

Methods we use in Mathematics

By Niki Byrne

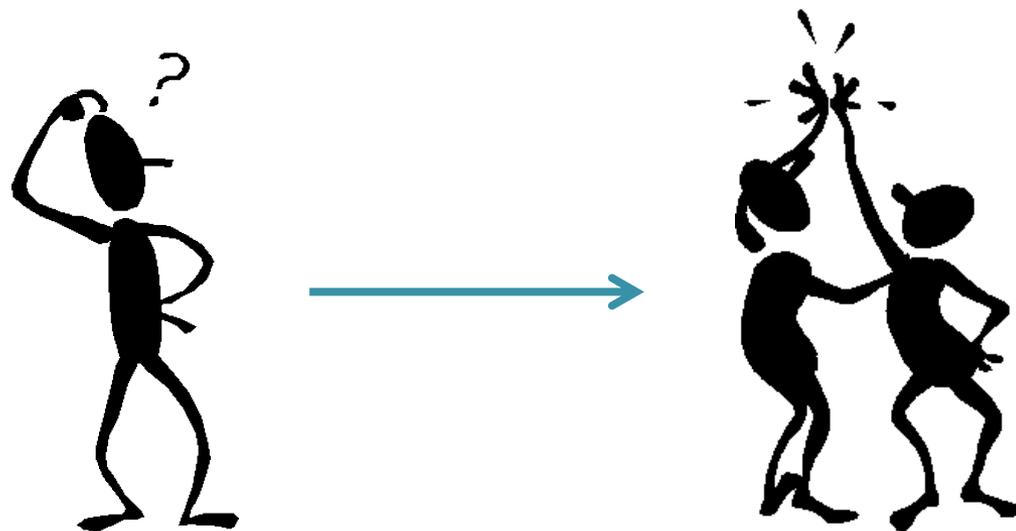
“They didn’t do it like that in my day!”

Does ‘Partitioning’ or ‘Grid
multiplication’ seem like a foreign
language?



- Aim;

To explain some of the methods we use in school following the introduction of the National Numeracy Strategy (NNS) in 1999.



Which is more important?

mental calculation



or

written



This will depend on the numbers involved
and the individual child.

Choosing a calculation method

Can I do it in my head using a mental strategy?

Could I use some jottings to help me?

Should I use a written method to work it out?

Addition

- Progressions

Recognise the size and position of numbers

Count forward in ones and tens

Know number bonds to 10 and 20

Add multiples of 10 to any number

Partition, add and recombine numbers

Bridge through 10 (mentally and written)

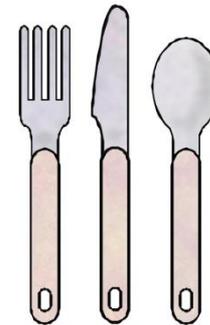
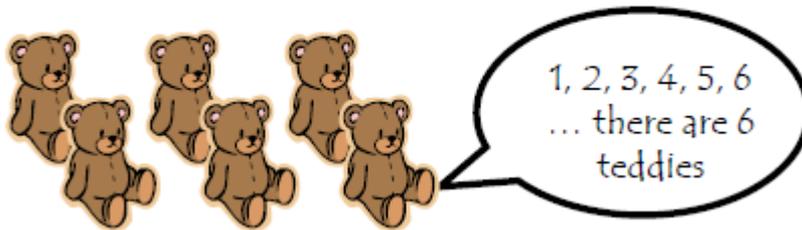
Apply methods to decimals

- Key Words

Add	Addition	And	Count on	Plus
More		Sum	Total	Altogether
		Increase		

Progressions followed

- Recognising numbers – tracing over numbers, what is that number?
- Counting groups of objects using concrete apparatus (ones and tens) –
counting everyday objects



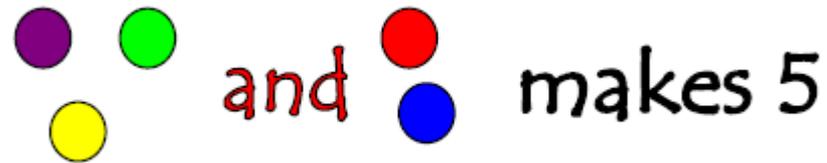
How many steps?



