



A pocket guide to...



Maths Methods



Mundy C of E Junior School



The purpose of this booklet is to outline the various **calculation methods** that your child is taught as they progress through our school, many of which look different to the methods that you may have been taught in your primary school days.

During our daily Maths lessons, your child will be doing a mixture of counting, talking about numbers, mental calculations, standard written methods and using numbers to solve real life problems.

As your child progresses through the school, they will build up a bank of strategies from early mental calculation skills to formal written recordings, which can be applied when appropriate.

This booklet shows the range of different calculation methods that we currently use. We hope that the explanations and examples of strategies will help you to assist your child at home. Any extra support you can provide is greatly valued.

At the end, there is a list of websites with games and resources to help inspire your child's mathematical confidence.

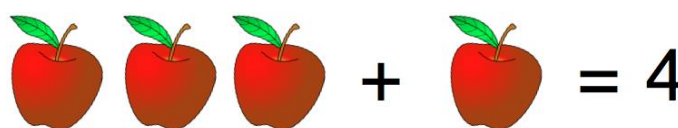
Addition

Stage 1 – Drawing objects in a group

Pupils record what they have done by drawing or tallying.

- The two sets are combined and the resulting set is counted out.
- The first set is put out and the second set is counted on.
- Physical objects can be used.

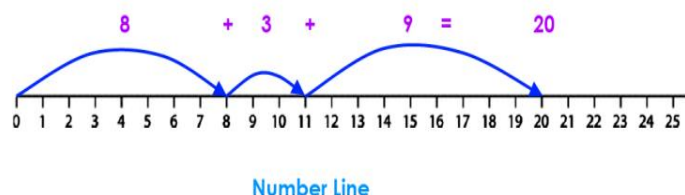
Counting on



Stage 2 – Marked number line or beads strings

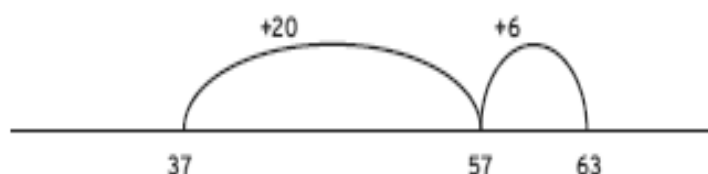
Pupils extend counting on from Stage 1 to just thinking about the numbers involved.

- A marked number line in ones is used.
- Steps in addition can be recorded on a number line e.g. $8 + 3 + 9 = 20$.



Stage 3 – Unmarked number line

The mental methods that lead to column addition involve **partitioning**, e.g. adding the tens and ones separately. Pupils need to be able to partition numbers in order to add multiples of tens then ones mentally. The unmarked number line helps to record the steps.



To work out $37 + 26$ children are taught to partition 26 into 2 tens and a 6, then add the 20 and finally the 6, making a total of 63.

Stage 4 - Partitioning

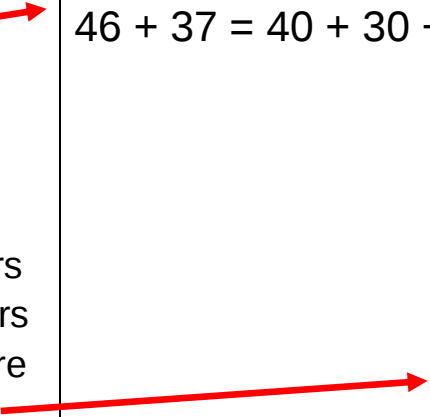
The next stage is to record mental methods using partitioning to check pupil's understanding.

- Pupils partition the tens and ones into two sums, e.g. $46 + 37 = 83$.
- Partitioning both numbers into tens and ones mirrors the column method where ones are placed under ones and tens under tens. Partitioned numbers are then written under one another.

