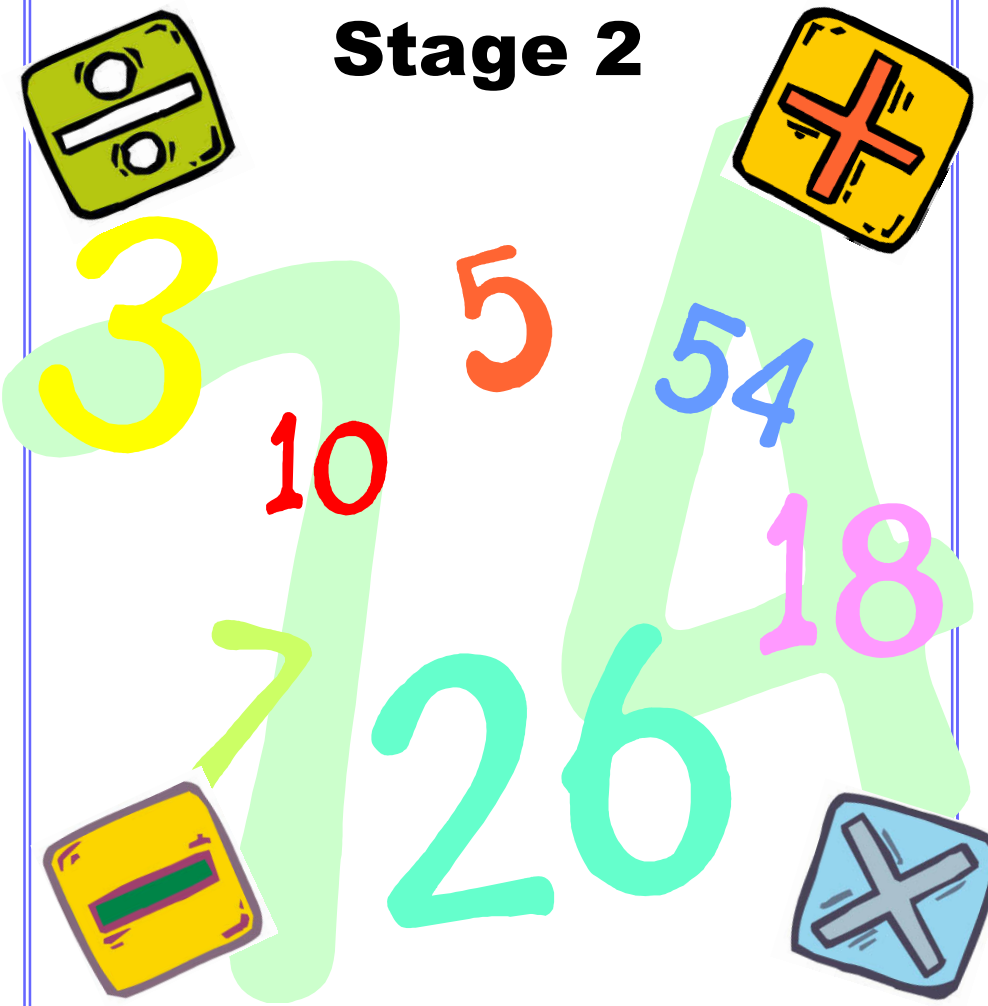
Progression in Calculation at Key Stage 2



Oakfield Primary School

Maths teaching has changed significantly over the last 20 years. It has changed in both the types of methods taught and the way the lessons are structured.

We have produced this booklet so that parents are able to see how maths develops at Oakfield, so that you can support your child at home using methods and language which is used in class.

We hope this booklet is helpful.

Calculation

The maths learning your child is doing in school may look very different to the 'sums' you remember. This is because children are encouraged to work mentally, where possible, using jottings to help support their thinking. Children start to consider more formal methods once they are in Key Stage 2 (from Year 3 onwards) but are still taught to look carefully at each calculation and decide whether they can solve it accurately in their heads first.

It is really important to remember that learning maths is developmental and to move too quickly may mean that concepts are not thoroughly understood. This can lead to difficulties later on. We work on 'steps of development' rather than year group.

