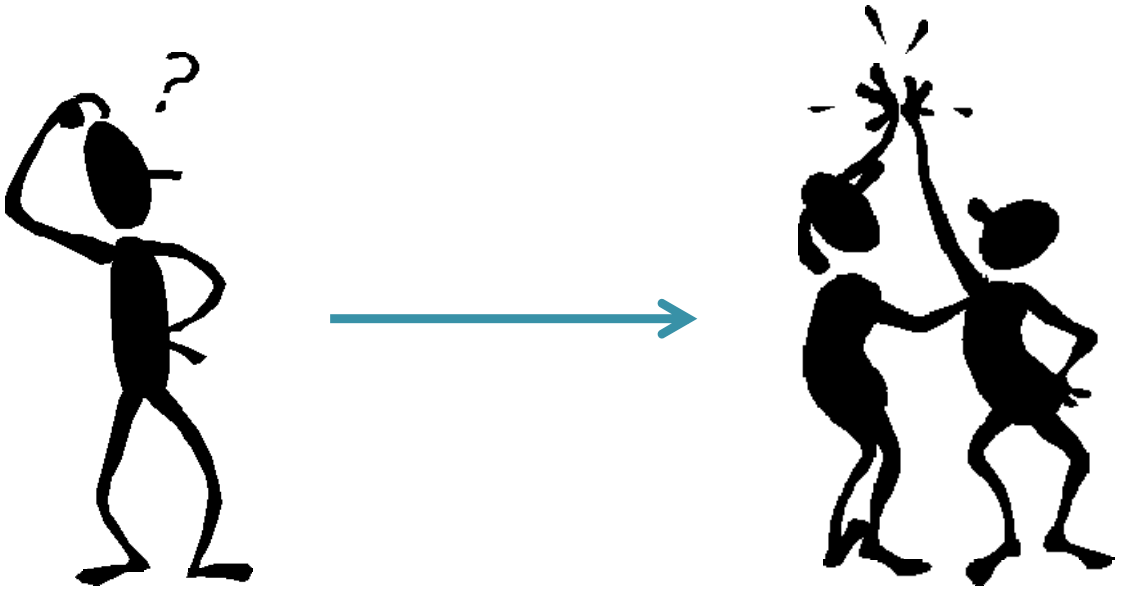
Methods we use in Mathematics

"They didn't do it like that in my day!"

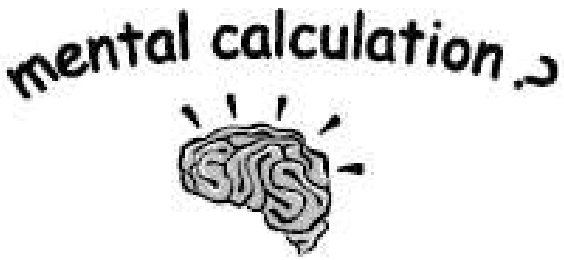
Does 'Partitioning' or 'Grid multiplication' seem like a foreign language?

- 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?



or

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

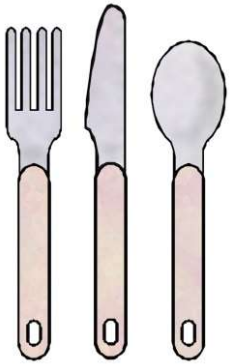
- Key Words

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

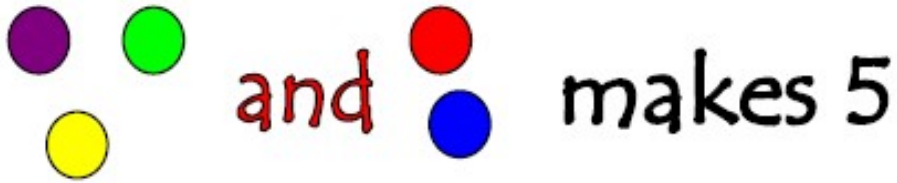


How many steps?

Counting beads

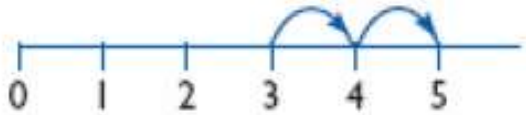
EYFS

- Combining groups of objects



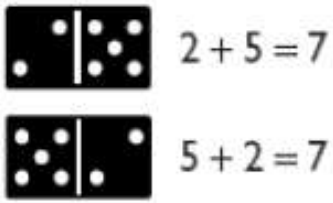
Count along number lines and solving missing box problems (start with larger number)

