

# Maths Calculation Booklet for parents



# INTRODUCTION

-  This booklet is intended to explain the ways in which your children are taught to write down their calculations.
-  We have revised the school calculation policy to fit in with the 2014 National Curriculum. The Hanham Primary Federation Maths policy includes the progression for each of the four operations from reception to year 6.
-  We have divided the progression of methods into KS1, Lower KS2 and Upper KS2. We teach to the needs of all our children and therefore your child may be using methods above or below the year they are in, depending on what the class teacher feels is appropriate.
-  The aim is that your children are more confident in their Maths and that they enjoy what they do because they have a genuine understanding.
-  If you have any questions or you wish to have some guidance with any of the methods, please see your child's class teacher.

# ADDITION



## Partitioning ( mental method)

Partitioning is another word for separating the digits.

This is a method for carrying out mental calculations by separating out the tens and units.

Example:

Partition both numbers and recombine. Refine to partitioning the second number only e.g.

$36 + 53 =$	<b>refined to:</b>	$36 + 53 =$
$6 + 3 = 9$		$53 + 6 = 59$
$50 + 30 = 80$		$59 + 30 = 89$
$80 + 9 = 89$		

NB: When extending to hundreds, it is vital that the children understand the importance of zeroes as place holders E.g. 102 = 1 hundred, **0 tens** and 2 units.

## Compensation method

Children who are confident with rounding may use the compensation method. This means they add on more than is needed, then adjust to fit the calculation.

E.g.  $358 + 19 = ?$

Round the 19 up to the nearest 10 first:

$$358 + 20 = 378$$

Then adjust by taking away the extra 1:

$$378 - 1 = 377$$

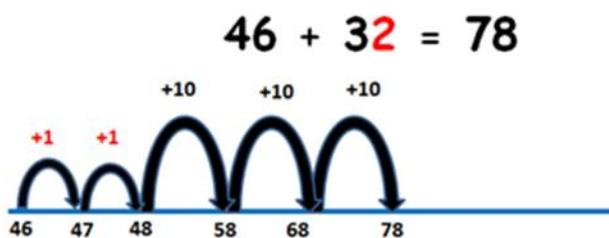
## The Number Line

Children are first taught to count on in ones from any number, for example: 7, 8, 9, 10, 11.

They then progress on to counting on in tens from any number, for example: 10, 20, 30, 40

extending to: 12, 22, 32, 42, 52.

The empty number line is a method that children are taught to help them with their mental calculations.



### Method:

Write the first number at the left hand end of the line.

Partition the number you are adding into tens and units ( $30 + 2$ )

Add the units to the bigger number, drawing the jumps as you do so.  
 Add the tens, again drawing the jumps.

**Progression-** Once children become confident with this method, they may be able to add 3 tens in one jump + 30 rather than + 10 +10 + 10

**Formal Written Methods**

**Expanded Method of Column Addition**

The expanded method is sometimes used when children are first taught standard written methods. This is taught to develop their understanding about the value of digits.

$76 + 47 = 70 + 40 \text{ and } 6 + 7.$

	H	T	U
		7	6
+		4	7
		1	3
	1	1	0
	1	2	3

NB: Often children will move straight onto the contracted method of column addition if they have a secure understanding of place value.

**Contracted method of column addition**

Once children are secure with place value, the expanded method can be contracted to:

	H	T	U
		7	6
+		4	7
	1	2	3
	1	1	

If the 2 numbers added together are larger than ten e.g.  $7 + 6 = 13$  the unit is placed in units column and the ten is carried over to the bottom of the tens column.

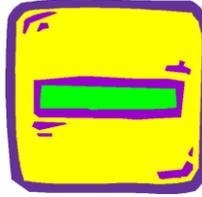
Next you add the tens-  $7 + 4 = 11$  and add the 1 carried over which makes 12. Lastly there are no hundreds to add apart from the 1 hundred carried over. Therefore a 1 needs to be placed in the hundreds column.

Once children are secure with this method they will learn to apply it to larger numbers, including numbers with 1 and 2 decimal places.