Record steps in addition using partitioning

$$46 + 37 = 46 + 30 + 7 = 83 \quad \text{OR}$$

$$46 + 37 = 40 + 30 + 6 + 7 = 83$$

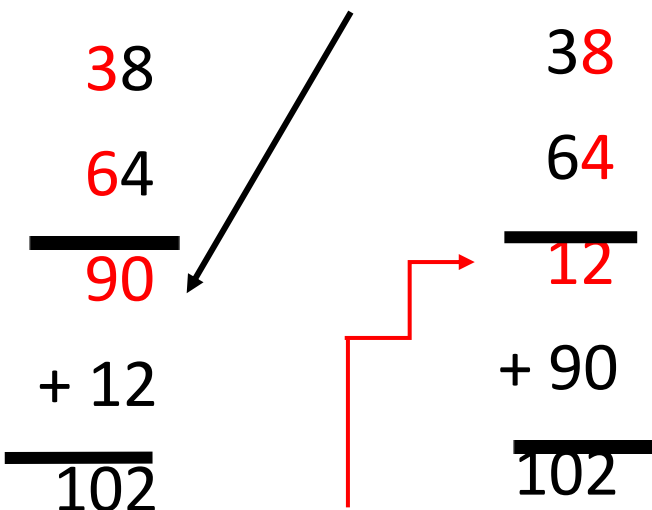

$$\begin{array}{r} 46 \\ + 37 \\ \hline \end{array} \quad \begin{array}{r} 40 + 6 \\ 30 + 7 \\ \hline 80 + 3 = 83 \end{array}$$

Stage 5 – Expanded method in columns

Pupils now move onto a layout showing the addition of the tens and ones separately. They can add either the tens or ones first but should be moved to starting with the ones when they gain confidence in the method.

- Links to the knowledge of single digit addition sums is taught here, e.g. if you know $4 + 3$ is 7 then you should know $40 + 30$ is 70.
- The expanded method leads pupils onto the final method of column addition. Pupils use this

Write the numbers in columns adding the tens first.


$$\begin{array}{r} 38 \\ 64 \\ \hline 90 \\ + 12 \\ \hline 102 \end{array} \quad \begin{array}{r} 38 \\ 64 \\ \hline 12 \\ + 90 \\ \hline 102 \end{array}$$

Then move onto adding the ones first. This is discussed with pupils to show how you get the same answer both ways. Pupils are then taught to refine it so they are adding the ones first consistently.

method until they are secure with their number facts and have a clear understanding of place value.

Stage 6 – Column method

- This is the final method pupil's use for addition. Any numbers that add up to 10 or more in each column are 'carried' and recorded below the line using a small number. Pupils are taught to say 'carry 10 or 100' and not 1 when the 1 is under the tens or hundreds column.
- Later pupils move onto adding more than two numbers together in ever increasing numbers and decimal places.

12786 people visited the museum last year.
The numbers increased by 2568 this year.
How many people altogether visited this year?

$$\begin{array}{r}
 12786 \\
 + 2568 \\
 \hline
 15354
 \end{array}$$

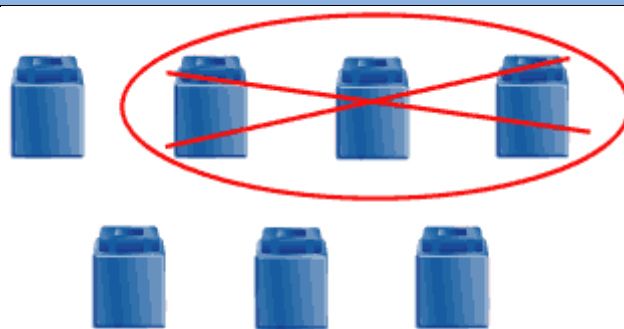
Carrying is shown with arrows and small numbers below the line.