Counting beads



- Combining groups of objects



Count along number lines and solving missing box problems (start with larger number)

$$3 + 2 = 5$$



$$5 + 1 = 6$$

$$5 + \square = 9$$

Recognising that addition can be done in any order

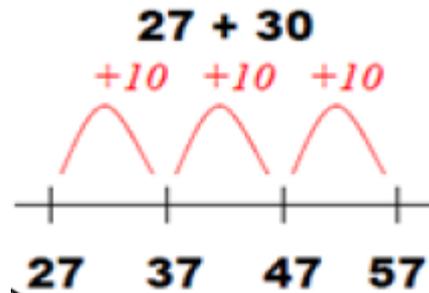
Two dice showing 2 and 5 dots.

$$2 + 5 = 7$$

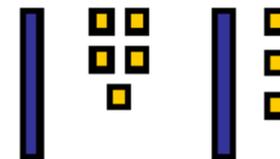
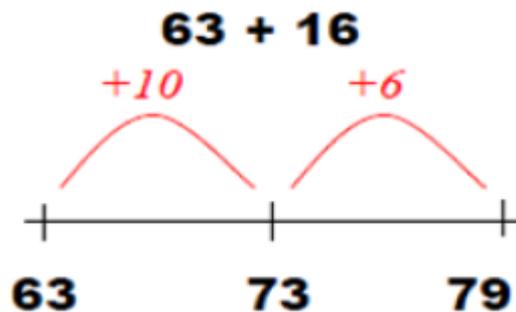
Two dice showing 5 and 2 dots.

$$5 + 2 = 7$$

- Recall number bonds to 10 and 20
- Add 2 digit numbers and multiples of tens, knowing which digit changes when adding tens



- Add 2 pairs of 2-digit numbers, beginning to introduce partitioning (not bridging 10 until secure with method).



$15 + 13 = 28$

(Number lines, number sticks, hundred squares)

- Partitioning methods when secure adding tens and units

$$34 + 23 = 57$$

$$30 + 20 = 50$$

$$4 + 3 = 7$$

Partitioning should be started with 2 digits numbers that do not bridge the tens or hundreds so children become fully confident with the method itself

$$58 + 43 = 101$$

$$50 + 40 = 90$$

$$8 + 3 = 11$$

Once children are confident they can start using the partitioning method to add numbers that bridge the tens and hundreds boundaries.

$$78 + 47 = 125$$

$$70 + 40 = 110$$

$$8 + 7 = 15$$

Partitioning column method

$$23 + 34:$$

2	0	+	3		
+	3	0	+	4	
<hr/>					
5	0	+	7		
				=	<u>57</u>

$$58 + 43:$$

5	0	+	8		
4	0	+	3		
<hr/>					
9	0	+	11		
				=	<u>101</u>

Partitioning is a mental method, but it is useful for children to record jottings.

Partitioning column method success criteria

$$\begin{array}{r} 34 + 23 \\ 30 + 4 \\ 20 + 3 \\ \hline 50 + 7 \\ = 57 \end{array}$$

- Write the number sentence
- Partition the first number
 $34 + 23$
 $30 + 4$
- Partition the second number
 $34 + 23$
 $30 + 4$
 $20 + 3$
- Draw a line
- Add the units first in preparation for more formal methods
- Add the tens
- Put the tens and units back together
- Write the answer

- Expanded column addition

$$\begin{array}{r}
 236 \\
 + 73 \\
 \hline
 309
 \end{array}$$

Add the units first, in preparation for the compact method

- Compact column addition (traditional!)

$$\begin{array}{r}
 236 \\
 + 73 \\
 \hline
 309 \\
 \hline
 1
 \end{array}$$

Add the units first,

'Carry' numbers underneath the bottom line

Remembering the actual value is 'three tens add seven tens', not 'three add seven', which equals ten tens.