$124.9 + 117.25 = 242.15$

	H	T	U	Te	H <sup>ths</sup>
	1	2	4	.9	
+	1	1	7	.25	
	2	4	2	.15	
	1	1			

# SUBTRACTION



Place value is taught mentally first from Key Stage 1, progressing to number lines to aid calculations.

In all cases make sure that the children always look out for special cases that can still be done entirely mentally e.g.  $21 - 9$ ,  $15 - 5$  (number bonds to 20).

## Partitioning (mental method)

$$42 - 15 =$$

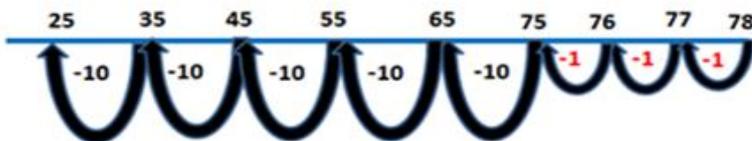
$$42 - 5 = 37 \text{ (partition the second number- } 15 = 10 + 5)$$

$$37 - 10 = 27$$

## The Number line:

In the early stages of KS2, children will use a number line to support them with subtraction. They will start at the end of the number line and jump backwards.

$$78 - 53 = 25$$



The larger number is written at the end of the number line and the smaller number is taken away by counting back. (jumps under the line)

Again, this calculation method requires children to be able to *partition* 2 digit numbers.

$$78 - 53 = ?$$

$$78 - 3 \text{ (units)} = 75$$

$$75 - 50 \text{ (5 tens)} = 25$$

## Formal Written Methods

$$\begin{array}{r} \text{H} \quad \text{T} \quad \text{U} \\ 5 \quad 6 \quad 3 \\ - 2 \quad 4 \quad 1 \\ \hline 3 \quad 2 \quad 2 \end{array}$$

### Column subtraction

For children who are very secure with using a number line, they will move onto more formal written methods for subtraction.

### Compact method

- 1) Subtract the units first ( $3-1=2$ ). Write the answer in the units column.
- 2) Next subtract the tens ( $6-4=2$ ). Write the answer in the tens column.
- 3) Lastly subtract the hundreds ( $5-2=3$ ). Write the answer in the hundreds column.

An important thing to bear in mind is that we are very careful in the language we use. We talk about subtracting 40 from 60 and not 4 from 6. This is to make sure that children recognise the value of the digits in preparation for the next step in decomposition.

### Column Subtraction using decomposition

Children will use the decomposition method when a subtraction cannot happen which means you need to 'exchange'.

$$\begin{array}{r} \text{H} \quad \text{T} \quad \text{U} \\ 4 \quad 15 \\ \cancel{5} \quad \cancel{6} \quad 11 \\ - 2 \quad 8 \quad 5 \\ \hline 2 \quad 7 \quad 6 \end{array}$$

- 1) Look at the units. You cannot subtract 5 from 1 so you go to the next place value column 'tens' and exchange a ten.
- 2) This means the 6 in the tens column is crossed out and reduced to 5 and 1 ten is carried over to the units column.
- 3) There are now 11 units in the units column. Therefore we can do the subtraction  $11-5=6$ .
- 4) Next go to the tens column. 8 tens cannot be subtracted from six tens so you go to the next place value column to the left 'hundreds' and exchange a hundred.
- 5) The '5' hundred is crossed out and reduced to 4 and 1 hundred is carried back to the tens column.
- 6) There are now 15 tens in the tens column. So  $15-8=7$ .
- 7) Lastly go to the hundreds column. 4 hundreds - 2 hundreds = 2 hundreds.

# MULTIPLICATION



It is essential that all children learn their times tables facts. They are used in many areas of maths and need to be learnt by heart.

Children need to understand that multiplication is based on repeated addition. Once this is understood, various methods of helping them to multiply 2 numbers and derive an accurate answer are taught.

The children will need to:

- Solve number sentences e.g.  $14 \times 8 = ?$
- Use their multiplication knowledge across many areas of maths e.g. calculating area of shapes, for division.
- Apply their knowledge of multiplication to solve word problems.