Subtraction

Stage 1 – Drawing Objects & crossing out

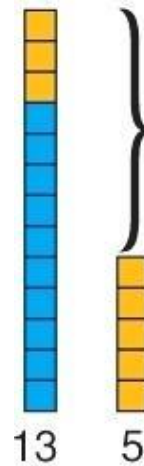
As addition started with combining groups, subtraction starts with separating or crossing out groups.

- Pupils use counters or other physical apparatus.
- They can remove objects or count on to **'find the**



$$7 - 3 = 4$$

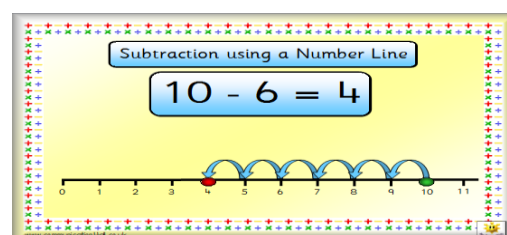
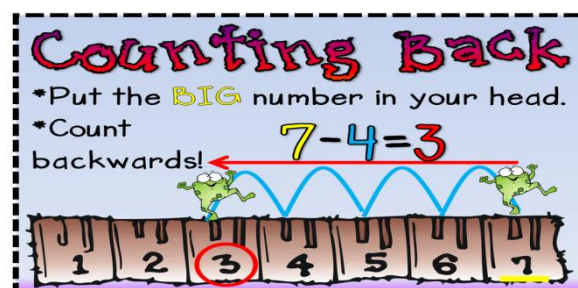
difference'. This is really addition but it is recorded as subtraction, other ways it may be taught is **'how many more'** or **'how many less'** does the smaller group have than the larger group.



"The difference is 8, five more to make ten then three more"

Stage 2 – Using a marked number line

- A numbered track can be used to count back, where the pupil jumps from one number to another.
- Then a fully numbered number line can be used to count back on.
- Pupils are encouraged to try and put (hold) the biggest number in their head in order for them to count back from it.
- Then pupils are moved onto using a partially marked number line to count back on and to record their number sentences. This is then extended to crossing the tens boundary.



Subtraction
using a number line and Counting back

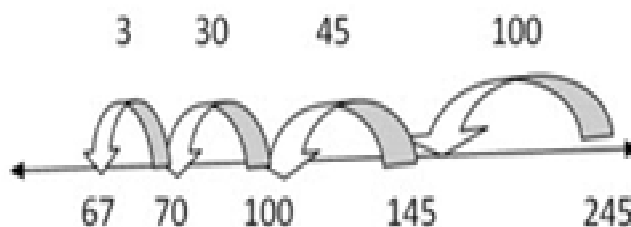
$$92 - 7$$



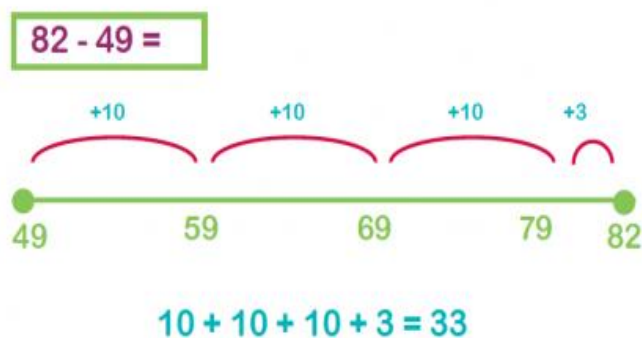
$$92 - 7 = 85$$

Stage 3 – Using an unmarked number line

The unmarked number line helps record the thought processes of the pupil. A calculation like $245 - 178$ can be recorded counting back 178 from 245. The empty number line is a good way of demonstrating to pupils how to bridge through a multiple of ten.



The steps can also be recorded by counting up from the smaller number to larger number by '**finding the difference**' between the two numbers.



With practise pupils will record less information on their number line and decide whether it is quicker to count forward or backwards to find the answer.