- 
- Column addition for larger numbers (to at least 4 digits)
 - Column addition for numbers up to 2 decimal places – this will then link to money and measure.
 - Column addition for numbers with a varying amount of digits

Subtraction

- Progressions

Recognising the size and position of numbers

Count back in ones and tens

Subtract multiples of 10 from any number

Partition, subtract and recombine numbers

Bridge through 10 (mentally and written)

Apply methods to decimals

- Key Words

Subtract

Take away

Minus

Count back

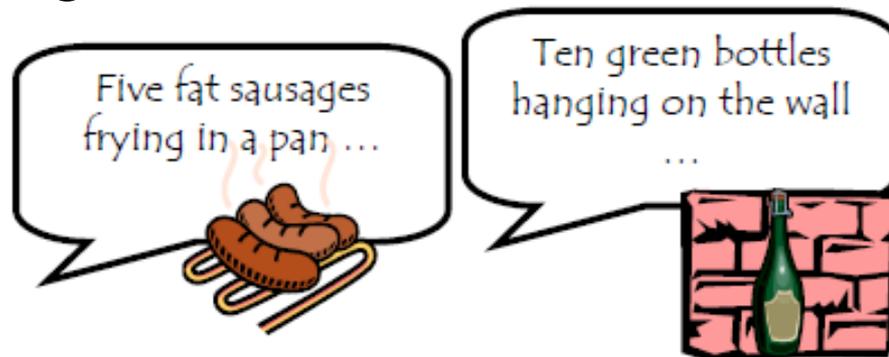
Less

Fewer

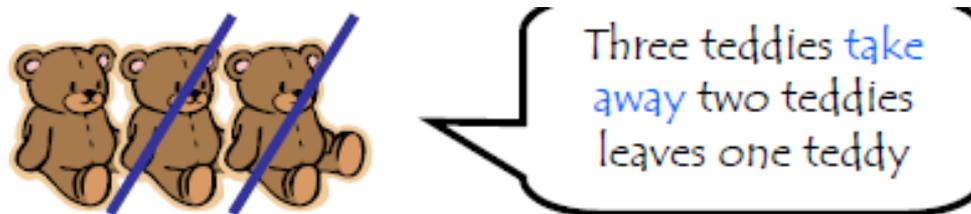
Difference between

Progressions followed

- Counting backwards in familiar contexts



- Begin to relate subtraction to 'taking away', using concrete apparatus / everyday objects.

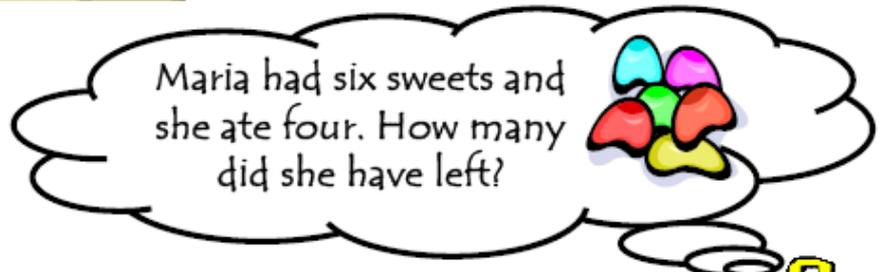


- Find one less than a number (up to 5 then up to 10)

- Subtracting numbers up to 20 (initially using a number line, hundred squares).

Putting subtraction into a context and beginning to use the – and = signs to record calculations. Finding missing values

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



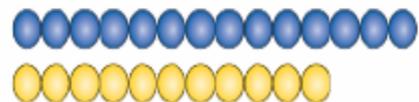
$6 - 4 = 2$




$5 - \square = 3$

- Find the difference between two values by counting up from the smallest number.

“What is the difference between 11 and 14?”



- 2 digit numbers subtracting multiples of ten (using number line or hundred square initially for visual aid)
- Subtracting pairs of 2 digit numbers

$47 - 23 = 24$ Partition the second number and subtract it in tens and units, as below:



24 25 26 27 37 47

Then subtract units.

Subtract tens first.

