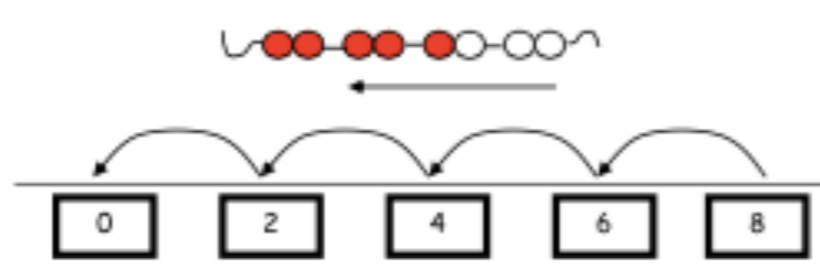
Standard written method

# Division

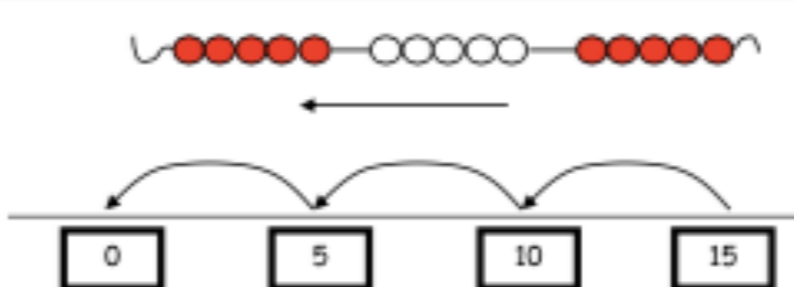
**Count back in tens**




**Count back in twos**



**Count back in fives**



**Know halves**



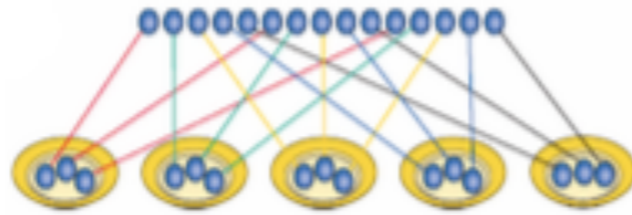
Half of 8 is 4  
 $8 \div 2 = 4$

Half of 6 is 3  
 $\frac{1}{2}$  of 6 = 3

**Use known multiplication facts to work out corresponding division facts**

If  $2 \times 10 = 20$   
then  
 $20 \div 10 = 2$   
 $20 \div 2 = 10$

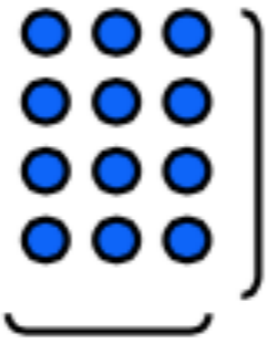
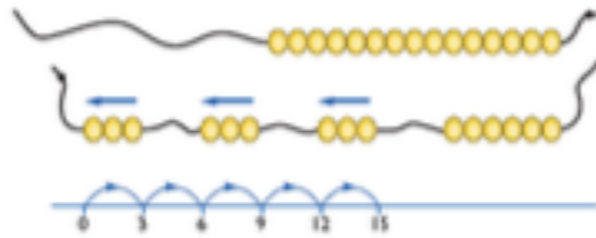
$15 \div 5 = 3$   
15 shared between 5



Understand division as sharing

Understand division as grouping

How many 3s in 15?