Stage 4 – Partitioning

Subtraction can be recorded using partitioning where pupils break down the subtraction into easier steps.



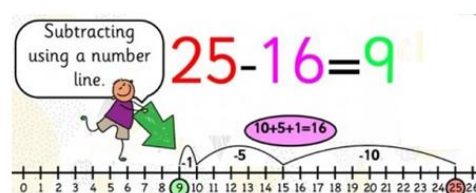
$$82 - 25 =$$

$$82 - 20 = 62$$

$$62 - 5 = 57$$

- This partitioning subtraction method can also be recorded on a number line.

$$25 - 10 - 5 - 1 = 9$$



Stage 5 – Expanded layout (leading onto column method)

Pupils then partition the numbers into tens and ones, writing one under the other. This prepares them for the full column method of subtraction.

- The expanded method leads pupils to the column method of subtraction but gives them more support until they are fully secure with their number facts and can move onto the final column method.

Partitioned numbers are then written under one another, e.g. $82 - 25 =$

$$\begin{array}{r}
 80 \quad 2 \\
 - 20 \quad 5 \\
 \hline
 50 \quad 7
 \end{array}
 \rightarrow
 \begin{array}{r}
 70 \quad 12 \\
 80 \quad 2 \\
 - 20 \quad 5 \\
 \hline
 50 \quad 7
 \end{array}
 \rightarrow
 \begin{array}{r}
 8 \quad 2 \\
 - 2 \quad 5 \\
 \hline
 5 \quad 7
 \end{array}$$

Stage 6 – Column method

- This is the final method used for subtraction and pupils are taught to avoid mistakes by making sure they lay out the numbers correctly in 'place value' order.

$ \begin{array}{r} \text{H T O} \\ 4 \quad 9 \quad 7 \\ - 2 \quad 6 \quad 3 \\ \hline 2 \quad 3 \quad 4 \end{array} $	This is how the method is laid out; the example on the left is one where no exchanging of numbers is needed and on the right is with exchanging.	$ \begin{array}{r} 4 \quad 1 \\ 5 \quad 6 \quad 9 \\ + 3 \quad 8 \quad 7 \\ \hline 1 \quad 8 \quad 2 \end{array} $
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Multiplication

Stage 1 – Continual addition of groups/steps of same size

Pupils begin to learn how to multiply by adding same sized groups or sets.

The term multiplication is introduced and can also be referred to as 'lots of' or 'groups' or 'sets of'.



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

$$4 \text{ lots of } 2 = 8$$

$$4 \times 2 = 8$$

Stage 2 – Arrays (leads to area method)

Pupils start with simple arrangements within their times tables knowledge (usually $\times 2$ $\times 5$ $\times 10$) – to show groups ordered into rows and columns.

- Keep terminology of 'lots of' for multiplication.
- The area method is useful for showing how the **distributive law** works. This means that you get the same answer when you multiply a number by a group of numbers added together, as when you do each multiplication separately.



$$3 \times 5 = 15$$

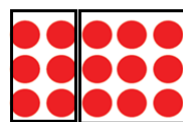


$$5 \times 3 = 15$$

An array of 15 can be arranged as either 3 lots of 5 or 5 lots of 3.

Distributive Law:

$$3 \times (2 + 3) = 3 \times 2 + 3 \times 3$$



So the "3" can be "distributed" across the "2+4" into 3 times 2 and 3 times 4

$$3 \times (2+4) = 3 \times 2 + 3 \times 4$$

Stage 3 – Mental multiplication using partitioning

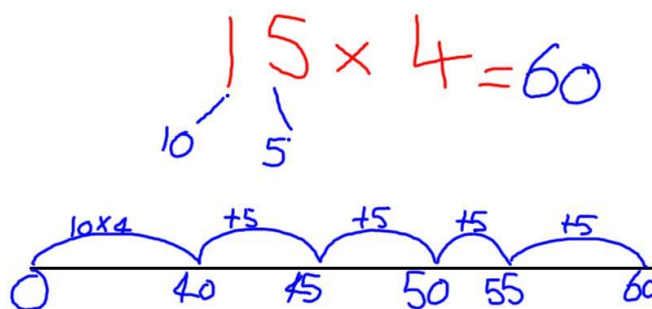
Mental methods for multiplying TO by O can follow on from the area method.