Move towards more efficient jumps back, as below:



24 27 47

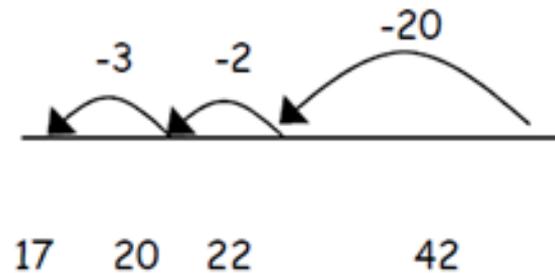
$$47 - 23$$

$$\begin{array}{l} 20 \quad 3 \end{array}$$

$$47 - 20 - 3 =$$

$$27 - 3 = 24$$

- Once confident with more efficient jumps then students are ready to subtract by bridging through ten. Partitioning and knowing number bonds are important.



- As a mental strategy some students can be taught to count on when numbers are close together. However a good understanding of number value is required first.

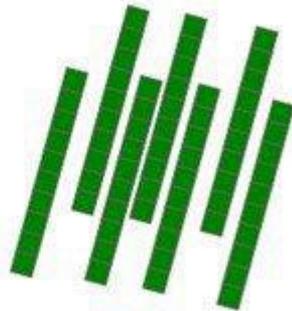
- Partitioned column subtraction

Step 1 : Introduce with no exchanging (emphasis on top number always being bigger value)

$$\begin{array}{r} 80 + 9 \\ - 30 + 5 \\ \hline 50 + 4 \end{array}$$

Step 2 : Introduce exchanging through practical subtraction (using number blocks)

$72 - 47$



$$\begin{array}{r} 60 \\ \cancel{70} + 2 \\ - 40 + 7 \\ \hline 20 + 5 = \underline{25} \end{array}$$

before subtracting '7', they will need to exchange a row of 10 for the for ten units

Step 3 : Progress to 2 and 3 digit numbers

- Partitioned column subtraction up to 4 digit
- Column subtraction

A handwritten column subtraction problem on a blue grid. The top number is 2754, with a small '6' above the 7 and a small '1' above the 5. The bottom number is 1562. A horizontal line is drawn under the bottom number. The result, 1192, is written below the line. The digits are written in a cursive style.

$$\begin{array}{r} 2754 \\ - 1562 \\ \hline 1192 \end{array}$$

Although seen as 'easiest' method, it is important that students see link between partitioned method

- Introduce use with decimals (including money and measure)

Multiplication

- Progressions

Repeated addition

Counting on in steps of 2, 5 and 10

Understanding multiplication can be done in any order

Recall of multiplication facts (up to 12 times tables)

Multiplying by multiples of 10, 100

Developing more formal written methods for larger numbers

- Key Words

Multiply

Groups of

Lots of

Times

Product

Sets of

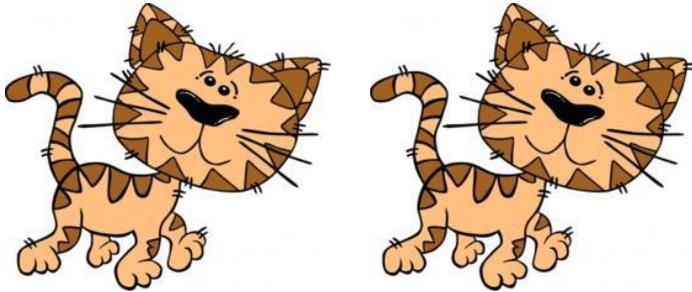
Once, twice, three times...

Double

Progressions followed

- Children use objects and pictorial representations to solve simple problems that involve repeated addition.

