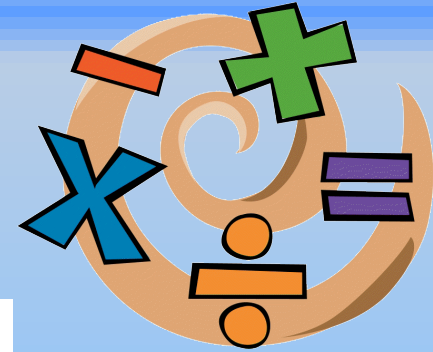


- Children should always be encouraged to consider if a mental calculation would be appropriate before using written methods.
- Why do children need to do written calculations?
 - To represent work that has been done practically.
 - To support, record and explain mental calculation
 - To keep track of steps in a longer task
 - To work out calculations that are too difficult to do mentally

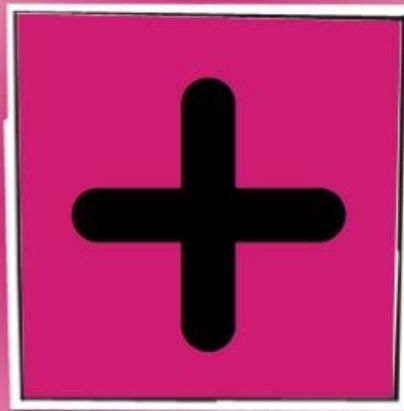
Addition



Add

More

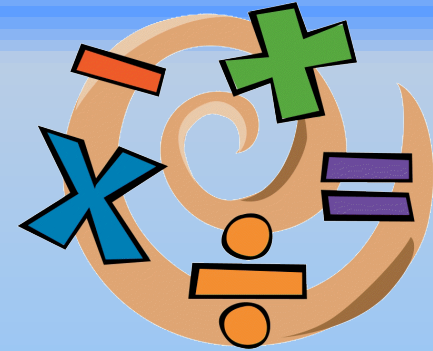
Plus



Sum

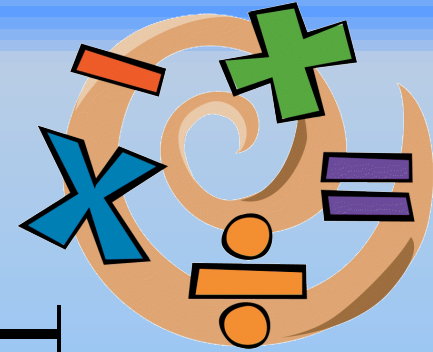
Addition

Stage 1: Recording and developing mental pictures

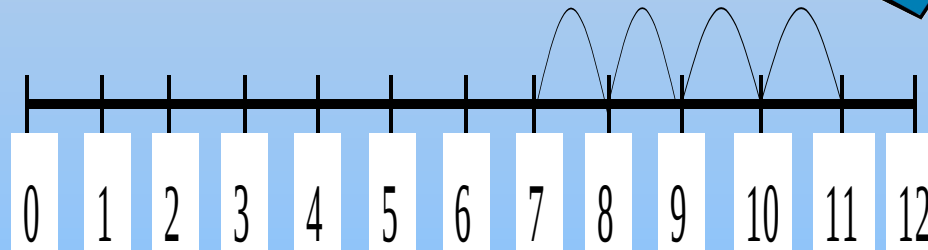


- Children will engage in a wide variety of songs and rhymes, games and activities.
- They will begin to relate addition to combining two groups of objects, first by counting all and then by counting on from the largest number.
- ‘You have five apples and I have three apples. How many apples altogether?’

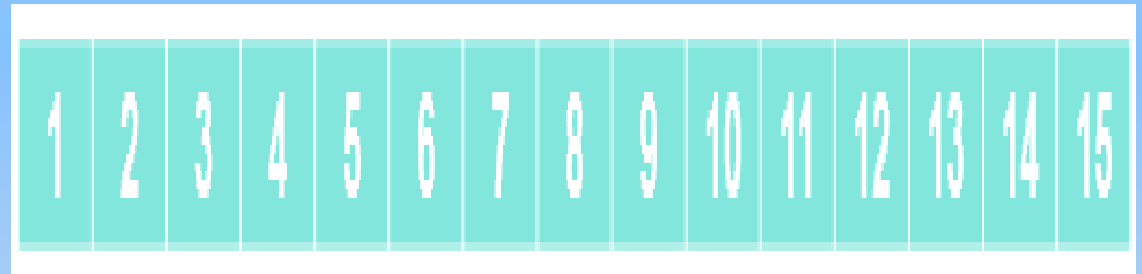
Stage 2:



- Number lines

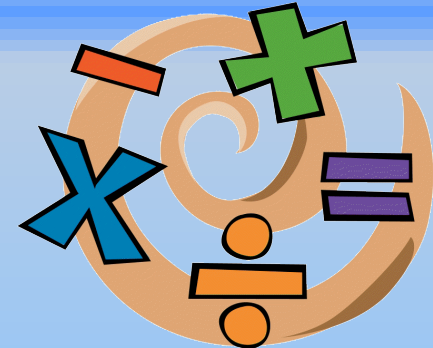


- Number tracks



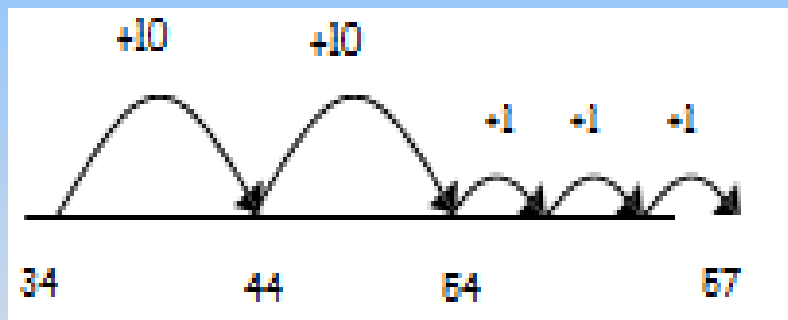
- 100 Grids

Stage 3: Empty Number Line

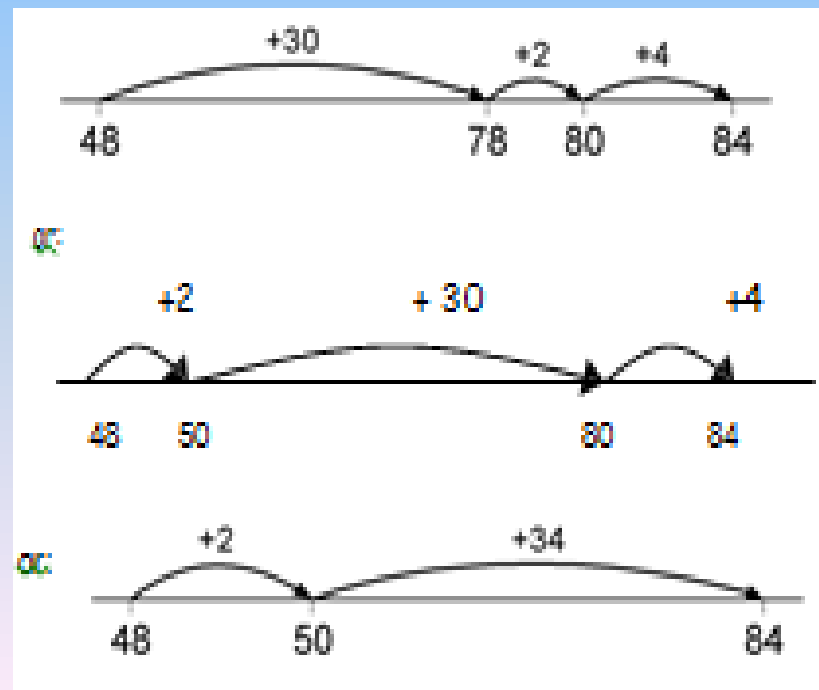


- Children will use blank number lines to record adding jumps of tens and ones.