- This allows tens (T) and ones (O) to be multiplied separately to partial products. These are then added to find the total product.
- Either the tens or the ones can be multiplied first; initially, it is more common to start with the tens.
- Pupils may also choose to use a number line, e.g. 15×4 is the same as $(10 \times 4) + (5 \times 4) = 60$

$$16 \times 3 = (10 + 6) \times 3$$

$$= (10 \times 3) + (6 \times 3) = 30 + 18 = 48$$

N.B. Pupils should be introduced to the distributive law (but not its name) through the area method and drawing it out should still be used until pupils are confident with their 2, 5 and 10 times tables.



Stage 4 – The Grid Method

The area method also leads into an expanded method which uses a grid.

- This is based on the distributive law and links directly to the mental method. It is an alternative way of recording the same steps. A lot of pupils prefer this method to the vertical column method.

If I bought 4 cans of coke, costing 47p each, how much is this altogether?

① 4×47 or $47 \times 4 = £1.88$

② partition 40

③

4×40	4×7
160	28

④ hide the zero
do, $4 \times 4 = 16$. Now add the zero back on.

⑤ now do 4×7 , which is 28

⑥ Add the 2
 $160 + 28$

⑦ Now change to pence if you need to

Stage 5 – Expanded Short Multiplication

The next step for pupils is to introduce the column method for multiplication, but partitioning the numbers (to show the working out) to check pupils understanding of the method.

- Pupils should describe what they do by referring to the actual values of the digits in the columns, e.g. 40×5 and not 4 times 5.
- The recording is then reduced but the working out is still expanded (xO then xT then add together to find the total)
- **The expectation is that most pupils will be able to use this method by the end of year 4.**

$$42 \times 5$$

$$40 \times 5 = 200$$

$$2 \times 5 = 10$$

Ask, does it matter which order I do it?

$$40 + 2$$

$$\begin{array}{r} \times \quad 5 \\ \hline \end{array}$$

$$200$$

$$+ \quad 10$$

$$\underline{210}$$

H T U

5 8

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

5 6

3 5 0

4 0 6

1

Stage 6 – Short Column Multiplication

- The recording is further reduced, with 'carried' digits recorded below the line.
- TO or HTO x O (one-digit numbers)
- Timestable knowledge is crucial at this stage.

$$\begin{array}{r} \begin{array}{ccc} \text{H} & \text{T} & \text{U} \\ 4 & 6 & 3 \end{array} \\ \times \quad \quad \quad 8 \\ \hline 3 & 7 & 0 & 4 \\ \hline 5 & 2 & & \end{array} \quad \leftarrow \text{Answer line}$$

Stage 7 – Long Multiplication (grid method and column method)

- Extend to multiplying by a two-digit number (TO) asking pupils to estimate first.
- Start with the grid method. First each number is partitioned into tens and units. Then each number is multiplied together. To find the total all of the totals are added together in a column method.

$12 \times 36 = 432$

1) Partition each number

$\times$	10	2
30	300	60
6	60	12

2) Calculate each multiplication

3) Then find the sum of all the products.

$$\begin{array}{r} 300 \\ + 60 \\ + 60 \\ + 12 \\ \hline 432 \end{array}$$

- The expectation is that most pupils will be able to multiply TO by TO by the end of year 5.**
- Column method or the grid method can be used for multiplying any two numbers together; this preference is left to the individual pupil.