## Partitioning (mental method)

Using partitioning with multiplication helps children solve their calculation in easier steps. Children will be taught this as a jotting for mental calculations.

Examples:  $18 \times 4 = 72$

↓

$$10 \times 4 = 40$$
$$8 \times 4 = 32$$

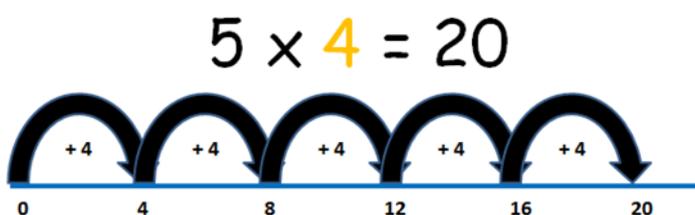
Moving onto :  $24 \times 2 = (20 \times 2) + (4 \times 2) = 48$

$$40 + 8$$

## The Number line

In the early stages of KS2 this is the most appropriate way of teaching multiplication. Think of the number sentence  $5 \times 4$  as 5 lots of 4.

Start at zero, on the left hand end of the number line. Make 5 jumps in 'lots of' 4.



## Grid Multiplication:

Grid Multiplication enables children to see each stage of their calculation. This method also uses partitioning but is set out in a grid.

It requires children to have an understanding of multiplying by 10 and 100.

$23 \times 7 =$

x	20	3
7	140	21



	H	T	U
	1	4	0
+		2	1
	1	6	1

### Instructions for this method:

- 1) Partition the 2-digit number into Tens and units ( 20 + 3)
- 2) Multiply 20 by 7 and fill in the answer (140)
- 3) Multiply 3 by 7 and fill in the answer (21)
- 4) Add the answers together using column addition.

The same method can be extended to larger numbers and then on to decimals.

E.g.  $56 \times 27 = 1512$

X	50	6
20	1000	120
7	350	42

	Th	H	T	U
	1	1	2	0
+		3	9	2
	1	5	1	2
		1		

When Grid Multiplication is understood, children can move onto the short method of multiplication.

### Short Multiplication (compact)

This method requires children to have a secure understanding of place value and times table facts. Children must make sure digits are in the correct columns.

$24 \times 6 = 144$

		2	4
x			6
	1	4	4
		2	

- 1) Start with the units.  $4 \times 6 = 24$  (carry the 2 tens over to tens column)
- 2)  $2 \times 6 = 12$ . Add the 2 (carried over) = 14.

## Multiplying decimals

Children will use short multiplication (compact) to multiply decimal numbers.

		4.	8	
	x	7		
	3	3.	6	
		5		

## Long Multiplication

This method will be used with multiplying larger numbers E.g. 3 digit x 2 digit.

$$124 \times 26 = 3224$$

	H	T	U	
	<sup>1</sup> 1	<sup>2</sup> 2	4	
X		2	6	
	<hr/>			
	7	4	4	
	2	4	8	0
	<hr/>			
	3	2	2	4
	<hr/>			
	1	1		
	<hr/>			

Position the digits in their place value columns.

- Multiply the top units by the lower units:  $6 \times 4 = 24$ . The '4' goes in the units column and the '2' tens are carried over to the top ten.
- Multiply the top tens by the lower units:  $6 \times 2 = 12$ . Add the 2 tens carried over which makes 14. The '4' is placed in the tens column and the 1 is carried over to the hundreds column.
- Multiply the top hundreds by the lower units:  $6 \times 1 = 6$ . Add the 1 (hundred) carried over = 7.
- Write a zero in the units column below the '4' to show all  $\times 10$ .
- Multiply the top units by the lower tens  $2 \times 4 = 8$ . Place '8' in the tens column.
- Multiply the top tens by the lower tens .  $2 \times 2 = 4$ . Write the answer in the hundreds column.
- Multiply the top hundreds by the lower tens:  $2 \times 1 = 2$ . Write the answer in the thousands column.
- Lastly add the numbers together using column addition.  $744 + 2480 = 3224$ .
- Check your workings.

Remember to carry across digits and remember to add on any tens which have been carried across.

# DIVISION



Children have many ways of interpreting what division means. They often talk about 'sharing' or 'grouping'.