$$\boxed{3 + 2 = 5}$$

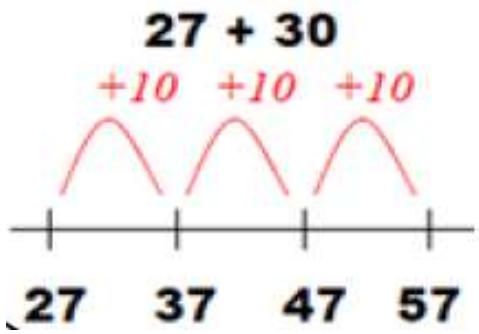


$$5 + \square = 9$$

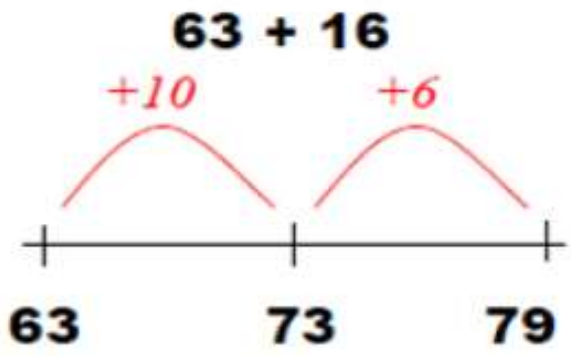
Recognising that addition can be done in any order

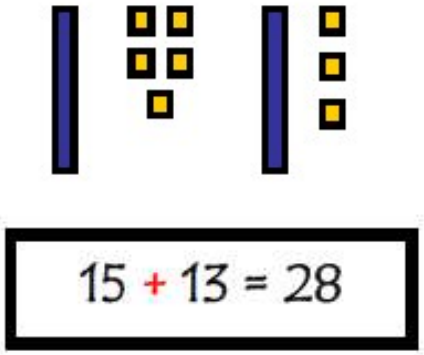


- Recall number bonds to 10 and 20
- Add 2 digit numbers and multiples of tens, knowing which digit changes when adding tens



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





(Number lines, number sticks, hundred squares)

Y2+

- 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

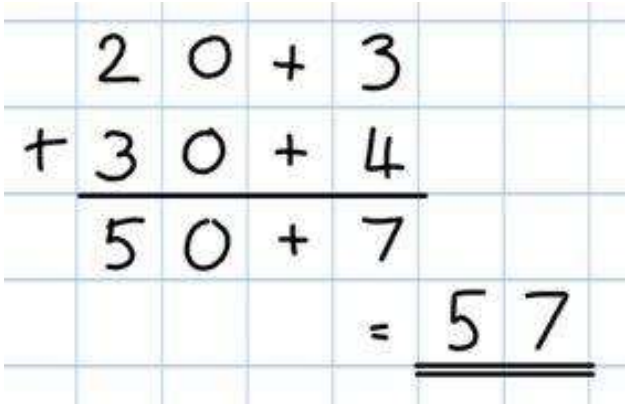
58 + 43 = 101
50 + 40 = 90
8 + 3 = 11

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

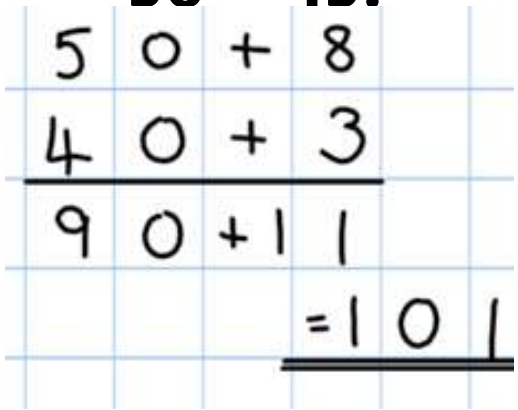
78 + 47 = 125
70 + 40 = 110
8 + 7 = 15

Partitioning column method

23 + 34:



58 + 43:



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

Partitioning column method success criteria

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

- 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

	2	3	6
+		7	3
			9
	1	0	0
	2	0	0
	3	0	9

Add the units first, in preparation for the compact method

- Compact column addition (traditional!)

```
  236
+  73
 309
  1
```

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.

Y3+

- 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

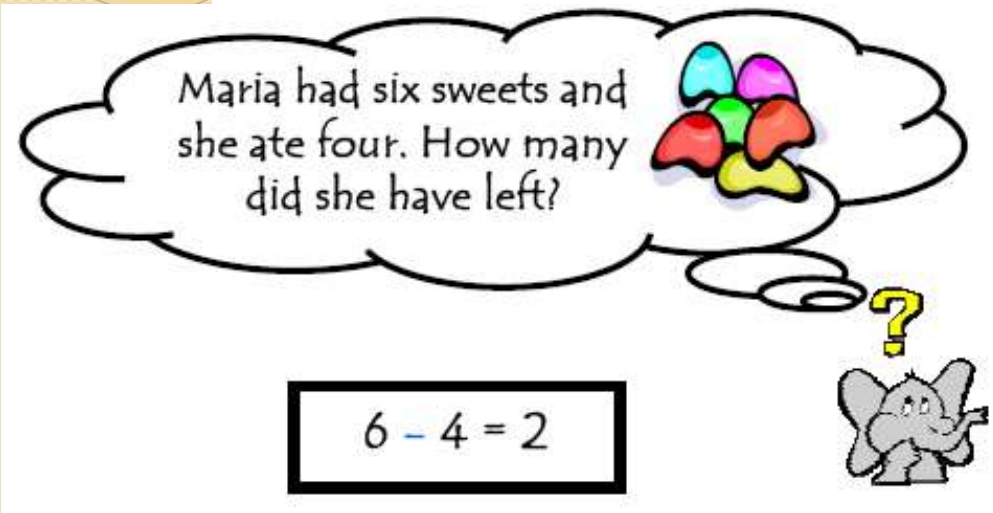
- Counting backwards in familiar contexts