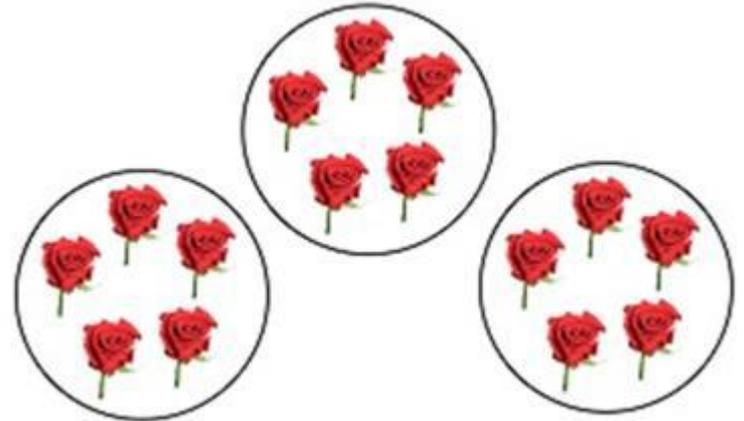
How many legs will 2 cats have?



$$4 + 4 = 8$$

- Make connection between counting in multiples of 2, 5 and 10

There are 5 roses in each garden. How many roses will be in 3 gardens?

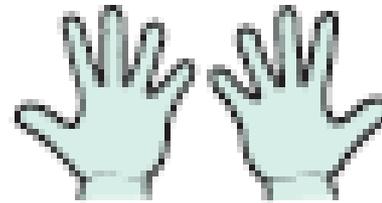
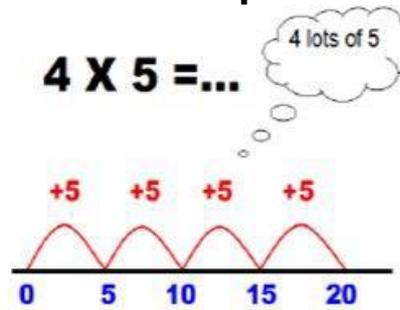


$$5 + 5 + 5 = 15$$

- Multiply using arrays and repeated addition (2, 3, 4, 5, 10)

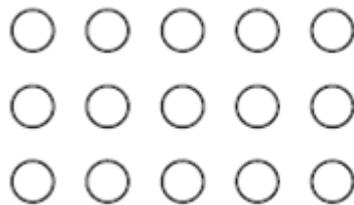
Use repeated addition on a number line:

Starting from zero, make equal jumps on a number line to work out multiplication facts.



$$4 \times 5 = 20$$

Use arrays (helps understanding that multiplication can be done in any order)



$$3 \times 5 = 15$$

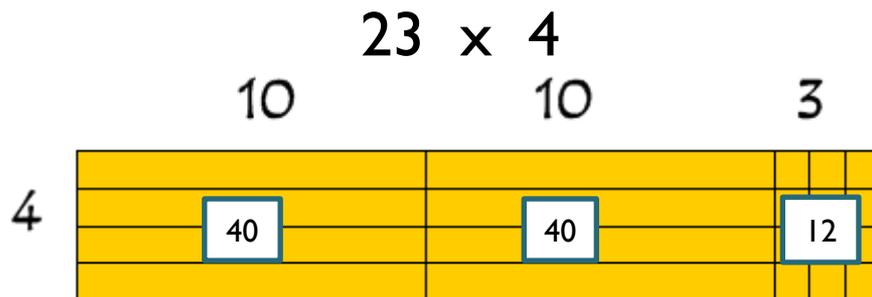
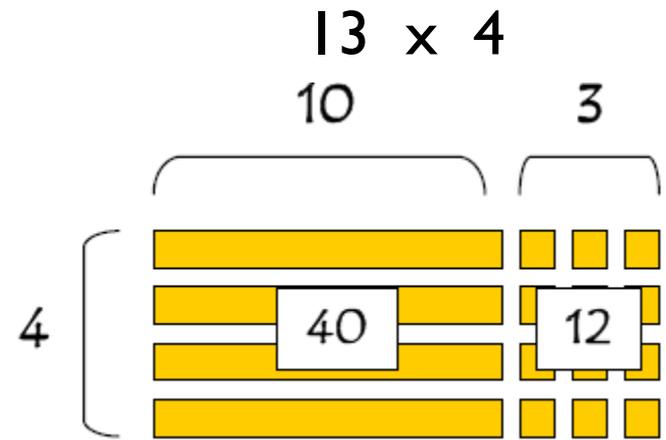
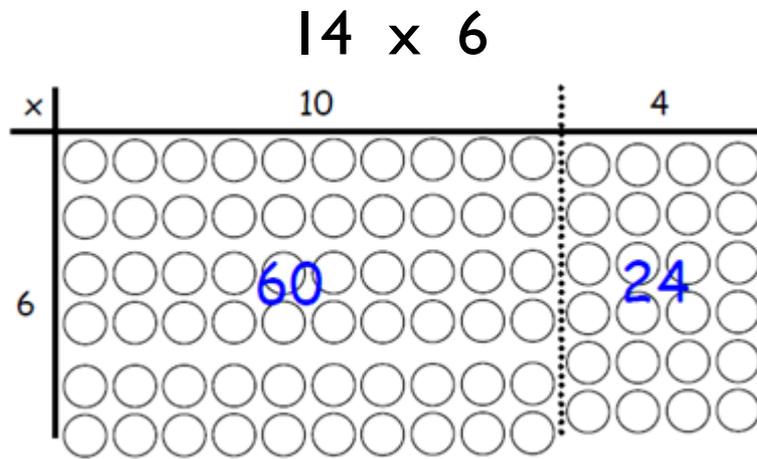
$$5 \times 3 = 15$$