The calculation  $12 \div 3 =$  can be read as:

-  12 divided by 3 equals
-  What is 12 divided by 3?
-  Share 12 out amongst 3
-  12 thirds
-  How many groups of 3 can you take away from 12?
-  How many lots of 3 in 12?

Children will be taught a range of written methods to support their work on division. Having a secure knowledge of all times table facts is crucial to support their work on division.

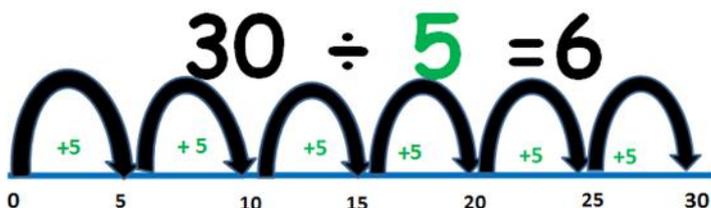
## The Number line

In the earlier stage of KS2, the children will be taught to use an empty number line to help with their division.

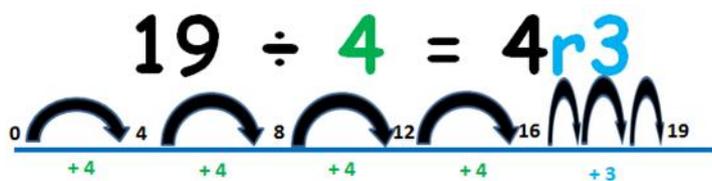
$30 \div 5$  can be modelled as:

Grouping - How many 5's make 30?

Draw jumps of 5 along a number line. After each jump write the multiple of 5 you land on. Complete this until you reach 30. Children to count the number of jumps they have made. This shows you need 6 jumps of 5 to reach 30.



## Division using grouping on a blank number line - leaving a remainder



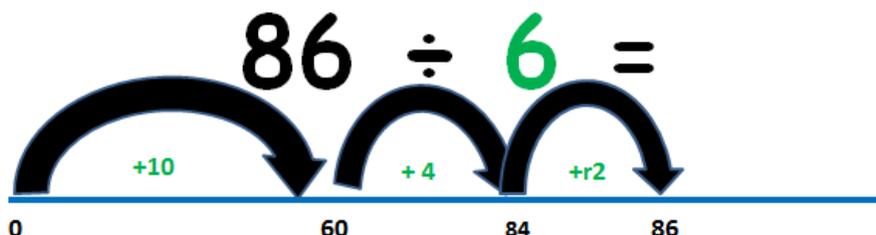
Remainders are found in division work when a number cannot be shared equally.

Start at 0. Repeatedly add the divisor (4) until you get to the nearest multiple of the divisor (16). Your answer is the number of jumps you need (4), along with the remaining number to get to the larger number.

### Development

As the children become more confident with using the number line, they can begin to make more efficient jumps e.g. 10 lots of 6 → 60

$$86 \div 6 = 14 \text{ r } 2$$



It would take a long time to jump in 6's to 86 so children can jump in bigger jumps using their tables facts to help them. A jump of 10 lots of 6 takes you to 60. A jump of 4 lots of 6 takes you to 84 with a remainder of 2. Altogether that is 14 (10 + 4) jumps of 6 remainder 2.

Once secure move to short division.

### Short division (compact)

A step by step guide to short division

[http://www.bgfl.org/bgfl/custom/resources\\_fnp/client\\_fnp/ks2/maths/school\\_booster/busstopdivision.html](http://www.bgfl.org/bgfl/custom/resources_fnp/client_fnp/ks2/maths/school_booster/busstopdivision.html)

This method can be referred to as the 'bus stop' method.

$$\begin{array}{r} 091 \text{ r } 3 \\ 4 \overline{) 367} \end{array}$$

- 1) See how many times the divisor will divide into each digit.  
 $3 \div 4$  does not possible so we carry the 3 over.
- 2)  $36 \div 4 = 9$  (answer goes directly above digits on top of bus shelter).
- 3)  $7 \div 4 = 1 \text{ r } 3$  (answer to be placed on top of bus shelter next to other digits).