- 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)

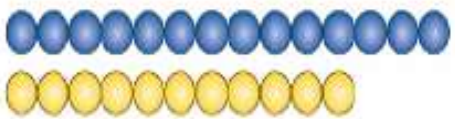
- Subtracting numbers up to 20 (initially using a number line, hundred squares).

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



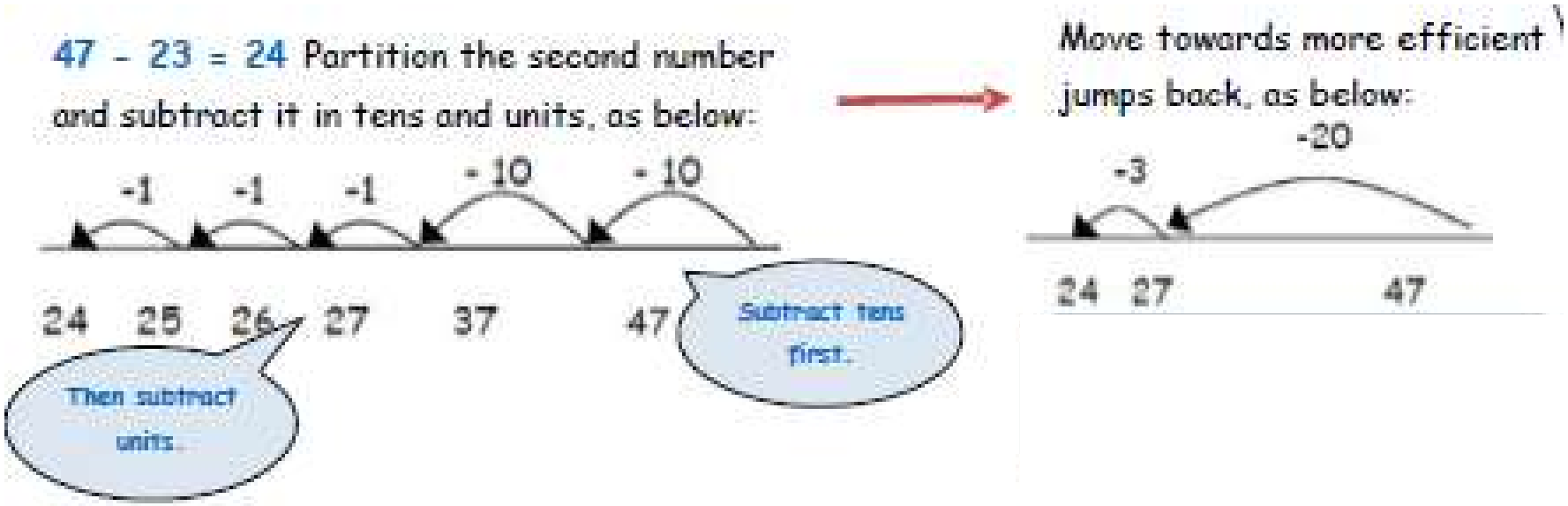
- Find the difference between two values by counting up from the smallest number.

"What is the difference between 11 and 14?"



Y1+

- 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

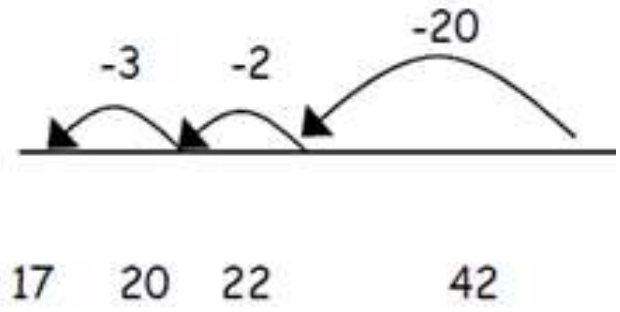
20 3

47 – 20 – 3 =

27 – 3 = 24

Y2+

- 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.