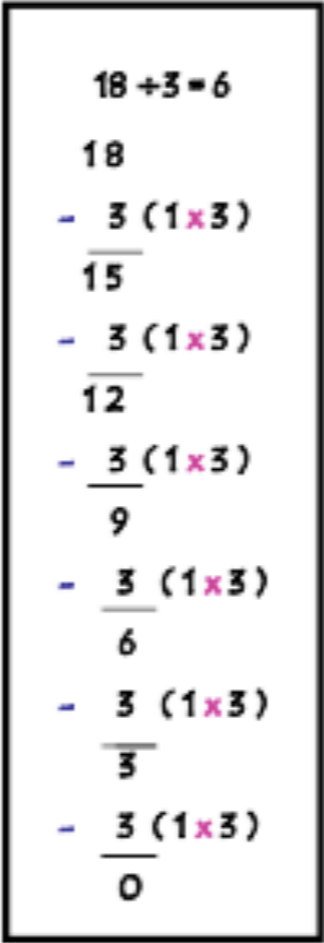
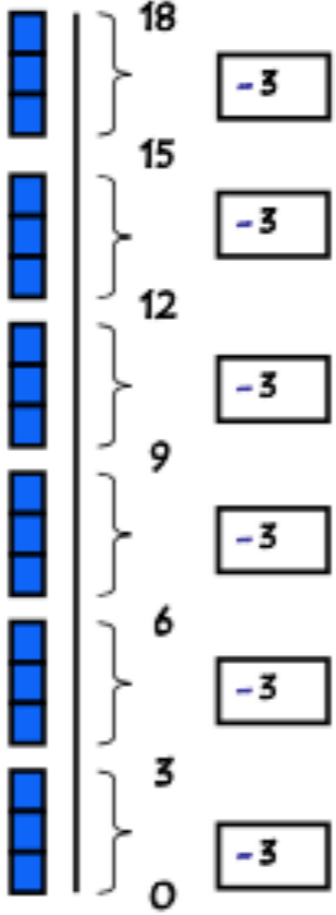
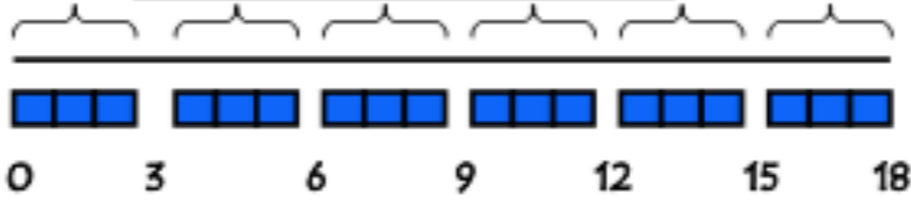
12 divided into groups of 3 gives 4 groups  
 $12 \div 3 = 4$

12 divided into groups of 4 gives 3 groups  
 $12 \div 4 = 3$

Reinforce division as grouping through the use of arrays

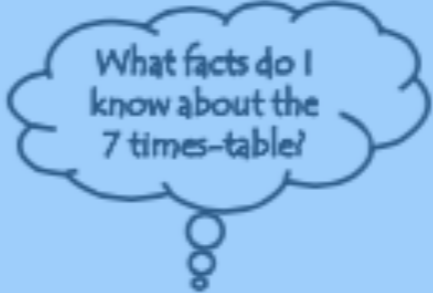
Represent 'groups' for division on a number line using apparatus alongside the line

18 divided into groups of 3  
 $18 \div 3 = 6$



Understand division as repeated subtraction using a vertical line and apparatus to make the links

Children need to see that as the numbers get larger, large chunk subtraction is the more efficient method. Multiples of the divisor (large chunks) are taken away. Multiplication facts are needed to see the size of the 'chunk'.



$$100 \div 7 = 14 \text{ r}2$$

$$\begin{array}{r} 100 \\ -70 \quad (10 \times 7) \\ \hline 30 \\ -28 \quad (4 \times) \\ \hline 2 \end{array}$$

$$518 \div 7 = 74$$

$$\begin{array}{r} 518 \\ -350 \quad (50 \times 7) \\ \hline 168 \\ -140 \quad (20 \times) \\ \hline 28 \\ -28 \quad (4 \times) \\ \hline 0 \end{array}$$

Fact Box

$$1 \times 7 = 7$$

$$2 \times 7 = 14$$

$$5 \times 7 = 35$$

$$10 \times 7 = 70$$

$$20 \times 7 = 140$$

$$50 \times 7 = 350$$

$$100 \times 7 = 700$$

$$560 \div 24$$

$$\begin{array}{r} 23 \text{ r}8 \\ 24 \overline{)560} \\ -480 \\ \hline 80 \\ -72 \\ \hline 8 \end{array}$$

Standard written method  
Links directly to large chunk subtraction

**QRA**