Long Multiplication
STEP 1: Multiply Units

Step 1: $5 \times 7 = 35$

Step 2: $5 \times 6 = 30$

Add on the carried tens

Carry the tens

Remember to add a '0'

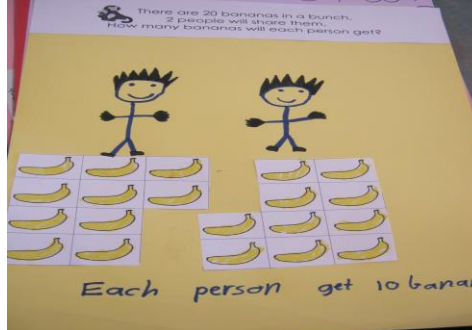
$$\begin{array}{r} 67 \\ \times 45 \\ \hline 335 \\ 2680 \\ \hline 3015 \end{array}$$

Division

Stage 1 - Sharing

Sharing is an early stage of division but is not efficient for larger numbers.

- Here there are 20 bananas which you need to share between 2 people. Pupils will use counters or other physical apparatus to divide this sum.



(one for you, one for me...)

Stage 2 – Grouping

This is an important step to introduce to pupils before they use chunking for division.

- It also helps to show that division is the inverse of multiplication (grouping).

Equal Grouping

$15 \div 3 = 5$ is the number of equal groups of 3 you can make with 15 items.



$$15 \div 3 = 5$$

12 is divided into 3 groups = 4 in each group OR



3 groups with 4 in each = 12 altogether.

Stage 3 – Division of TO by O using a number line

Pupils are introduced to the idea that division is the inverse of multiplication.

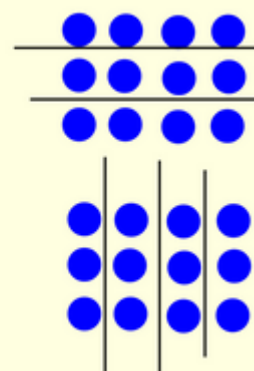
- The process of continual subtraction can be used on a number line e.g. taking away 5 equal groups of 5 from 25
- Pupil's then move on to 'chunking' on a number line.
- Timestable knowledge is used, so instead of continually subtracting (or adding) 1 lot of 4, 'multiples /or/ chunks' are used instead

e.g. $10 \times (\text{lots of}) 4 = 40 >$ much quicker!

$$\text{If } 3 \times 4 =$$

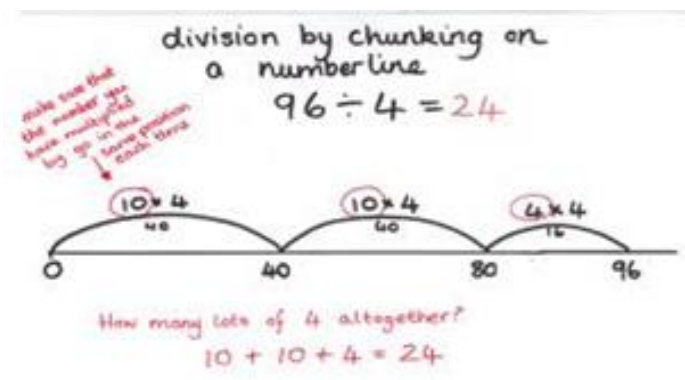
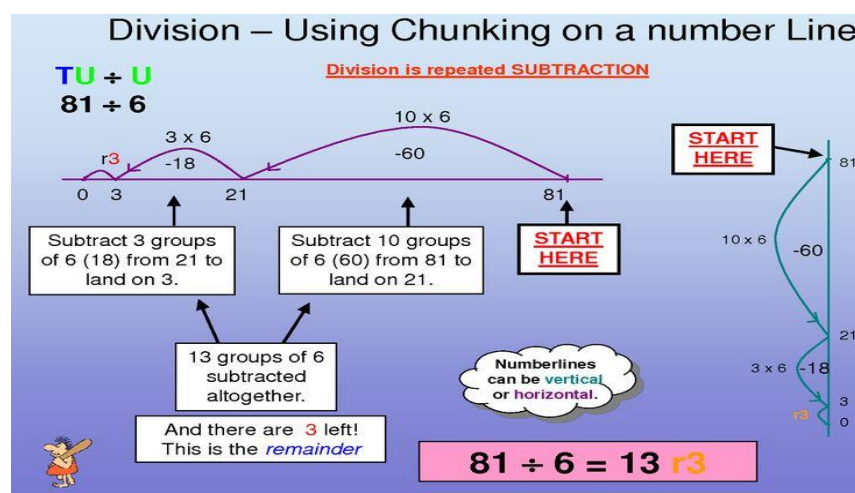
$$12 \div 3 =$$