Every child is unique and will progress at different rates. If you have any concerns, please speak to your child's teacher.

In maths lessons, we talk about the most efficient ways to solve problems. This way, the children can draw on a variety of strategies to approach problems.

Ask your child to explain their thinking.

Talk to your child about how they are working things out.

When faced with a calculation problem encourage your child to ask…

- Can I do this in my head?
- Could I do this in my head using drawings or jottings to help me?
- Do I need to use practical equipment?
- Do I need to use a written method?
- Do I need a calculator?

Also help your child to estimate and consider the answer.

- Is my answer sensible?

Addition

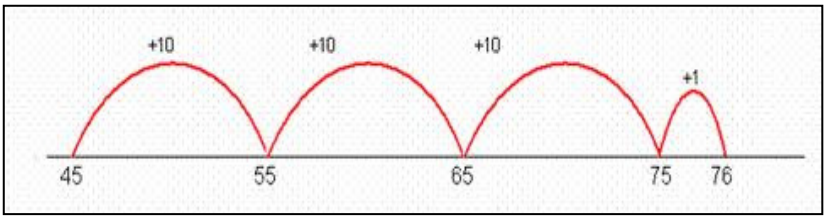
Step 1

KEY VOCABULARY
+, add, addition, more, plus, make, sum, total, altogether, score, double, near double
one more, two more... ten more... one hundred more, how many more to make…?
how many more is… than…? how much more is…?

Children continue to use structured number lines and practical resources, but when they are ready, progress to using a blank number line.

Partitioning

Using a blank number line to partition into tens and units. The second number is



'partitioned' into tens and units so that larger jumps can be taken.

45 + 31 =

Another strategy is to partition in a written method:

45 + 31 = 40 + 30 = 70

= 5 + 1 = 6

= 70 + 6 = 76

Children may initially partition both numbers – particularly when working practically but will be moved towards keeping the largest number whole and partitioning only the second

Addition

Step 2

No new vocabulary is introduced at this step.

Numbers gradually become bigger until confident with any jumps of hundreds, tens and units.

Children may still use apparatus but should be more reliant on known facts to help their calculation.

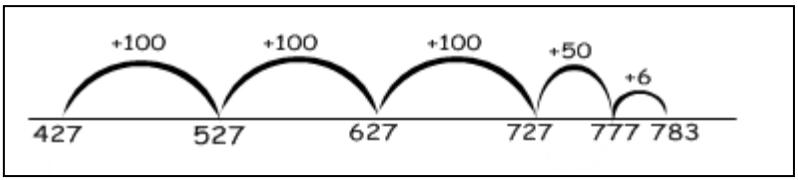
427 + 356 = 427 + 300 + 50 + 6

= 727 + 50 + 6

= 777 + 6

= 783

Children may continue to add in single 100s until ready to jump in multiples of 100 once number bonds are secure.



As much as possible calculations are given in the context of 'real life' so why not ask your children to help you with the shopping bill or to help measure wood or material when you're doing some DIY? The more practice the children get at applying their maths the more confident they will become.

Addition

Step 3

KEY VOCABULARY
add, addition, more, plus, increase, sum, total, altogether, score, double, near double how many more to make…? equals, sign, is the same as, tens boundary, hundreds boundary inverse

Recording starts to move away from number lines and takes on a horizontal appearance.

We are still starting with the biggest number and partitioning only the second one as this aids mental methods.

E.g.:
242 + 379 = 621

379 + 200 + 40 + 2 =

379 + 200 = 579
579 + 40 = 619
619 + 2 = 621

'Bridging', where we go over the next multiple of 100 is much harder than a calculation where the 100s digit always stays the

Decimals are also used more commonly, especially for working out money or measures e.g. lengths.

This is then arranged vertically to help transference to the 'traditional' method. Note that this now involves partitioning both numbers. .