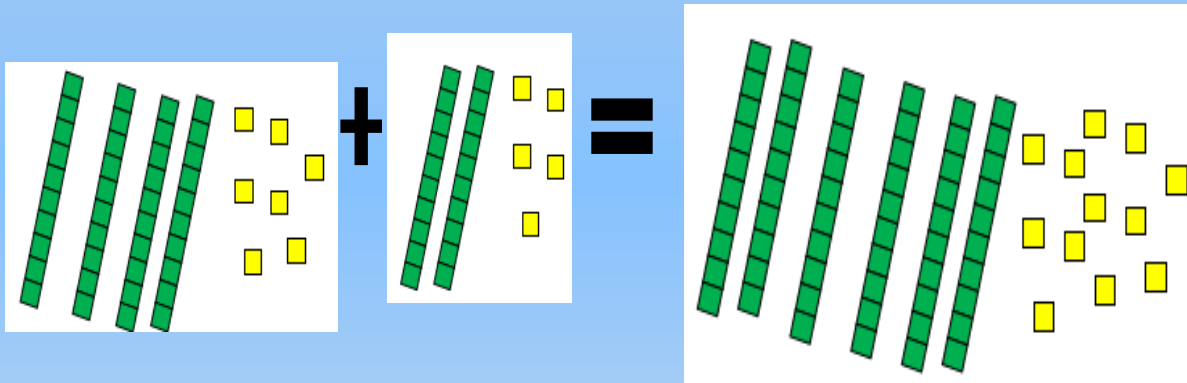
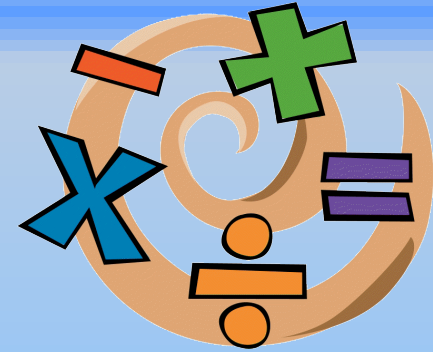
$$34 + 23 =$$



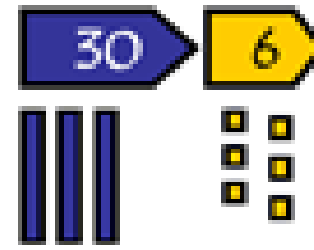
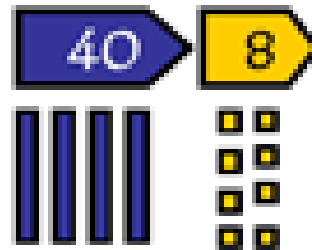
$$48 + 36 =$$



Stage 4: Place Value Resources leading to formal method



$$48 + 36$$

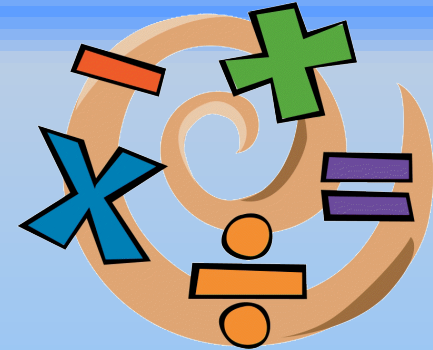


$$40 + 30 = 70$$

$$8 + 6 = 14$$

$$70 + 14 = 84$$

Stage 5: Using Dienes/place value counters alongside column written method



100 100	10 10 10 10	1 1 1 1 1 1 1
100	10 10	1 1 1 1 1

$$\begin{array}{r}
 200 + 40 + 7 \\
 100 + 20 + 5 \\
 \hline
 300 + 60 + 12 = 372
 \end{array}$$

Diagram illustrating the addition of 257 and 47 using place value counters and a column written method.

Place Value Counters:

- Tens:** 2 tens rods (20) + 4 tens rods (40) = 6 tens rods (60)
- Ones:** 5 ones units (5) + 7 ones units (7) = 12 ones units (12)

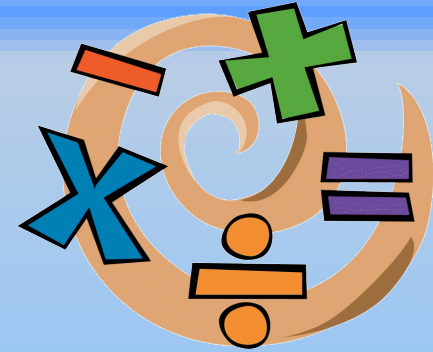
Column Written Method:

$$\begin{array}{r}
 25 \\
 + 47 \\
 \hline
 72 \\
 1 \\
 \hline
 72
 \end{array}$$

Leading to:

The final result is 72, represented by 7 tens rods and 2 ones units.

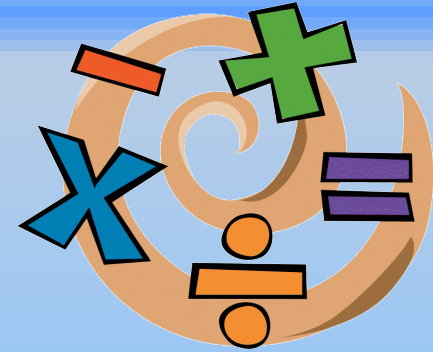
Stage 5: Using Dienes/place value counters alongside columnar written method



Expanded written method, vertical layout, adding the least significant number first.

$$\begin{array}{r} 264 \\ + 148 \\ \hline 12 \\ 100 \\ 300 \\ \hline 412 \end{array}$$

Stage 6: Compact Column Method



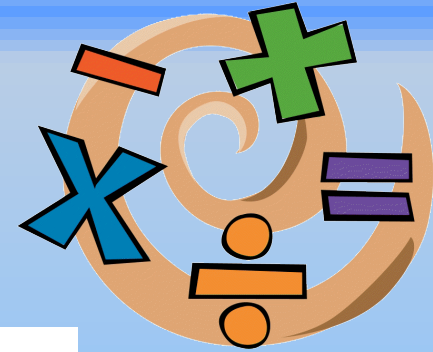
$$\begin{array}{r} 258 \\ + 87 \\ \hline \end{array}$$