$$12 \div 4 =$$



Chunking backwards (continued subtraction) helps prepare for more efficient methods of division.

$$25 \div 5 = 5$$



Stage 4 – Short division of TO by O

Short division of a two-digit number by a one-digit number can be introduced to pupils who are confident with their times tables, division facts and subtracting multiples of ten

- Pupils at the end of year 4 are expected to be able to record and explain division of a two-digit number by a one-digit number including numbers with remainders.
- This can be achieved by either using a written method or drawing on an empty number line.

$84 \div 3 =$ What number facts can we use to solve this?

$$10 \times 3 = 30$$

$$20 \times 3 = 60$$

$30 \times 3 = 90$ (Too much, so the answer will be more than 20 but less than 30)

$$84 - 60 (20 \times 3) = 24$$

$$1 \times 3 = 3 > 8 \times 3 = 24 \text{ (Exact amount)}$$

$$24 - 24 (8 \times 3)$$

So, if we take away 20 lots of 3's and 8 lots of 3's the answer is $84 \div 3 = (20 + 8) = 28$

Number Line

$$78 \text{ divided by } 3 = 26$$



"Chunking"

$$196 \text{ divided by } 6 = 32 \text{ r } 4$$

$$32 \text{ r } 4$$

$$\begin{array}{r} 6 \overline{)196} \\ -180 \quad (30 \times 6) \\ \hline 16 \\ -12 \quad (2 \times 6) \\ \hline \text{r}4 \end{array}$$

Stage 5 – Written recording of chunking method

Pupil's then learn that the number line method of division can be recorded vertically.

- $84 = 20$ lots of 3 and 8 lots of 3.
- These 'chunks' (lots of) are taken away, breaking the division into smaller sections.

$$84 \div 3 = 28$$

$$\begin{array}{r} 28 \\ 3 \overline{)84} \\ \underline{-30} \text{ (10 lots of 3)} \\ 54 \\ \underline{-30} \text{ (10 lots of 3)} \\ 24 \\ \underline{-24} \text{ (8 lots of 3)} \\ 0 \end{array}$$

$$\begin{array}{r} 31 \text{ r}5 \\ 6 \overline{)191} \\ \underline{-180} \text{ (30 x 6)} \\ 11 \\ \underline{-6} \text{ (1 x 6)} \\ 5 \text{ (r5)} \end{array}$$

The key to efficient chunking lies in the **estimate** that is made before the chunking starts.

- Estimating for HTO divided by O involves multiplying by 10 until you go over the HTO number and finding the two multiples of ten that 'trap' the HTO dividend.

To find $191 \div 6$ we begin by multiplying 6 by 10, 20, 30 etc. until we go over the HTO number. The multiples 180 (6×30) and 240 (6×40) trap the number 191. This tells us the answer is between 30 and 40.

We start the division by first subtracting 180 from 191 which is 11. Then how many 6s go into 11 which is 1 remainder 5. So the answer is 31 remainder 5

- Estimating has two important purposes when doing a division.
1. To help choose a starting point for the division
 2. To check the answer after the calculation.

division by chunking

$$216 \div 12 = 18$$

$$\begin{array}{r}
 12 \overline{) 216} \\
 \underline{(10 \times 12) - 120} \\
 096 \\
 \underline{(5 \times 12) - 60} \\
 36 \\
 \underline{(3 \times 12) - 36} \\
 00
 \end{array}$$

← children must be confident in subtraction for this method.