	HTU
+	379
	242
	11 (9+2)
	110 (70+40)
	500 (300+200)
	621

	HTU.t h
+	431.65
	138.13
	0. 08 (0.05 + 0.03)
	0. 70 (0.60 + 0.10)
	9. 00 (1 + 8)
	60. 00 (30 + 30)
	500. 00 (400 + 100)
	569. 78

Addition

Step 4

KEY VOCABULARY
add, addition, more, plus, increase, sum, total, altogether, score double, near double how many more to make…? equals, sign, is the same as, tens boundary, hundreds boundary, ones (units) boundary, tenths boundary, inverse.

The 'traditional' method is introduced as an efficient, compact method.

The language used to explain how the method works is really important.

587 + 375

HTU
587
+375
2
1

Add the ones; **seven** add **five** is **twelve**; ***put one ten under the tens column and the 2 in the ones***

HTU
587
+375
62
1 1

Add the tens. **Eighty** add **seventy** is **one hundred and fifty** add **ten** underneath, is **one hundred and sixty;** ***put sixty on the tens column and one hundred under the hundreds column***

HTU
587
+375
962
1 1

Add the hundreds; **five hundred** add **three hundred** is **eight hundred**, **add one hundred underneath is nine hundred;** ***put the nine hundreds in the hundreds column***

This is further practised and refined with decimals and in real life applications.

This is the method which most children will leave Oakfield with.

Subtraction

Step 1

KEY VOCABULARY:
how many more to make…? how many more is… than…? how much more is…? –, subtract, subtraction, take (away), minus, leave, how many are left/left over? one less, two less… ten less… one hundred less, how many fewer is… than…? how much less is…? difference between half, halve, =, equals, sign, is the same as, tens boundary

Continue with number lines and the 2 different approaches - takeaway and counting up (finding the difference).

The numbers gradually become bigger and sometimes we have to cross over hundreds, but we still teach both methods.

If the numbers are close together e.g. 32 – 27 then always count up.

Remember, if the numbers are far apart e.g. 732 – 34 then encourage takeaway.

Subtraction

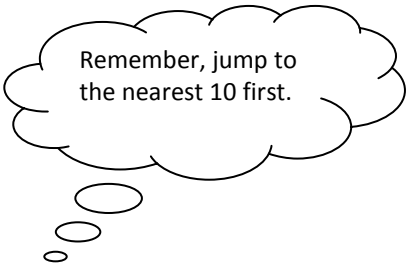
Step 2

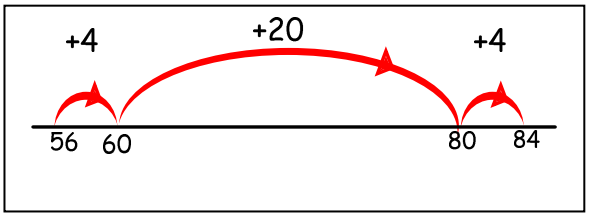
KEY VOCABULARY:
how many more to make…? subtract, subtraction, take (away), minus, decrease leave, how many are left/left over? difference between, half, halve, how many more/fewer is… than…? how much more/less is…? equals, sign, is the same as tens boundary, hundreds boundary, inverse

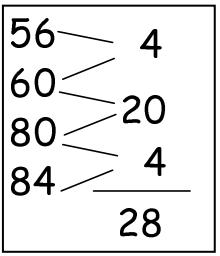
Now your child will be using hundreds, tens and units and will start to show a slightly more familiar written format. Number lines are still encouraged alongside the written method.

Here's another example for you…

84 – 56 = 56 + 4 + 20 + 4







If your child counts on to the next multiple of 10 (from 56 to 60 in the example above) it makes it easier to then count on to the final number. Your child will gradually refine it to only 1 step from there.

Children may start using decimals in context such as money or measures about now. They will still be encouraged to use the above methods.

Subtraction

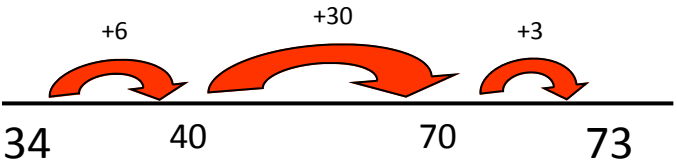
Step 3

KEY VOCABULARY:
subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is… than…? how much more/less is…? equals, sign, is the same as
tens boundary, hundreds boundary units boundary, tenths boundary, inverse

Your child will still be encouraged to think about both methods but 'Counting Up' becomes the taught written and mental method subtraction.