$$\begin{array}{r} 258 \\ + 87 \\ \hline 1 \\ 5 \end{array}$$

$$\begin{array}{r} 258 \\ + 87 \\ \hline 11 \\ 45 \end{array}$$

$$\begin{array}{r} 258 \\ + 87 \\ \hline 11 \\ 345 \end{array}$$

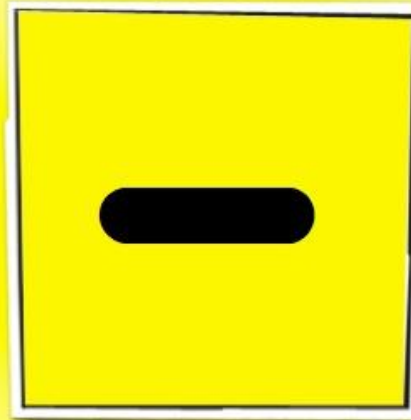
Subtraction



Leave

Subtract

Minus

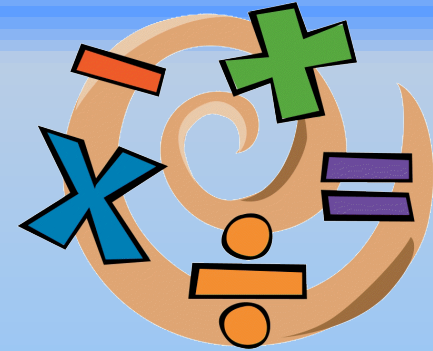


Less

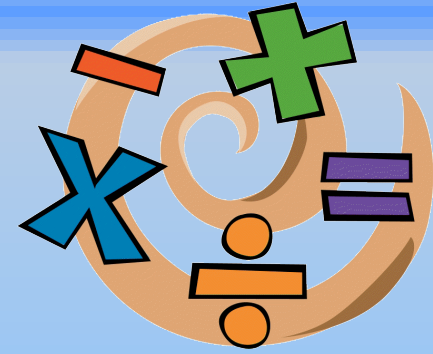
Take
away

Difference

Stage 1: Recording and developing mental pictures



- Children will engage in a variety of counting songs and rhymes and practical activities.
- They will begin to relate subtraction to ‘taking away’ using objects to count ‘how many are left’ after some have been taken away.
- ‘Take two apples away. How many are left?’
- Children will begin to count back from a given number.



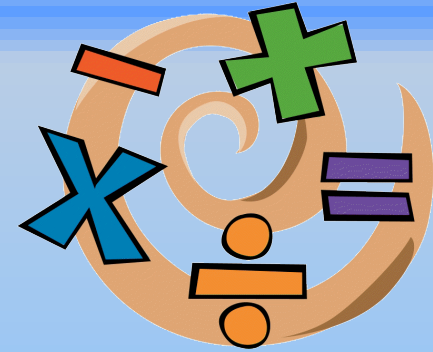
- The 'difference between' is introduced through practical situations and images.



Which line has most money?

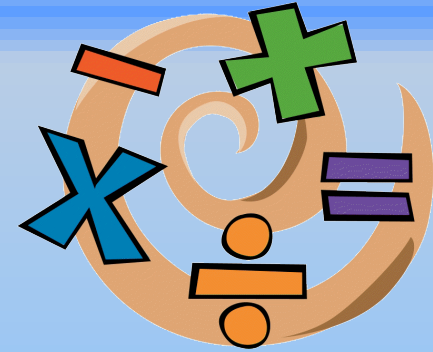
How much more?

Stage 2:

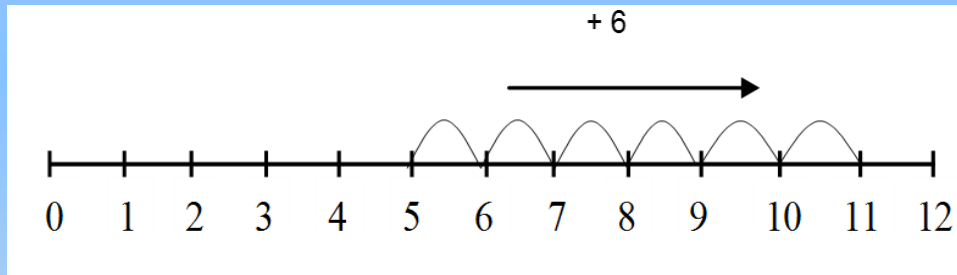


- Number line
- Number track
- 100 Grid

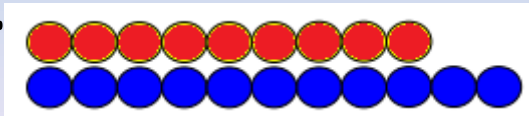
Stage 2:



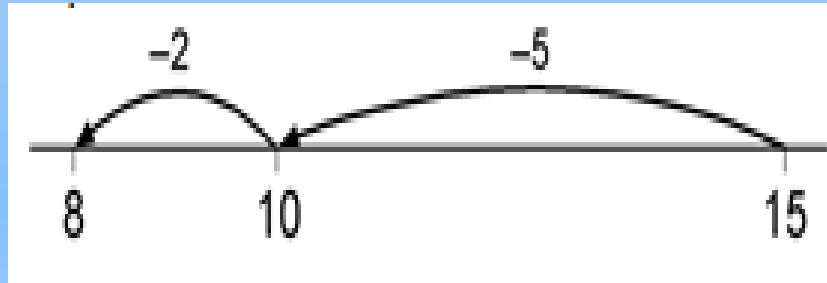
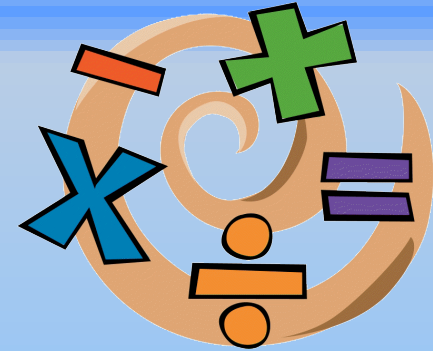
- Counting on to find a small difference:



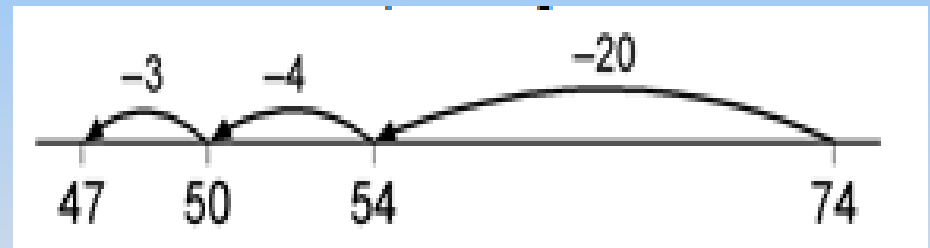
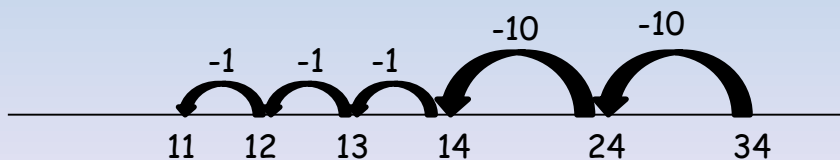
- $11 - 9 = 2$
- The difference between nine and eleven is two.