$$5 \times 3 = 3 + 3 + 3 + 3 = \underline{15}$$

$$3 \times 5 = 5 + 5 + 5 = \underline{15}$$

- Multiplying 2-digits by a single digit number

Introduce grid method using multiplication of numbers in the teens or small 2 digit numbers with 2, 3, 4 & 5, by linking the layout of the grid to an array initially.



23×4

X	20	3
4	80	12

- Multiplying 2 and 3 digits by a single digit , using all multiplication tables.

Eg. $136 \times 5 = 680$

X	100	30	6
5	500	150	30

$$\begin{array}{r} 500 \\ 150 \\ + 30 \\ \hline 680 \end{array}$$

Use column addition to add accurately

- Introduction of column multiplication

Short multiplication (multiplying by a single digit)

x	300	20	7
4	1200	80	28



$$\begin{array}{r} 327 \\ \times \quad 4 \\ \hline 1308 \\ \hline \end{array}$$

$$\begin{array}{r} 3652 \\ \times \quad 8 \\ \hline 29216 \\ \hline \end{array}$$

Long multiplication for multiplying by 2 digits

		1	8	
	×	1	3	
		<hr/>		
		5	4	
			₂	
	1	8	0	
	<hr/>			
	2	3	4	

18 × 3 on the 1st row

(8 × 3 = 24, carrying the 2 for twenty, then 1 × 3).

18 × 10 on the 2nd row. Put a zero in units first, then say 8 × 1, and 1 × 1.

Progress to more complex numbers

		1	2	3	4	
		×		1	6	
		<hr/>				
		7	4	0	4	(1234 × 6)
	1	2	3	4	0	(1234 × 10)
	<hr/>					
	1	9	7	4	4	

- Multiplying with decimals with up to 2 decimal places by a single digit.

Division

- Progression

Group and share small quantities

Group and share using the \div and $=$ sign

Use multiplication and division facts

Divide 2 digit numbers by a single digit

Divide 3 and 4 digit numbers by a single digit

Divide up to 4 digit numbers by a single digit. Including remainders

- Key Words

Share

Share equally

Groups of

Lots of

Divided by

Divided into

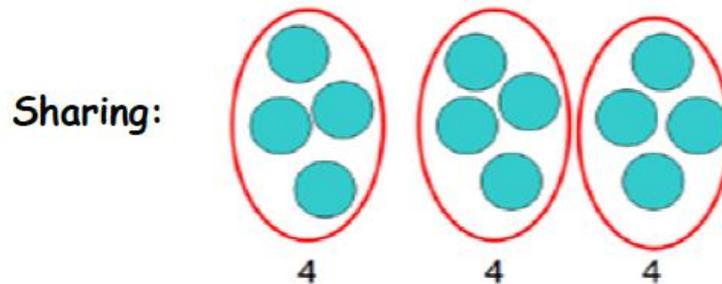
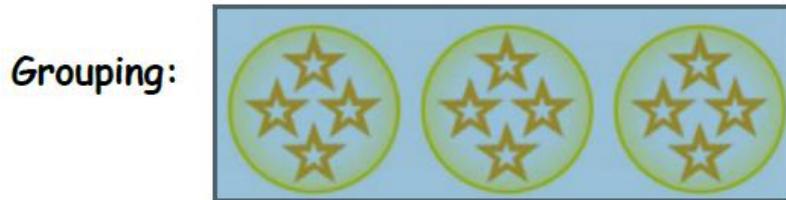
Left over