Decimals are used more and more and the children are always encouraged to consider finding the most efficient method for the question.

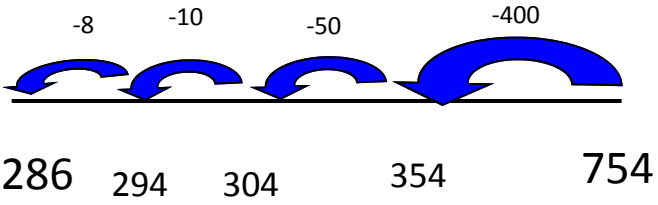
Remember the 'Counting Up' method shown below is used to subtract smaller numbers.



73-34= 39

	TU
	30
+	6
	3
	39

The Subtraction on a number line method is used to subtract larger numbers.



754-286 = 468

	HTU
	400
+	50
	10
	8
	468

Subtraction

Step 4

KEY VOCABULARY:
subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/fewer is… than…? how much more/less is…? equals, sign, is the same as
tens boundary, hundreds boundary units boundary, tenths boundary, inverse

In Years 5 and 6 children are encouraged to use a more formal method of column subtraction.

Have a look at the example below:

	H	T	U
	3	$^{8}\not{9}$	$^{1}2$
-	2	6	4
			8
		2	0
	1	0	0
=	1	2	8

This then turns into the compact method of column subtraction:

	H	T	U
	3	$^{8}\not{9}$	$^{1}2$
	2	6	4
=	1	2	8

Multiplication

Step 1

KEY VOCABULARY: lots of, groups of, times, multiply, multiplication, multiplied, multiple of, product, twice, three times…, ten times…, array.

Your child should now have a solid grounding of what multiplication is and what it means.

You can help support your child by learning tables facts. As a guide, by the end of …

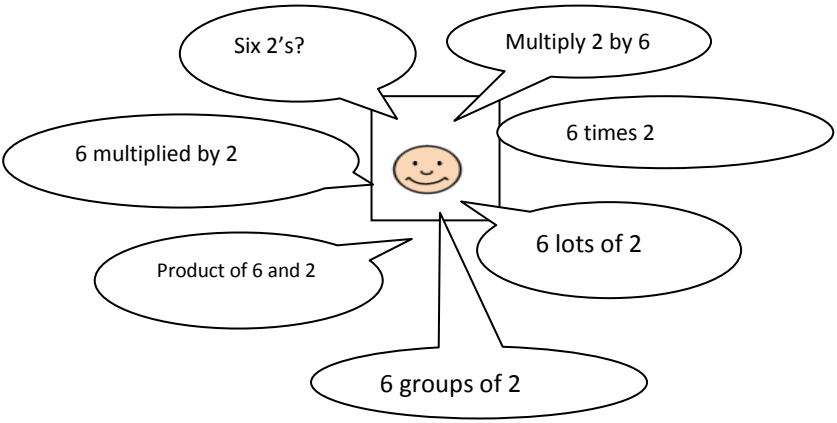
Year 2 your child should know their 2, 5 and 10 times tables.

Year 3 your child should also know the 3, 4 and 8 times tables.

Year 4 your child should know all their facts up to 12 x 12.

When you help your child learn, please try to use a range of questions. To say they 'know' them they must know the answers out of sequence with quick recall.

Here are some ideas for ways to ask tables questions…



This step is REALLY important. If your child does not know their tables facts it will make maths much harder as they get older.