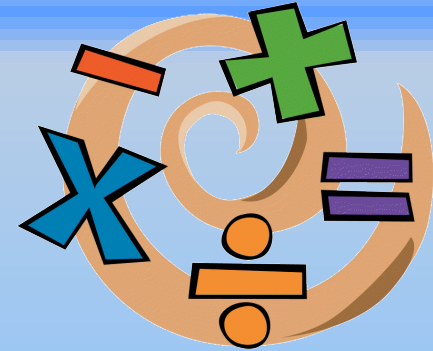
Stage 3: Empty Number Line



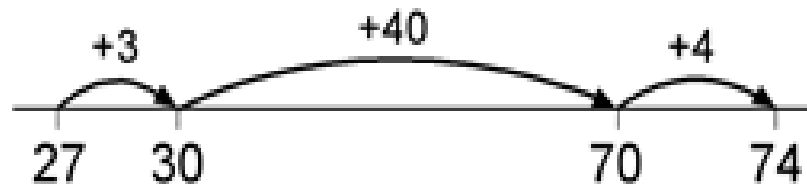
- $34 - 23 = 11$



Stage 3: Empty Number Line

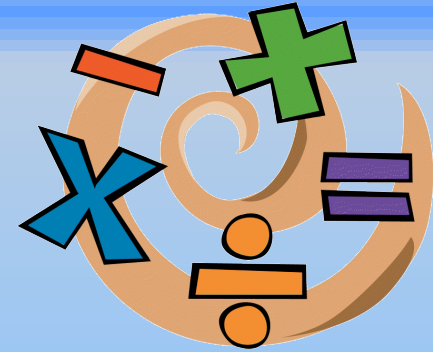


$$74 - 27 =$$



The 'jumps' should be added, either mentally or with jottings according to confidence, beginning with the largest number e.g. $40 + 4 + 3$.

Stage 4: Practical equipment using exchange to 'take away'



- $72 - 47 =$

This is now
"Sixty-twelve"

67^{12}

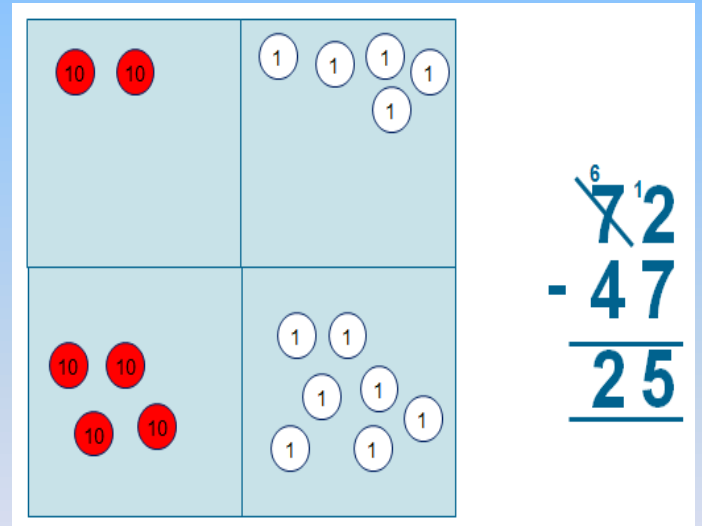
$72 - 47 = 25$

Expanded written methods using vertical layout:

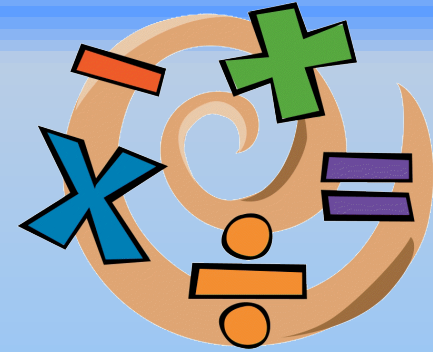
$$81 - 57 =$$

$$80 \quad 1 \rightarrow 70 \quad 11$$

$$\begin{array}{r} 50 \quad 7 \\ \hline 20 \quad 4 = 24 \end{array}$$



Stage 6: Compact method

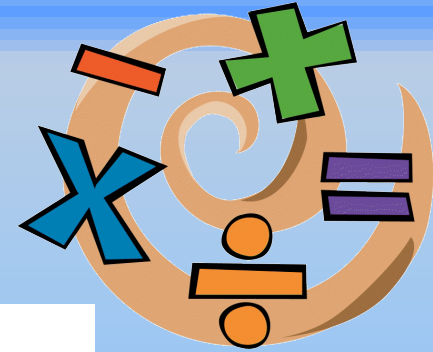


$$563 - 246 = 317$$

A pixelated, low-resolution version of the subtraction problem. The numbers are rendered in a blocky, multi-colored font. The problem is written as follows:

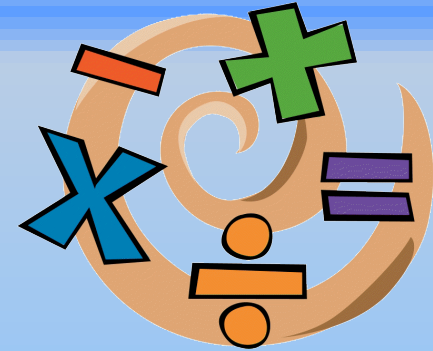
$$\begin{array}{r} 563 \\ - 246 \\ \hline 317 \end{array}$$

Multiplication

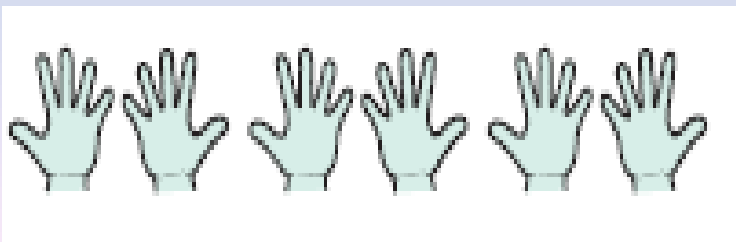


Multiplication
Groups of  Times
Multiply Lots of

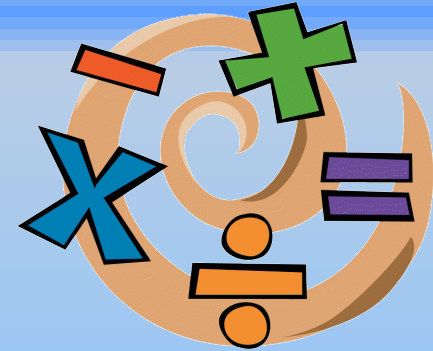
Stage 1: Recording and developing mental images



- Children will count repeated groups of the same size in practical contexts.
- They will solve practical problems that involve combining groups of 2, 5 or 10.



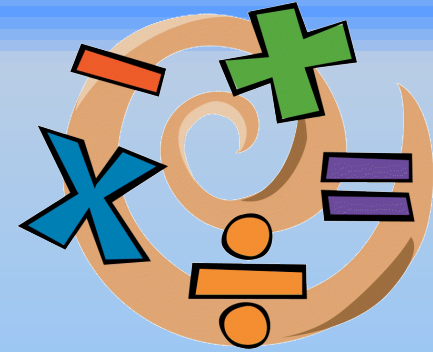
Stage 1: Recording and developing mental images