Children can also be asked to express remainders as a decimal or a fraction.

**Expressing as a decimal**     $59 \div 4 = 14.75$

$$\begin{array}{r} 14.75 \\ 4 \overline{) 59.30} \end{array}$$
 Follow the same method as above. If there are any remainders you need to put a decimal point and a zero after the decimal point as a place holder.

Carry the remainders to this zero (3 was the remainder so we now have 30 tenths).

$30 \div 4 = 7 \text{ r } 2$ . The 2 gets carried to the final zero (hundredths).

Finally see how many times 4 goes into 20 = 5. This makes the answer 14.75.

**Expressing as a fraction**

$$\begin{array}{r} 1 \text{ r } 3 \text{ } \frac{1}{5} \\ 5 \overline{) 6 \text{ } \frac{16}{5}} \end{array}$$

1)  $6 \div 5 = 1 \text{ r } 1$ . Carry the 1 across.

2)  $16 \div 5 = 3 \text{ r } 1$ .

3) This time children would be taught to use the remainders as a numerator (1) and the divisor as a denominator (5), making  $\frac{1}{5}$

**Short division with decimal numbers**

$34.2 \div 6 = 5.7$

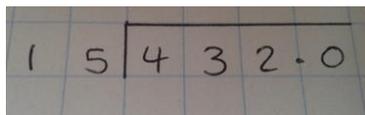
$$\begin{array}{r} 5.7 \\ 6 \overline{) 34.2} \end{array}$$

This method can also be used to divide decimal numbers.

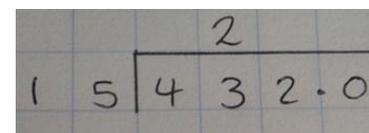
## Long Division

This method is used when you have to divide larger numbers (beyond their times table knowledge).

**Example:  $432 \div 15 = 28.8$**


$$15 \overline{)432.0}$$

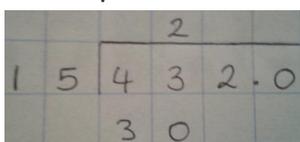
1)  $4 \div 15 =$  is not possible, so look at the first two digits together and divide by the divisor.  $43 \div 15 \rightarrow 2$


$$15 \overline{)432.0} \quad 2$$

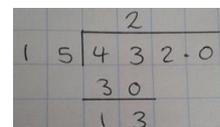
( $2 \times 15 = 30$ ,  $3 \times 15$  would be 45 which is too big).

2) The 2 goes in the tens column above the bus stop.

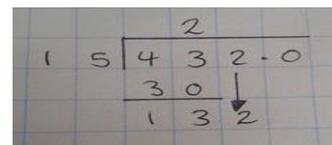
3) To calculate the remainder from the first part, write the answer to  $2 \times 15$  underneath like this:


$$15 \overline{)432.0} \quad 2$$
$$30$$

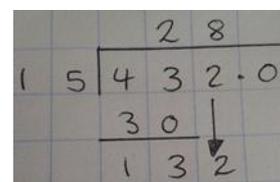
4) Now we subtract the bottom number from the top number  $43 - 30 = 13$  (this was the remainder from the first division).


$$15 \overline{)432.0} \quad 2$$
$$\underline{30}$$
$$13$$

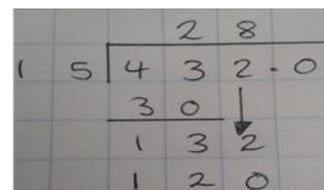
5) Now we bring down the next digit of the dividend (2) to give 132.


$$15 \overline{)432.0} \quad 2$$
$$\underline{30}$$
$$132$$

6) Divide this number by the divisor:  $132 \div 15 = 8$  (because  $8 \times 15 = 120$ , the nearest multiple of 15 below 132)

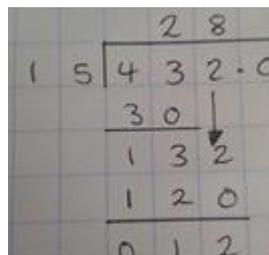

$$15 \overline{)432.0} \quad 28$$
$$\underline{30}$$
$$132$$

7) The whole number answer (8) is placed at the top (on bus stop). To find the remainder, write the 120 below the 132.


$$15 \overline{)432.0} \quad 28$$
$$\underline{30}$$
$$132$$
$$\underline{120}$$

8) Now we subtract the bottom number from the top number

$$132 - 120 = 12.$$


$$15 \overline{)432.0} \quad 28$$
$$\underline{30}$$
$$132$$
$$\underline{120}$$
$$012$$

9) Bring down the next digit of the dividend (0).