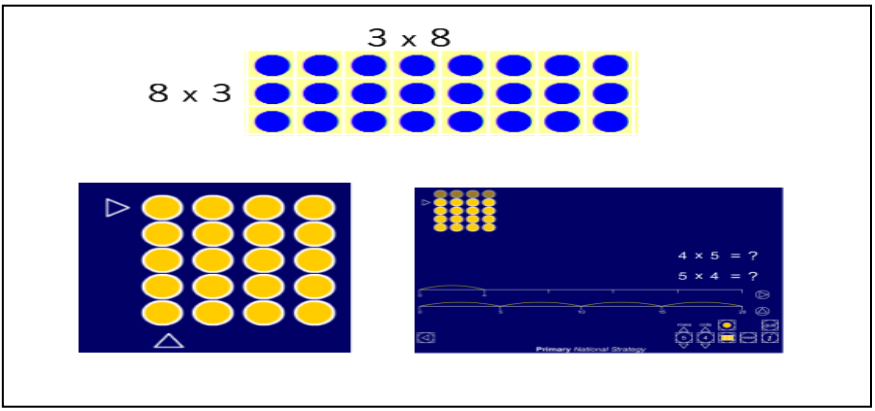
Multiplication

Step 2

KEY VOCABULARY: lots of, groups of, times, multiply, multiplication, multiplied, multiple of, product, twice, three times…, ten times…, array.

Children will continue to use arrays for multiplication at the beginning of Key Stage 2.

The images below will help your child understand multiplication in arrays. At home you can use everyday objects to show arrays e.g. eggboxes, chocolate bars or patterns on wrapping paper.



Your child will be encouraged to draw arrays and use **known number facts** to work out multiplication.

Multiplication

Step 3

KEY VOCABULARY:
lots of, groups of, times, multiply, multiplication, multiplied, multiple of, product, twice, three times…, ten times…, array, column, row, grid method.

Your child will now be ready to start moving away from the array to the 'Grid' method of multiplication. We do this gradually so that your child is clear in methods used.

You will also see that your child must have reliable addition methods for this to be really successful.

The progression at Oakfield is:

(U = units, T = tens, H = hundreds)

U x U

TU x U

HTU x U

TU x TU

HTU x TU

U x decimal number

TU x decimal number

So 8 x 3 = 24

x	3
8	24

So 18 x 3 = 54

x	3
10	30
8	24

30 + 24 = 54

Multiplication

Step 4

58 x 32 = 1856

x	30	2
50	1500	100
8	240	16

1500 + 100 = 1600

240 + 16 = 256

Then add these answers together:

1600 + 256 = 1856

The children will use this method for increasingly larger numbers, adjusting their grids accordingly.

This can also be applied when multiplying decimal numbers:

8 x 2.5 = 20

x	2	0.5
8	16	4

16 + 4 = 20

Multiplication

Step 5

KEY VOCABULARY:
lots of, groups of, times, multiply, multiplication, multiplied, multiple of, product, twice, three times…, ten times…, array, column, row, grid method.

By the end of Year 4, most children will be using **short and long multiplication.**

Short multiplication

24 × 6 becomes

	2	4
×		6
1	4	4
	2	

Answer: 144

4 x 6 = 24

The 4 units are placed in the units column and the 2 tens placed underneath the tens column.

20 x 6 = 120. The 2 tens underneath are added on to make 140.

342 × 7 becomes

	3	4	2
×			7
2	3	9	4
	2	1	

Answer: 2394

Multiplication

Step 5

Long multiplication

24 × 16 becomes

$$\begin{array}{r} {\scriptstyle 2} \\ 24 \\ \times\ 16 \\ \hline 240 \\ 144 \\ \hline 384 \\ \hline \end{array}$$

Answer: 384

24 x 10 = 240

4 x 6 = 24

The 4 units are placed in the units column and the 2 tens placed above the tens column.

20 x 6 = 120. The 2 tens above are added on to make 140.

The numbers are added together by adding the units, tens and hundreds.

The method is used for bigger numbers as children progress through Years 5 and 6.