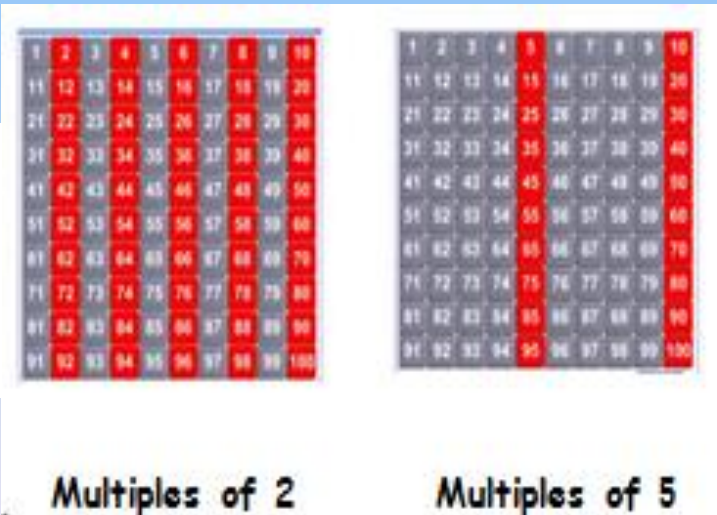
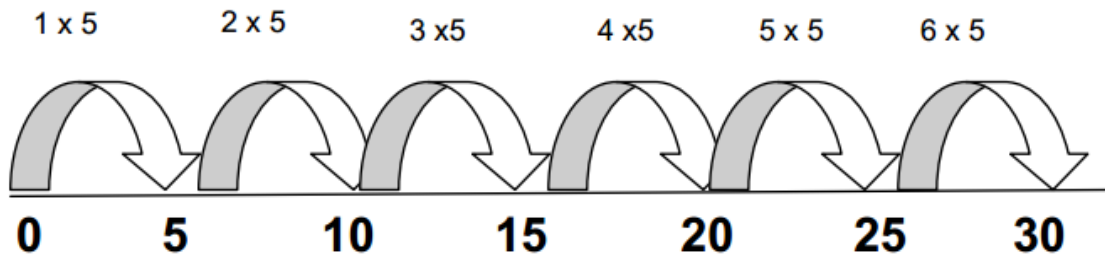
They will see everyday versions of arrays, e.g. egg boxes, baking trays, ice cube trays, wrapping paper etc. and use this in their learning answering questions such as; 'How many eggs would we need to fill the egg box? How do you know?'



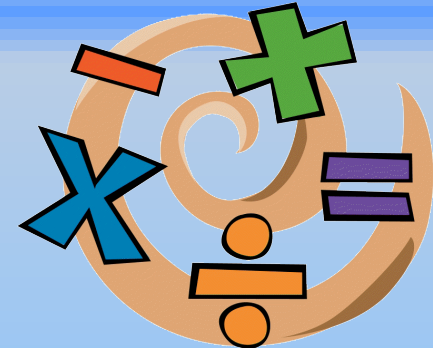
Stage 2: The bead string, number line and hundred grid.



Continue to use repeated addition and represent on a bead string or hundred grid.



Stage 3: Arrays



'5 + 5 + 5 + 5 + 5 + 5 = 30'

'6 rows of 5'

'6 groups of 5'

'5 groups of 6'

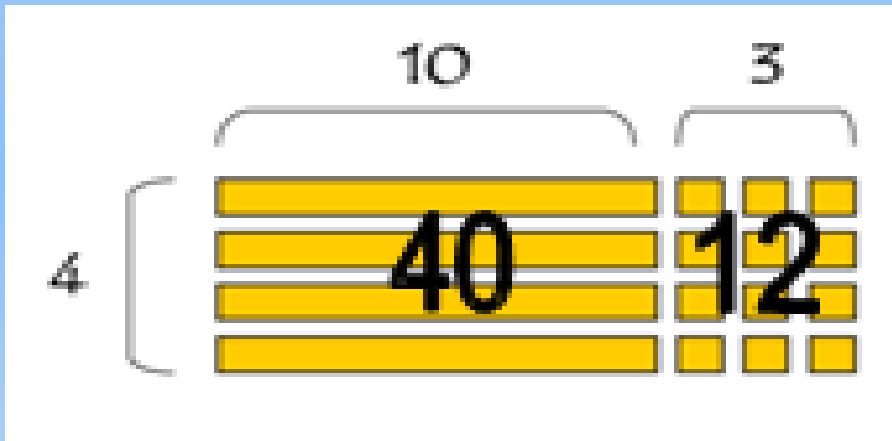
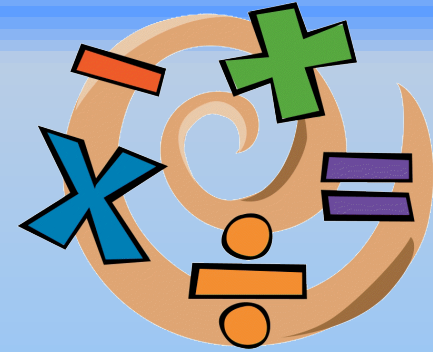
'5 x 6 = 30'

'6 x 5 = 30'

$$6 \times 5 = 30$$



Stage 4: The Grid Method

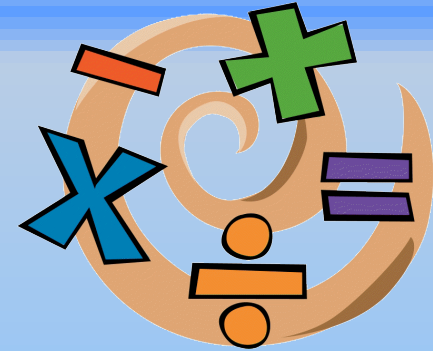


This then becomes

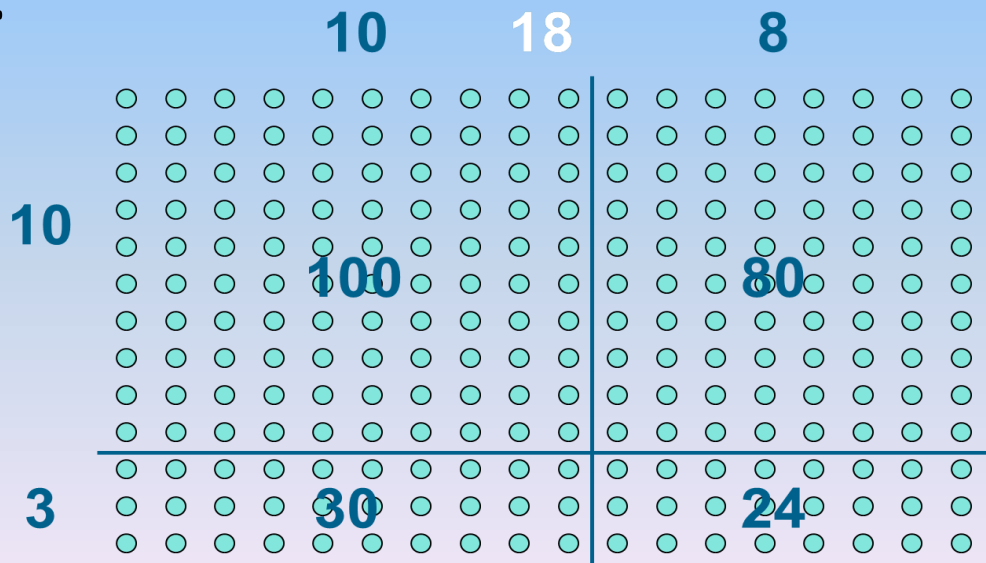
x	10	3
4	40	12

$$40 + 12 = 52$$

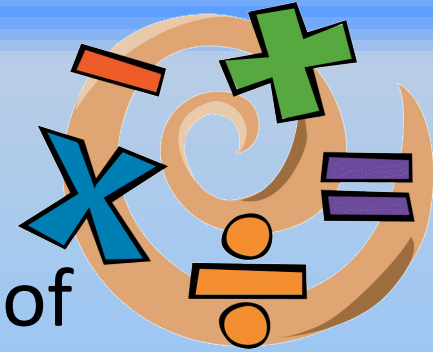
Stage 4: The Grid Method



Children to embed and deepen their understanding of the grid method to multiply up 2digit x 2digit. Ensuring this is still linked back to their understanding of arrays and place value counters.