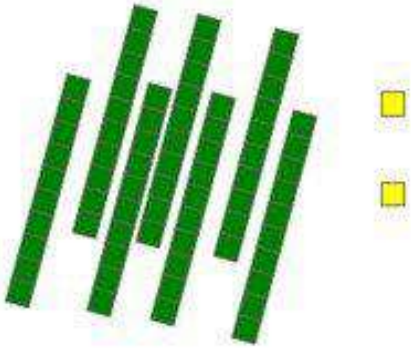
- Partitioned column subtraction

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

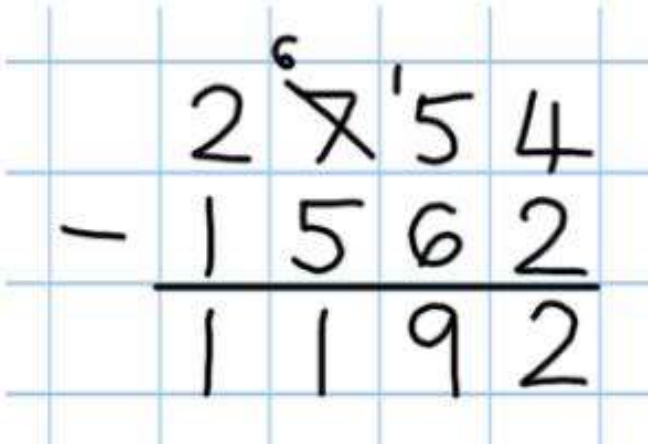


$$\begin{array}{r} 60\ \cancel{70} + {}^{1}2 \\ -\ 40 + 7 \\ \hline 20 + 5 \end{array} = \underline{\mathbf{25}}$$

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



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

- Introduce use with decimals (including money and measure)

Y4+

Multiplication

- <u>Progressions</u>

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

- <u>Key Words</u>

Multiply Groups of Lots of Times

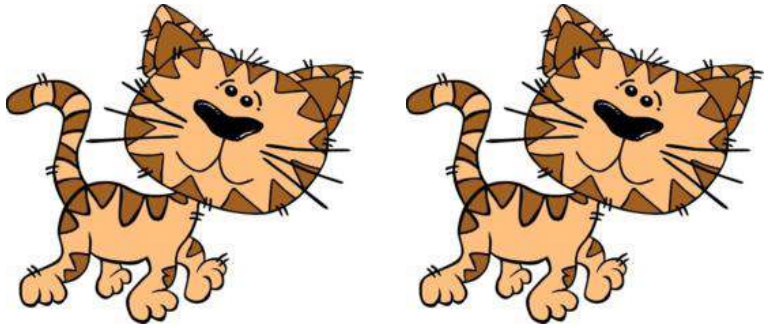
Product Sets of Once, twice, three times…

Double

Progressions followed

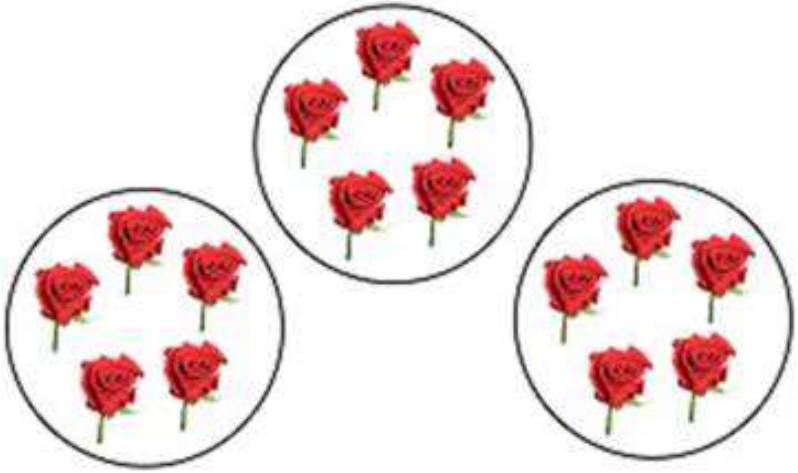
- Children use objects and pictorial representations to solve simple problems that involve repeated addition.

How many legs will 2 cats have?



4 + 4 = 8

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



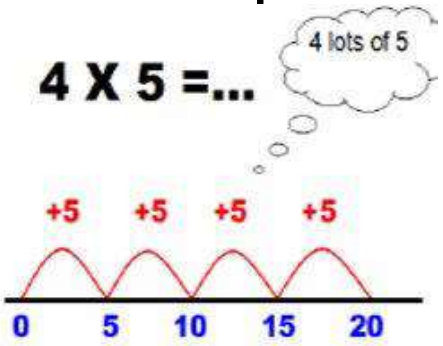
5 + 5 + 5 = 15

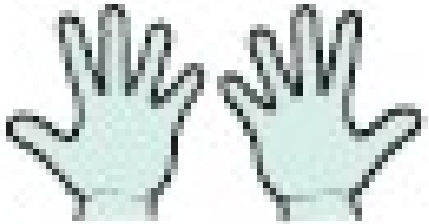
- Make connection between counting in multiples of 2, 5 and 10

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

Use repeated addition on a number line:

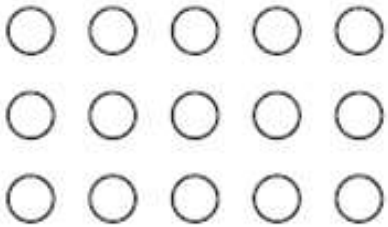
Starting from zero, make equal jumps on a number line to work out multiplication facts.