124 × 26 becomes

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ 124 \\ \times\ 26 \\ \hline 2480 \\ 744 \\ \hline 3224 \\ \hline {\scriptstyle 1\ 1} \end{array}$$

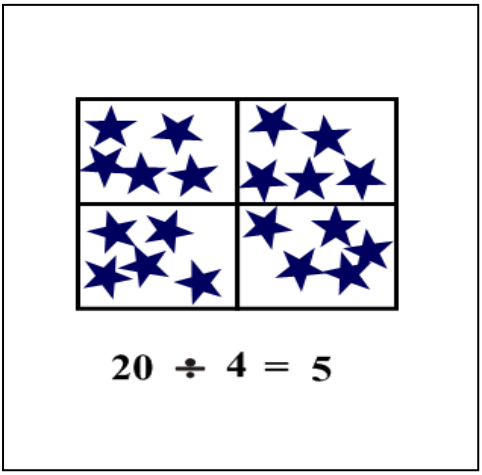
Answer: 3224

Division

Step 1

KEY VOCABULARY:
share, group, divide, divided by, divided into, divisible by.

The sharing image still has relevance (see below). It does, however, become harder for children to visualise and use as a mental model as the numbers become larger.

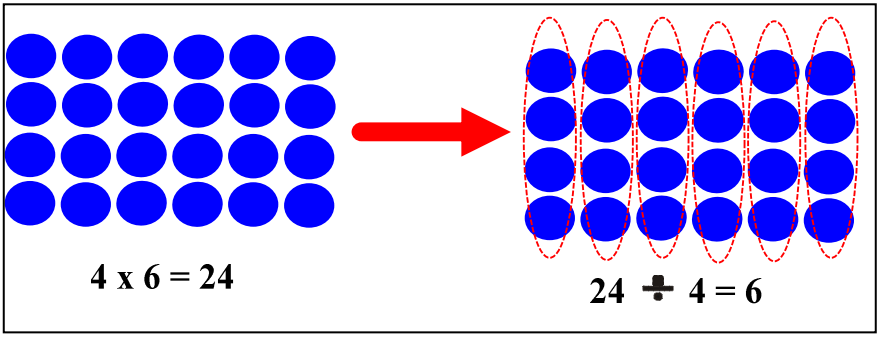


The grouping image of division is the basis of 'chunking' which will be developed in Key Stage 2. Children should continue to interpret a division sentence such as '20 ÷ 4 'as 'How many groups of 4 in 20?'

Division

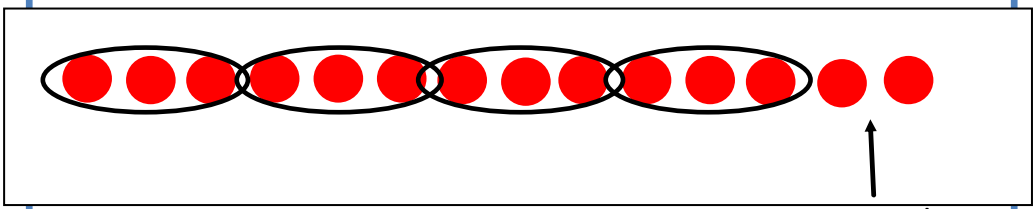
Step 2

Arrays are used in multiplication as a picture that helps children gain a mental picture. Arrays can also be used in division…



Remainders are started to be introduced. Word problems are given as much as possible so that the calculations have a meaning.

Q. What is the remainder when you divide 16 by 3?
Q. If a 15m floorboard is cut into 4m lengths, how much is left over?
Q. I have 46p to spend on sweets. If the sweets cost 5p each how many sweets can I buy? How much change will I get?



14 ÷ 3 = 4 r2

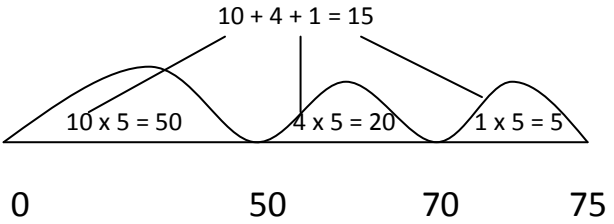
Division

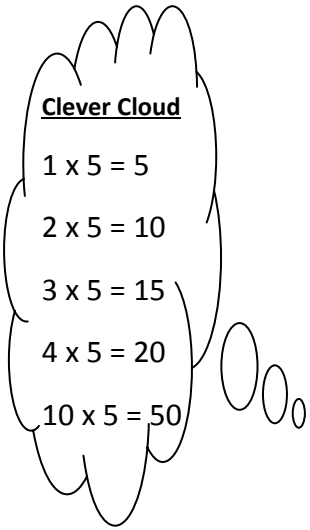
Step 5

Division on a number line

Children will use their times tables knowledge in order to help them calculate how many groups of the divisor are in the number.