Stage 5: Expanded Short Multiplication



The first step is to represent the method of recording in a column format, but showing the working. Multiply the units first which enables them to move towards the compact method

e.g.

$$30 + 8$$

$$\begin{array}{r} \times \quad 7 \\ \hline \end{array}$$

$$56$$

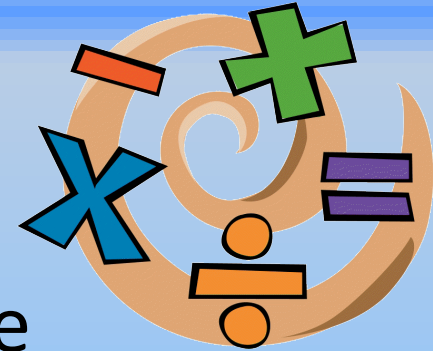
$$7 \times 8$$

$$\begin{array}{r} 210 \\ \hline \end{array}$$

$$7 \times 30$$

$$\begin{array}{r} 266 \\ \hline \end{array}$$

Stage 6: Short multiplication for up to TU x 12



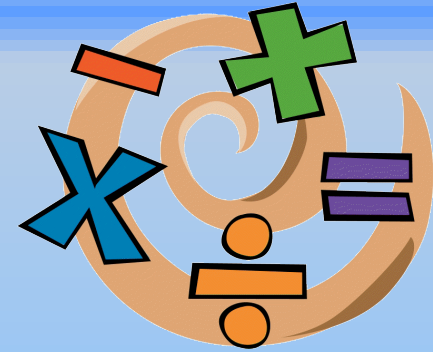
The recording is reduced further, with the carried digits recorded.

342 $\times$ 7 becomes

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ \hline 21 \end{array}$$

Answer: 2394

Expanded long multiplication (TU x TU)

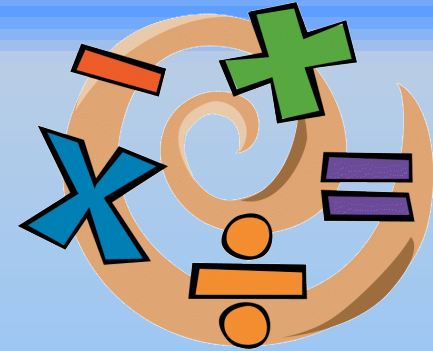


$$53 \times 16$$

x	10	6
50	500	300
3	30	18

$$\begin{array}{r} 53 \\ \times 16 \\ \hline 500 \text{ (50 x 10)} \\ 300 \text{ (50 x 6)} \\ 30 \text{ (3 x 10)} \\ + 18 \text{ (3 x 6)} \\ \hline 848 \end{array}$$

Long multiplication (TU x TU)



124 x 26 becomes

	1	2		
	1	2	4	
x		2	6	
	7	4	4	
2	4	8	0	
3	2	2	4	
	1	1		

Answer: 3224

$6 \times 4 = 24$ so record the 4 in the units and carry the 20 (2) into the tens

$6 \times 20 = 120 + (\text{the carried}) 20 = 140$ so record the 40 in the tens and carry the 100 (1) into the hundreds column.

$6 \times 100 = 600 + (\text{the carried}) 100 = 700$. Record as 7 in the hundreds.

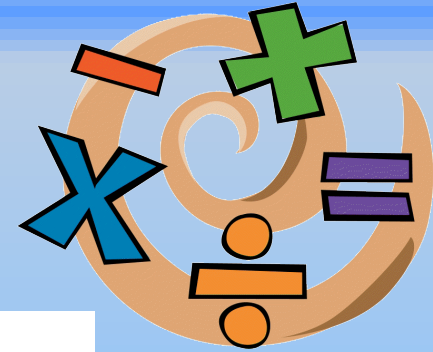
$20 \times 4 = 80$ so record this on a new answer row in the correct columns.

$20 \times 20 = 400$. Record the 4 in the hundreds column.

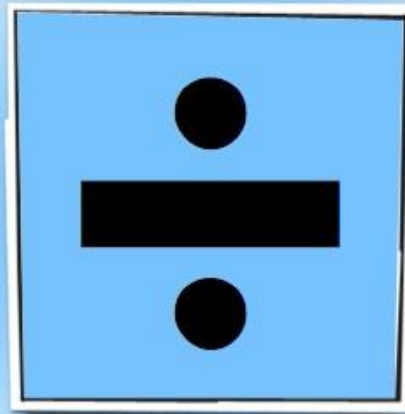
$20 \times 100 = 2000$ so record this appropriately.

Use column addition to add the two totals together, resulting in 3224.

Division



Share
equally

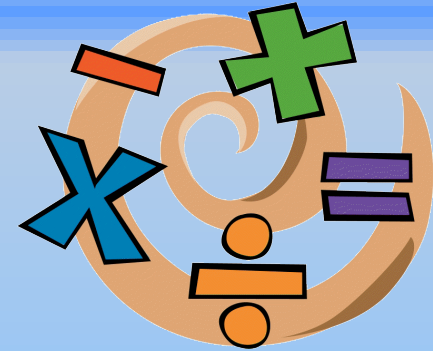


Divide

Share

Equal
groups

Stage 1: Recording and developing mental images

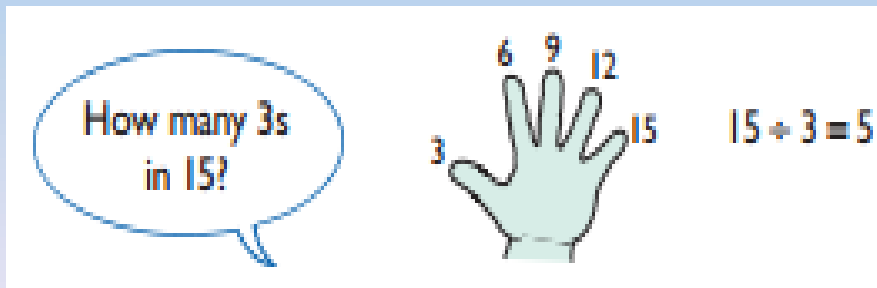
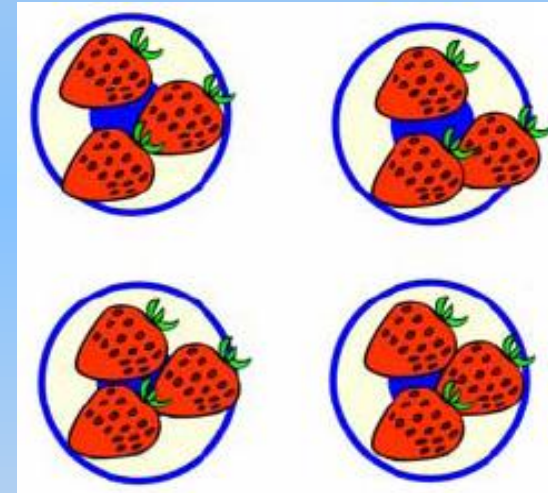
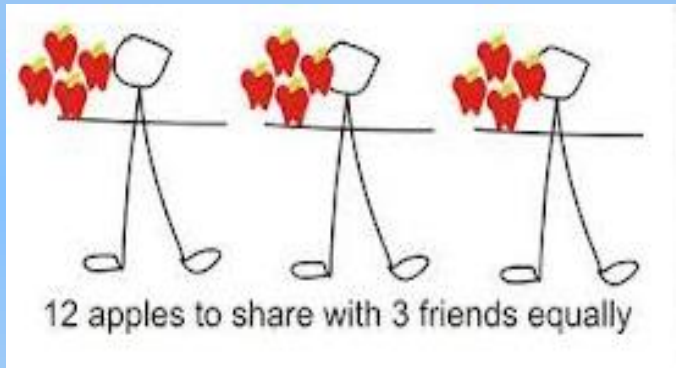
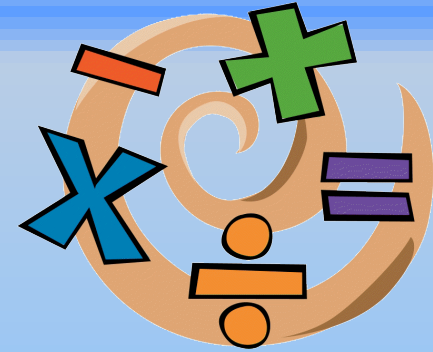