Half

Carry

- Use objects, diagrams and pictorial representations to solve problems involving grouping and sharing.

How many groups of 4 can be made with 12 stars?



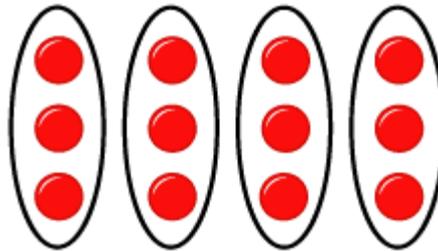
Share 12 between 3

Important students understand the difference between **grouping** objects (How many groups of 2 can you make?) and **sharing** (Share these sweets between 2 people)

- Find half of a group of objects by sharing in to 2 equal groups.

- Sharing and grouping using the \div and $=$ sign, using arrays, diagrams, number lines

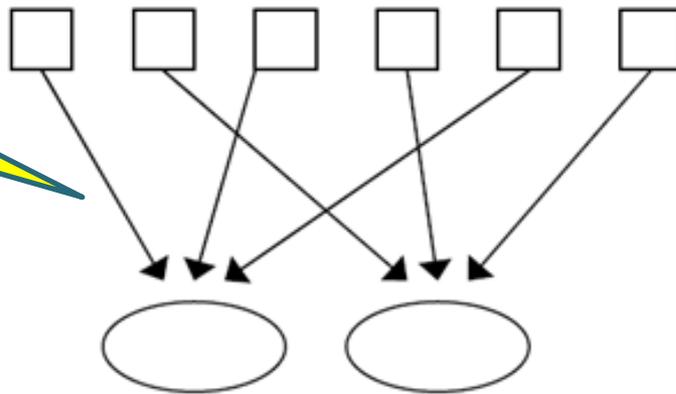
$12 \div 3$, posed as how many groups of 3 are in 12?



$$12 \div 3 = 4$$

Understand grouping and sharing in contexts

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



Sharing

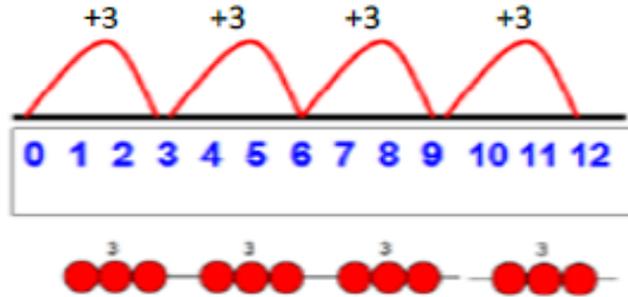
Grouping

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



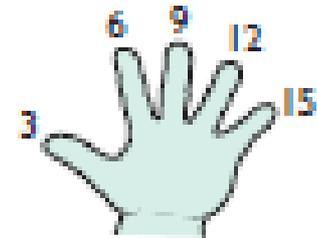
Grouping using a number line

$12 \div 3$, posed as how many groups of 3 are in 12?



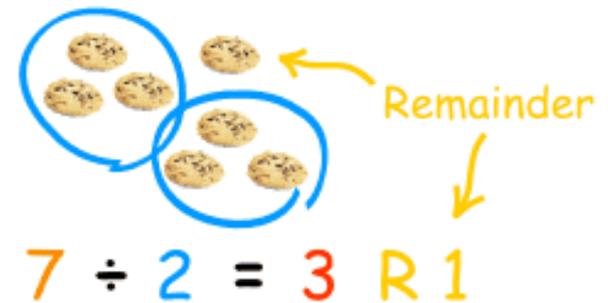
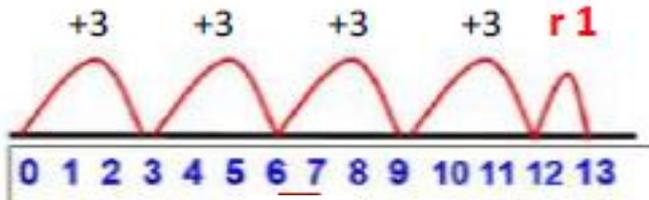
$$12 \div 3 = 4$$

How many 3's are in 12?