How many $\times 12$ altogether?

$$10 + 5 + 3 = 18$$

Stage 6a – Short division method

This is the one of the final methods pupil's use and it is nicknamed the 'bus stop' method.

- Timestable knowledge and understanding is crucial!

$$3 \overline{) 36}$$

how many 3's in 36?

This is what we do:

How many 3's in 3?

1

so we put the one above the 3 and then carry on

$$\begin{array}{r}
 1 \\
 3 \overline{) 36}
 \end{array}$$

How many 3's in 6?

Answer = 2

So we have $\begin{array}{r}
 12 \\
 3 \overline{) 36}
 \end{array}$

- This method can be used with any size number or numbers with decimals.

BUS STOP DIVISION

$$142 \div 4 = 35.5$$

$$\begin{array}{r} 0 \ 3 \ 5 \cdot 5 \\ 4 \overline{) 1 \ 4 \ 2 \cdot 0} \end{array} \quad \begin{array}{l} r2 \\ 2/4 = 1/2 = 0.5 \end{array}$$

496 ÷ 11 becomes

$$\begin{array}{r} 4 \ 5 \ r1 \\ 11 \overline{) 4 \ 9 \ 6} \end{array}$$

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

Stage 6b – Long division method

Pupils who have a secure knowledge of multiplication facts and place value should be able to move on quickly to this recording method which shows their working out clearly.

- Answers can use r (remainder), fractions or decimals.
- Pupils at the end of year 6 are expected to be able to use this method.

$$3640 \div 15 = 242 \text{ r}10 \text{ or } 10/15 = 2/3$$

$$\begin{array}{r} 2 \\ 15 \overline{) 3640} \\ - 30 \\ \hline 6 \end{array}$$

15 into 3 doesn't go, so look at the next digit.

15 goes into 36 two times, so put a 2 above the 6.
 $15 \times 2 = 30$

Take that 30 away from the 36 to get your remainder.
 $36 - 30 = 6$

$$\begin{array}{r} 24 \\ 15 \overline{) 3640} \\ - 30 \\ \hline 64 \\ - 60 \\ \hline 4 \end{array}$$

Next, carry the 4 down to make 64.

15 goes into 64 four times, so put a 4 above the 4.
 $15 \times 4 = 60$

Take 60 from the 64 to get your remainder.
 $64 - 60 = 4$

$$\begin{array}{r} 242 \\ 15 \overline{) 3640} \\ - 30 \\ \hline 64 \\ - 60 \\ \hline 40 \\ - 30 \\ \hline 10 \end{array}$$

Carry the 0 down to make 40.

15 goes into 40 two times, so put a 2 above the 0.
 $15 \times 2 = 30$

Take 30 from the 40 to get your remainder.
 $40 - 30 = 10$



Helpful websites to encourage maths:

www.primaryhomeworkhelp.co.uk (maths zone)

www.nrich.maths.org

www.topmarks.co.uk

www.mathsisfun.com

www.bbc.co.uk (keyword search e.g. maths KS2)

www.mathszone.co.uk

www.twinkl.co.uk (membership needed - some free resources)

Also, remember our school has a subscription to:

www.activelearnprimary.co.uk

Your child has access to Maths, English and Reading games and resources allocated by their teacher.

<https://ttrockstars.com/home>

Children have access to their own account on this timestables website where they can practise and test their timestables skills.

Finally, your child has been given a ‘Superhero’ booklet to help them to learn and practise their timestables at home.

If you have any queries regarding the content of this booklet or want support in knowing how best to help your child, please talk to your child’s teacher.