4 X 5 = 20

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



5 x 3 = 15

3 x 5 = 15

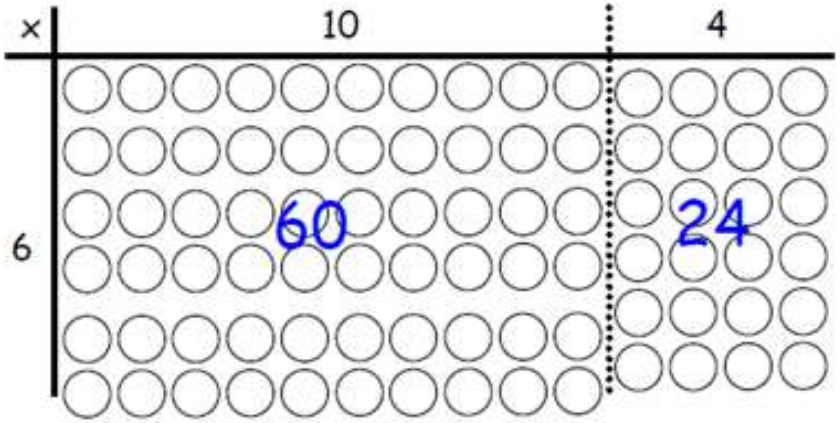
5 x 3 = 3 + 3 + 3 + 3 = **15**

3 x 5 = 5 + 5 + 5 = **15**

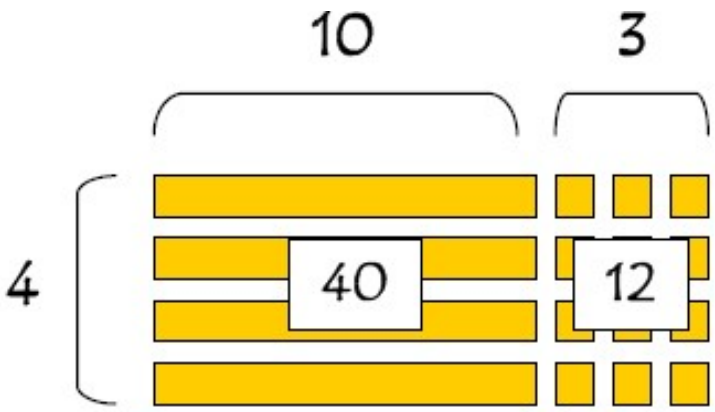
- Multiplying 2-digits by a single digit number

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.

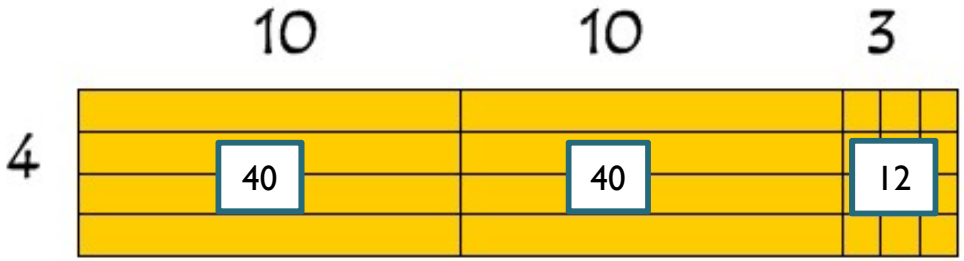
14 x 6



13 x 4



23 x 4



23 x 4

X	20	3
4	80	12

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

Eg. 136 x 5 = 680

X	100	30	6
5	500	150	30

500
150
+ 30
680

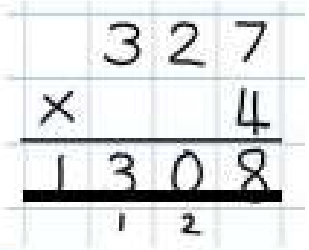
Use column addition to add accurately

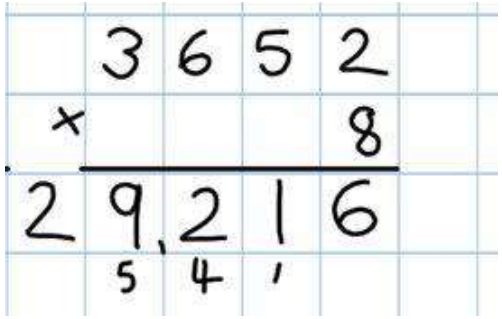
Y4

- Introduction of column multiplication

Short multiplication (multiplying by a single digit)