Here a zero has been added beyond the decimal point to enable the final answer to be calculated as a decimal.

Divide this new number underneath by the divisor:

$$120 \div 15 = 8 \text{ (exactly so no remainder this time).}$$

Handwritten long division on a grid background. The divisor is 15 and the dividend is 432.0. The quotient is 28. The remainder is 120. A vertical line is drawn after the decimal point in the dividend, and a horizontal line is drawn under the 120 remainder.

10) Again, the whole number (8) is placed at the top (on bus shelter).

Handwritten long division on a grid background. The divisor is 15 and the dividend is 432.0. The quotient is 28.8. The remainder is 120. A vertical line is drawn after the decimal point in the dividend, and a horizontal line is drawn under the 120 remainder.

11) The answer from the operation (8) is multiplied by the divisor (15)  $8 \times 15 = 120$ . The result is placed under the number divided into.

Handwritten long division on a grid background. The divisor is 15 and the dividend is 432.0. The quotient is 28.8. The remainder is 120. A vertical line is drawn after the decimal point in the dividend, and a horizontal line is drawn under the 120 remainder.

12) Now we subtract the bottom number from the top number. There is no remainder this time so we have our answer - 28.8 (remember to include the decimal point in the answer).

Handwritten long division on a grid background. The divisor is 15 and the dividend is 432.0. The quotient is 28.8. The remainder is 000. A vertical line is drawn after the decimal point in the dividend, and a horizontal line is drawn under the 000 remainder.

## How can you help at home?



- ☺ Practise recalling times tables
- ☺ Count using money
- ☺ Tell the time
- ☺ Weigh and measure out cooking ingredients
- ☺ Guess the shape
- ☺ Play puzzles and other games that develop numerical and logical reasoning.

### **Mathletics** <http://www.mathletics.co.uk/>

Teachers set mathletics homework every fortnight. If your child cannot access this at home, there is a mathletics club run on Thursdays at lunchtime.

### **Websites**

There are several good websites for practising Maths at home and developing skills with number and reasoning. You may like to look at:

<http://resources.woodlands-junior.kent.sch.uk/maths/>

<http://www.mathsisfun.com/> Covers all areas of Maths. Lots of good logic puzzles!

<http://www.coolmath4kids.com/> Covers all areas of maths

<http://www.bbc.co.uk/bitesize/ks2/maths/> Covers all areas of maths

[http://www.transum.org/Software/SW/Starter\\_of\\_the\\_day/index.htm](http://www.transum.org/Software/SW/Starter_of_the_day/index.htm) Good for years 5 and 6.

<http://www.maths-games.org/times-tables-games.html> - Good website for grouping games for all areas of maths from various websites.

<http://www.mad4maths.com/> - Fun games for KS2 children.

<http://www.crickweb.co.uk/> Good variety of maths games.

<http://www.ictgames.com/resources.html> wide variety of games for KS1 and Lower KS2.

<http://www.topmarks.co.uk/Flash.aspx?f=SpeedChallenge> speed challenge activities for practising times tables, rounding, number bonds.

[http://mathszone.webspace.virginmedia.com/mw/add\\_sub/3d\\_3d\\_add.swf](http://mathszone.webspace.virginmedia.com/mw/add_sub/3d_3d_add.swf) column addition.

<http://www.amblesideprimary.com/ambleweb/mentalmaths/pyramid.html> column addition.

[http://mathsframe.co.uk/en/resources/resource/48/column\\_subtraction](http://mathsframe.co.uk/en/resources/resource/48/column_subtraction) column subtraction.