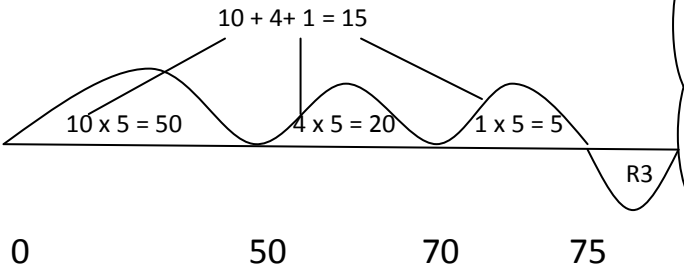
$75 \div 5 = 15$

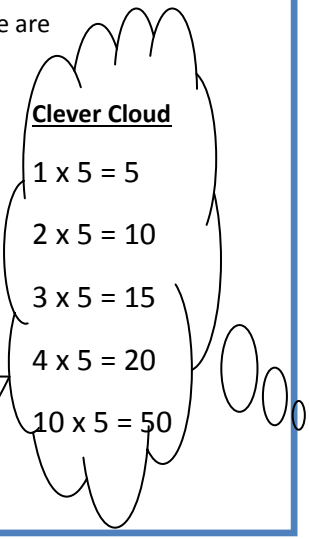




Using this method allows the children to easily identify if there are any remainders:

$78 \div 5 = 15$ r3





Division

Step 6

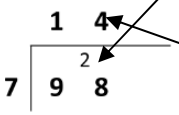
KEY VOCABULARY:
share, group, divide, divided by, divided into, divisible by, factor , remainder, inverse, chunking, known facts.

By the end of Year 4, most children will be encouraged to use **short and long division.**

This is referred to as the 'Bus Stop' method.

Short division

98 ÷ 7 becomes

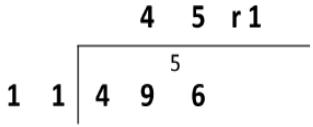


Answer: 14

There is 1 lot of 7 in 9, with 2 left over. The one is written above the 'bus stop'

There are 4 lots of 7 in **28.** This is written above the 'bus stop', giving a final answer of 14.

496 ÷ 11 becomes



Answer: $45\frac{1}{11}$

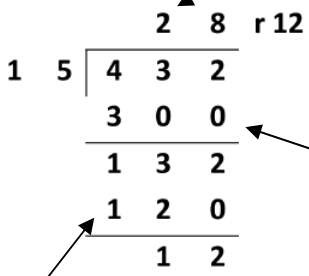
The same method is used here. In the final step, there are 5 lots of 11 in 56 with one leftover. This can be written as a remainder or a fraction.

Division

Step 6

Long division

432 ÷ 15 becomes



There are 2 lots of 15 in 43. The 2 is written above the 'bus stop' in the **tens column** standing for **20.**

15 x 20 = 300.

This is written underneath the 'bus stop'. It is then subtracted from the 432 giving an answer of 132.

There are 8 lots of 15 in 132. The 8 is written above the 'bus stop'.

15 x 8 = 120. This is written underneath the bus stop and subtracted giving an answer of 12. 15 **cannot** go into 12, so this is written as a remainder.

The remainder will sometimes be required to be written as a fraction:

Both the 12 and the 15 can be divided by 3, giving answers of 4 and 5.

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\ \frac{4}{5}$

Division

Step 6

The long division method is expanded to work with bigger numbers as children move through Years 5 and 6.

To accurately and efficiently use these methods, it is vitally important that children have quick recall of their times tables and division facts.

We hope you found this booklet useful to support you in helping with your child's learning. If you have any feedback about this booklet please feel free to email Miss Mackintosh at:

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