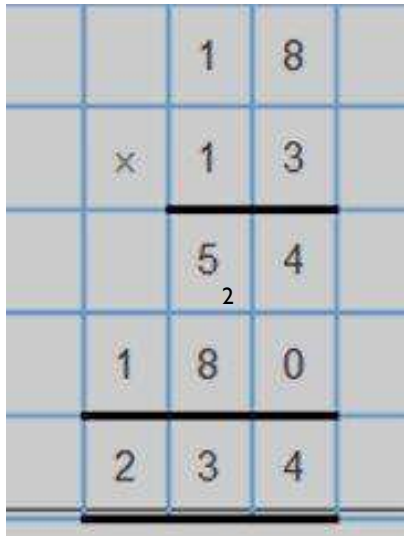
x	300	20	7
4	1200	80	28





Y4/5

Long multiplication for multiplying by 2 digits

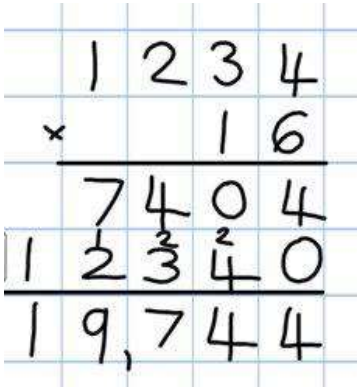


18 x 3 on the 1st row

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

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

Progress to more complex numbers



(1234 x 6)
(1234 x 10)

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

Division

- <u>Progression</u>

Group and share small quantities

Group and share using the ÷ 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

- <u>Key Words</u>

Share Share equally Groups of Lots of

Divided by Divided into Left over

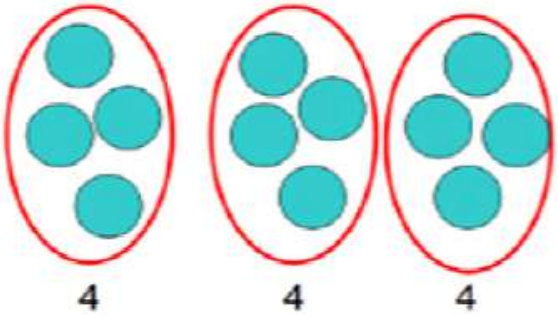
Half Carry

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

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

Grouping:

Sharing:



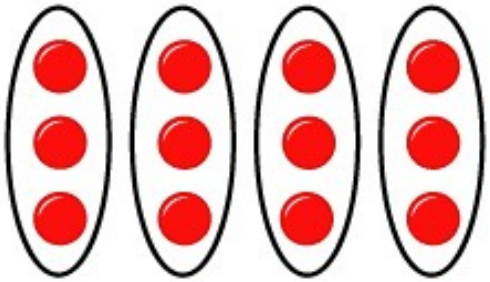
Share 12 between 3

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 ÷ and = sign, using arrays, diagrams, number lines

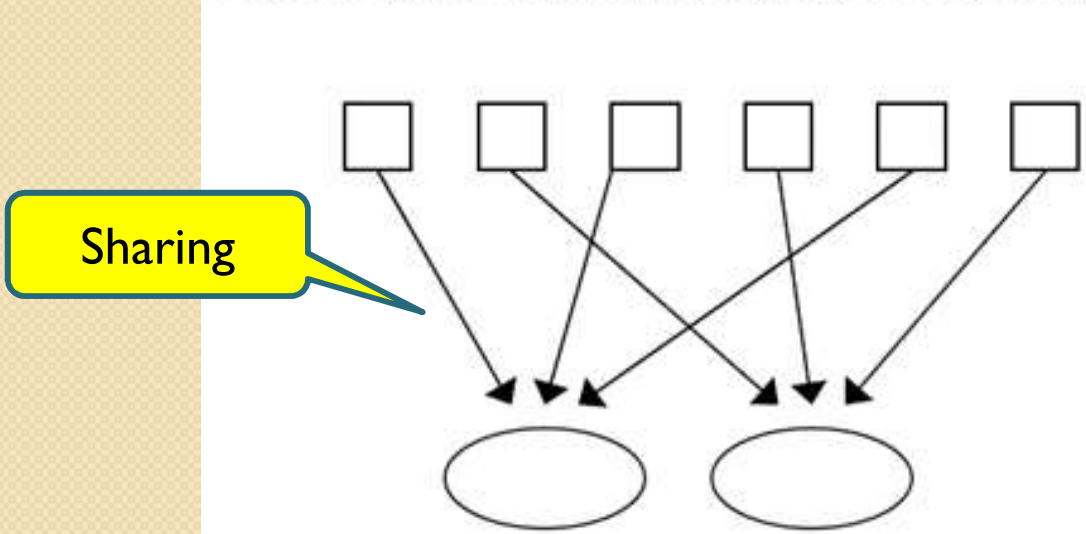
12 ÷ 3, posed as how many groups of 3 are in 12?