Progress to grouping with a remainder

$$13 \div 3 = 4 \text{ r } 1$$



- Divide 2 digit numbers by a single digit
- Short Division (for larger 2 digit numbers)

Step 1 : with no remainders in answer or carried (each digit must be a multiple of the divisor)

$$\begin{array}{r} 32 \\ 3 \overline{)96} \end{array}$$

Remind children of correct place value, that **96** is equal to **90** and **6**, but in short division, pose:

- How many 3"s in 9? = 3, and record it above the **9 tens**.
- How many 3"s in 6? = 2, and record it above the **6 ones**.

- **Step 2** : **NO** remainders in the final answer, but with remainders occurring within the calculation to be carried to the next digit.

$$\begin{array}{r} 18 \\ 4 \overline{)72} \end{array}$$

Only covered when understand remainders. Then taught to 'carry' the remainder to the next digit.

- Develop short division method to dividing a 3 digit number by a single digit – no remainders in final answer.
- Divide up to 4 digit numbers by a single digit, including with remainders

$$\begin{array}{r}
 0663 \text{ r } 5 \\
 \hline
 8 \overline{) 5309}
 \end{array}$$

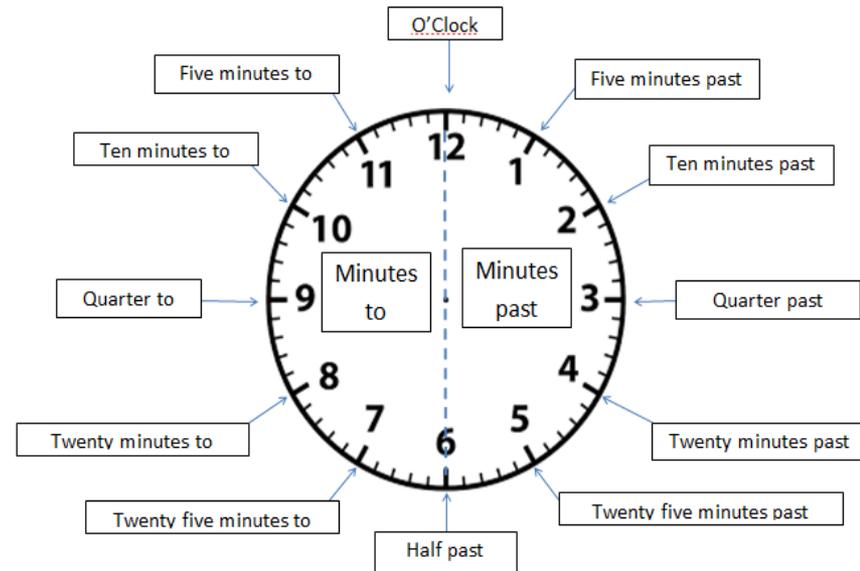
Problems in real life context



Time

Progressions

- Units of time – days in week, months in a year, minutes in hour, seconds in a minute.
- Reading from analogue clock
- Using vocabulary associated with time (am, pm)
- Convert between analogue and digital times
- Read, write and convert between 12 hour and 24 hour clocks.
- Solve problems involving time.



Useful resources

- **Mymaths** [MyMaths - Bringing maths alive - Home](#)

Username : Rigby

Password : kilometer



- **Topmarks** [Topmarks Education: teaching resources, interactive resources, worksheets, homework, exam and revision help](#)

- **Sumdog** [Sumdog - Games that make learning fun](#)

Username : initial and surname

Password : initials and year group

School code : rigbyhall