Sharing and Grouping

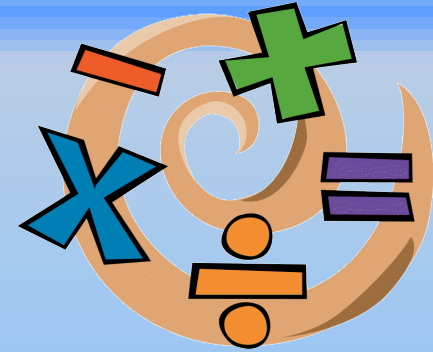
They solve **sharing** problems by using a 'one for you, one for me' strategy until all of the items have been given out. Children will be taught to share using concrete apparatus.

They solve **grouping** problems by creating groups of the given number. Children will apply their counting skills to develop some understanding of grouping.

Stage 1: Recording and developing mental images



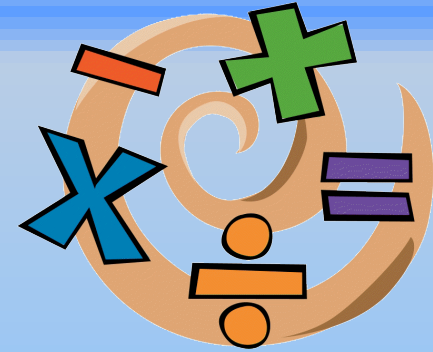
Stage 1: Recording and developing mental images



Children will move from sharing to grouping in a practical way

Sharing- 'Share 20 crayons between 2 pots.'
'How many crayons are in each pot?'

Grouping- 'Put 20 crayons into groups of 10.
How many pots do we need?'



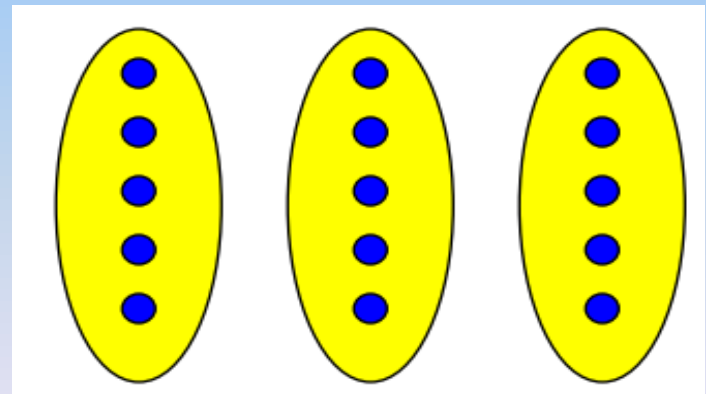
They will begin to use their own jottings to record division.

How many groups of 5?’

‘15 shared equally between 3 people is...?’

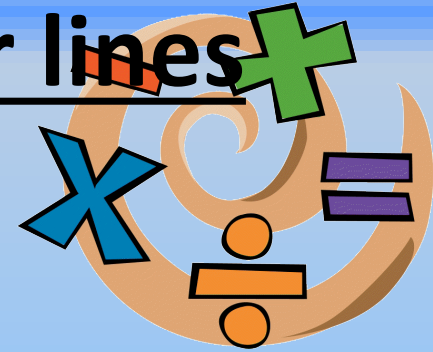
‘15 divided by 3 equals 5’

‘15 divided by 5 equals 3’



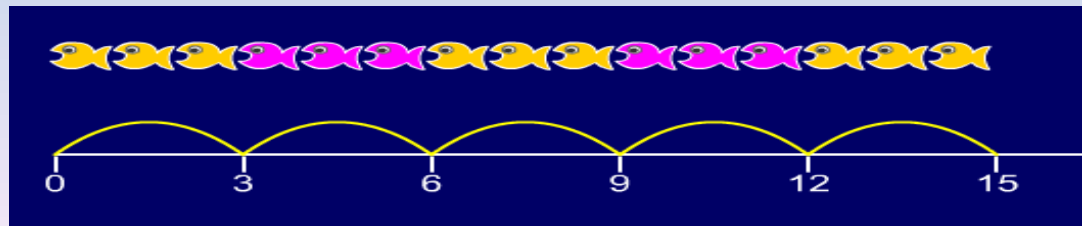
Stage 2: Bead strings, number lines

simple multiples

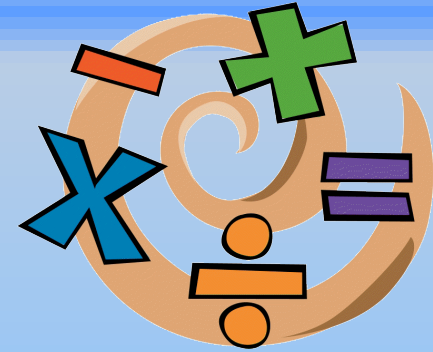


Using a bead string, children can represent division problems

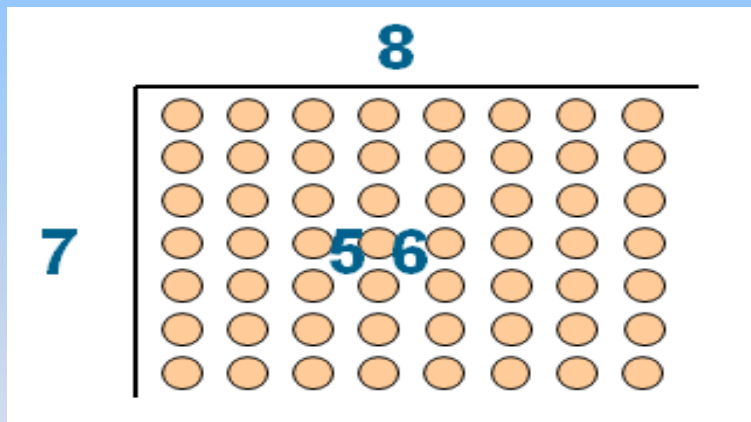
They count on in equal steps based on adding multiples up to the number to be divided.