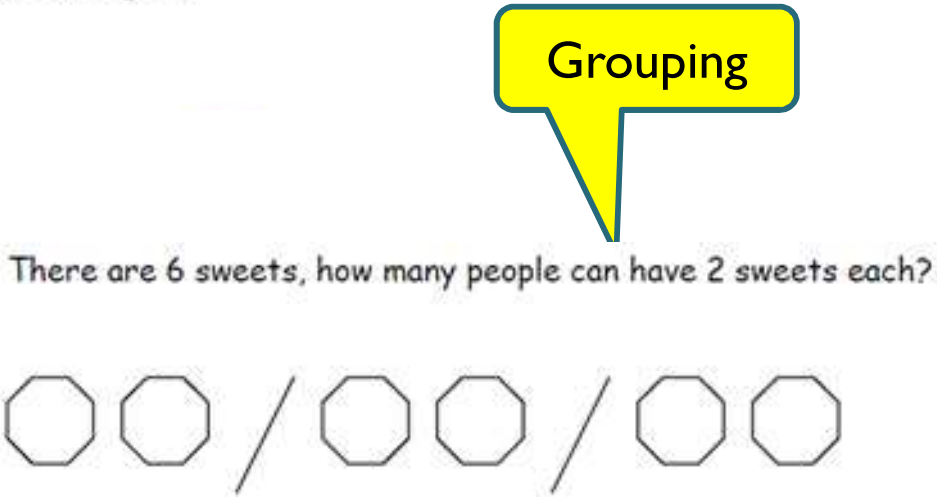


12 ÷ 3 = 4

Understand grouping and sharing in contexts

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

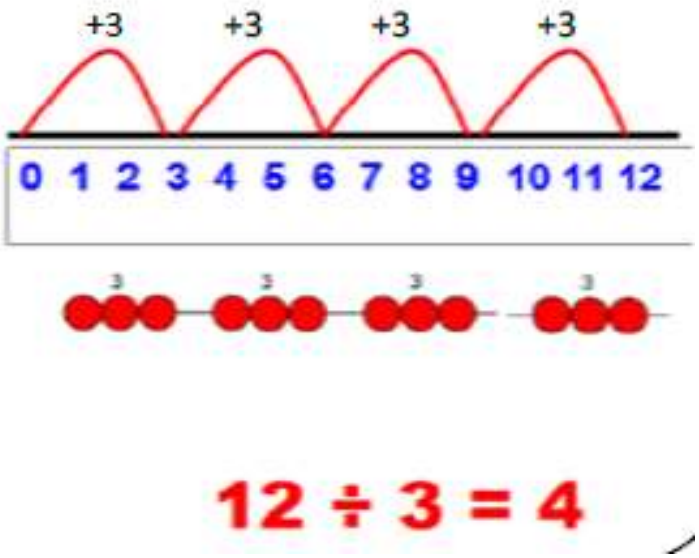




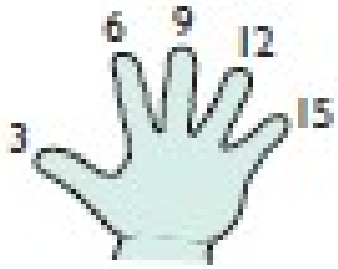
Y2

Grouping using a number line

12 ÷ 3, posed as how many groups of 3 are in 12?

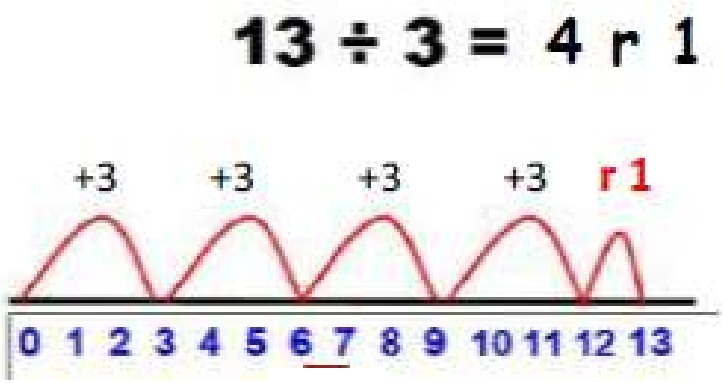


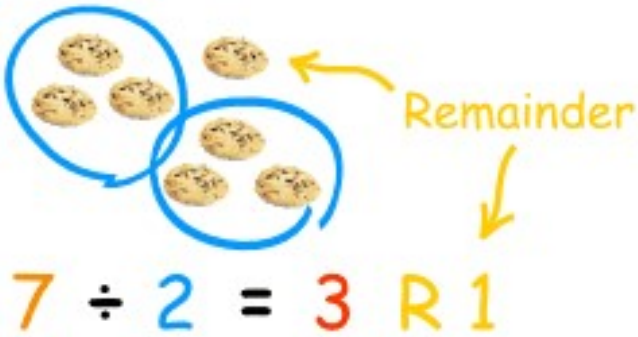
How many 3's are in 12?



Y3

Progress to grouping with a remainder

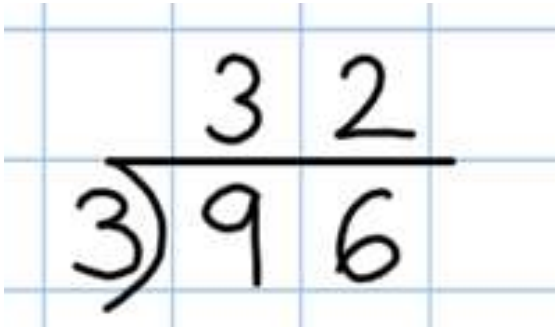




- Divide 2 digit numbers by a single digit

Short Division (for larger 2 digit numbers)

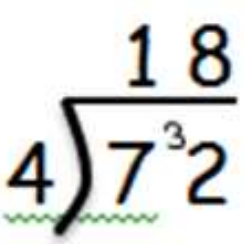
Step 1 : with no remainders in answer or carried (each digit must be a multiple of the divisor)



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

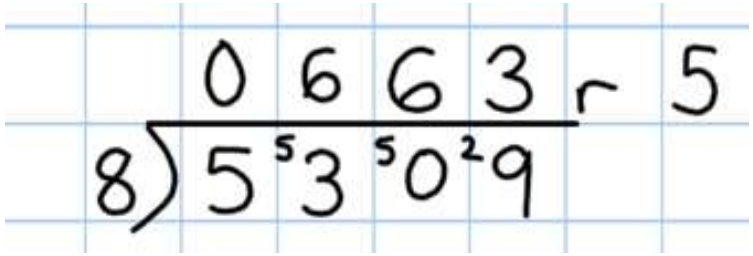
- How many 3"s in 9? = 3, and record it above the **9 tens**.
- How many 3"s in 6? = 2, and record it above the **6 ones**.

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



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

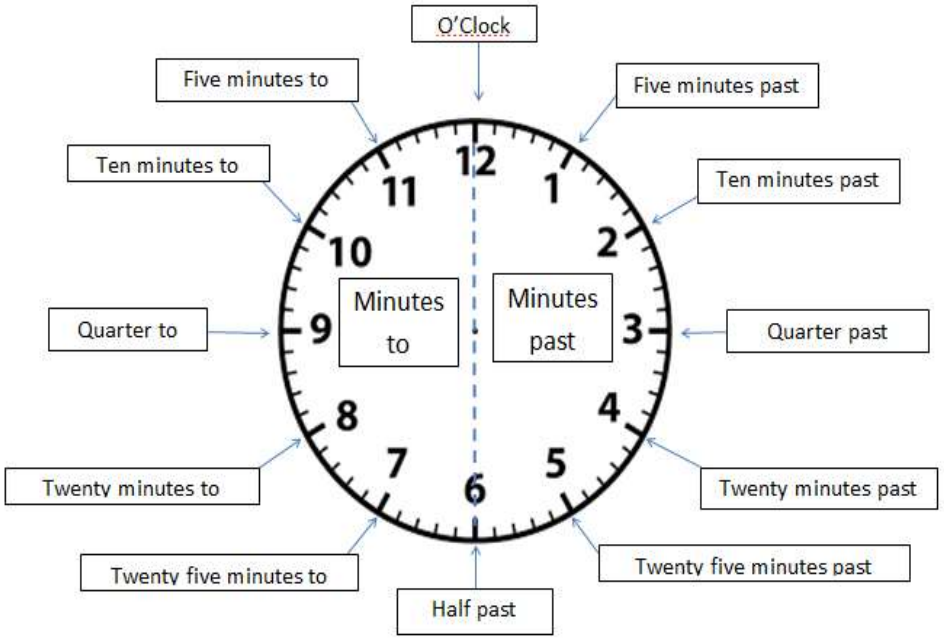


Problems in real life context

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

- ConquerMaths ConquerMaths - Maths has never seemed so simple...
  - Student logins in school planners/diaries

- Topmarks Topmarks Education: teaching resources, interactive resources, worksheets, homework, exam and revision help

- BBC Bitesize Maths BBC Bitesize Maths