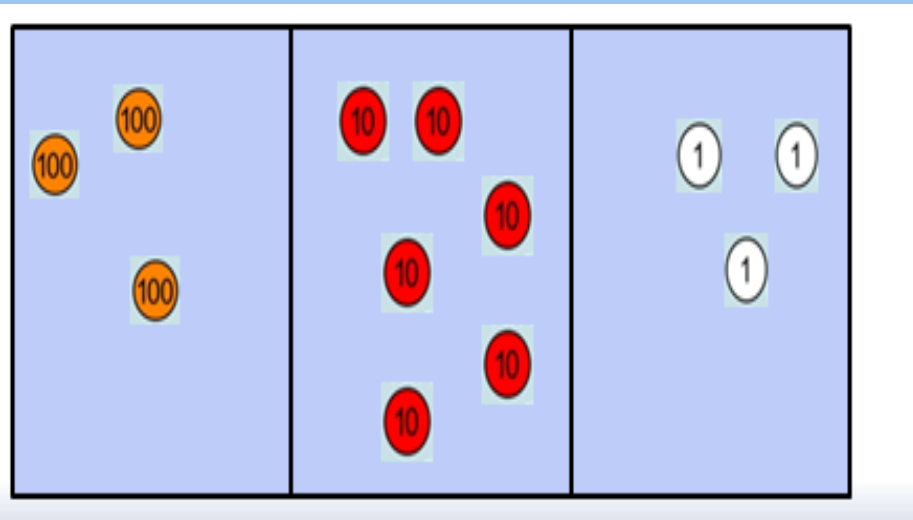
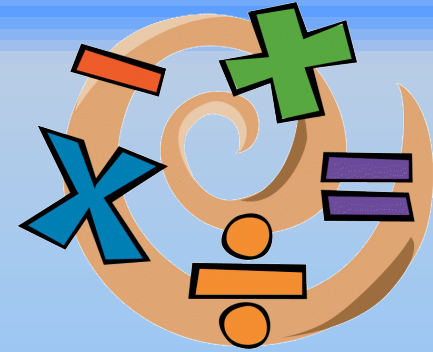
Stage 3: Arrays for division



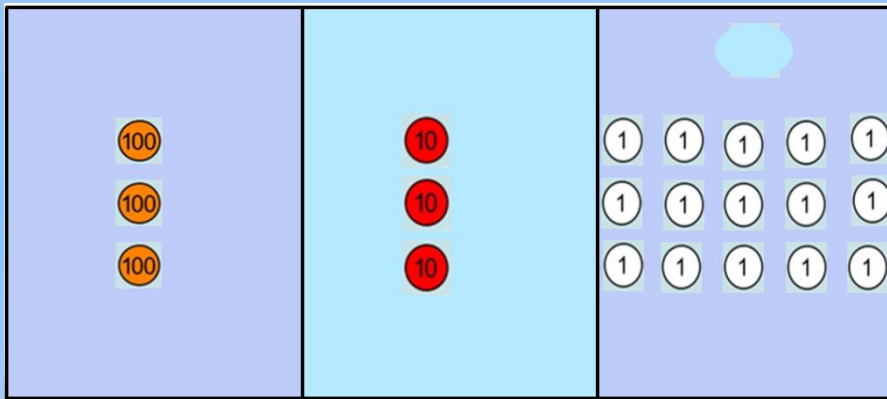
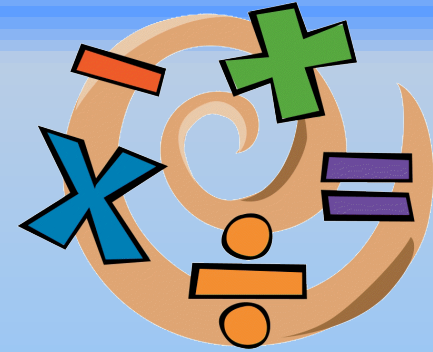
Children construct arrays by grouping the dividend into groups of the divisor. The number of groups made is recorded as the quotient.



Divided $(56) \div \text{divisor } (7) = \text{Quotient } (8)$

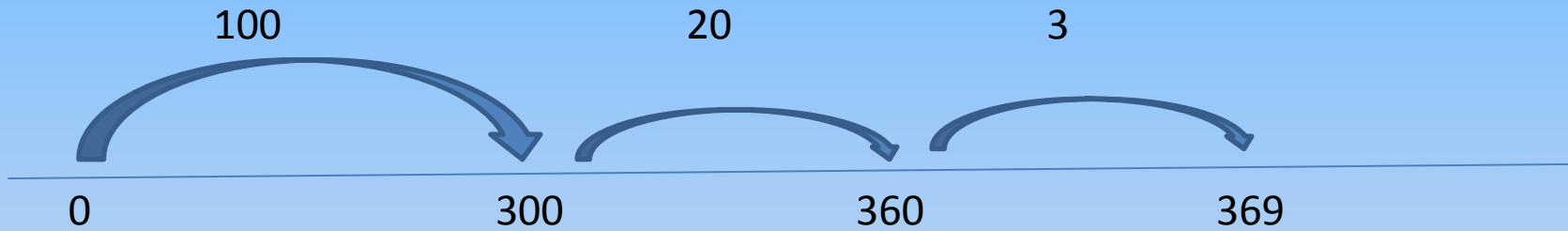
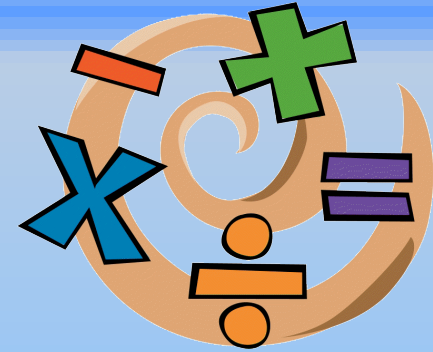


$$\begin{array}{r}
 121 \\
 3 \overline{) 363} \\
 \underline{363} \\
 0
 \end{array}$$

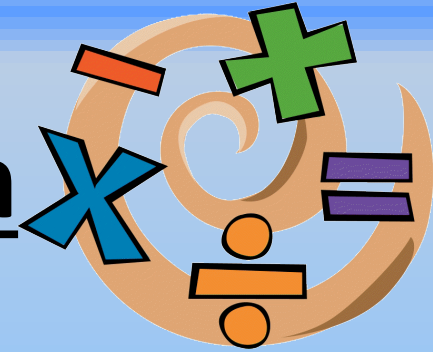


$$\begin{array}{r}
 115 \\
 3 \overline{) 345} \\
 \underline{3} \\
 4 \\
 \underline{3} \\
 1
 \end{array}$$

$$369 \div 3 = 123$$



Stage 5: Short Division

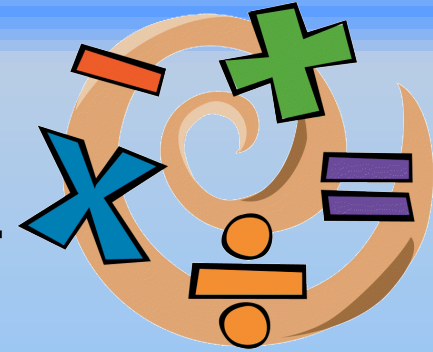


432 ÷ 5 becomes

$$\begin{array}{r} 86 \\ 5 \overline{) 432} \end{array}$$

Answer: 86 remainder 2

Stage 5: Long Division



432 ÷ 15 becomes

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{30} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12