

# Olive Hill Primary School Calculations Policy- Version 2- May 2014



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## **Introduction**

This policy has been produced to ensure consistency and progression in teaching throughout Olive Hill Primary School.

The Primary Framework for Mathematics provides a structured and systematic approach to the teaching of calculation. There is considerable emphasis on teaching mental calculation methods.

Children are introduced to the processes of calculations through practical, oral and mental activities. Through these activities, they consolidate their understanding of number facts and begin to develop ways of recording to support their thinking and calculation methods.

As children's mental and informal 'jotting' methods are strengthened, they become ready to use more efficient written methods.

## Aims

It is our aim at Olive Hill Primary School that by the end of Year 6:-

- children will be equipped with mental, written and calculator methods that they understand and use correctly and appropriately for the calculation required.
- that when faced with a calculation, children should also have the strategies to check its accuracy.
- children to be able to select an efficient method of their choice (whether this be mental, written or using a calculator) that is appropriate for a given task.

They will do this by always asking themselves:

- Can I do this in my head?
- Can I use drawings and jottings?
- Do I need to use a pencil and paper procedure?
- Do I need a calculator?

This policy aims to identify the progression in each of the four operations that the children will follow. Each stage is built upon previous experience and all stages are levelled according to National Curriculum Levels to enable teachers to teach the most appropriate methods of written calculation for their children.

Children should be encouraged to see mathematics as both a written and spoken language. Teachers and other adults working with children in supporting mathematics should support and guide children in learning through the following important stages:

- developing the use of pictures and a mixture of words and symbols to represent numerical activities;
- using standard symbols and conventions;
- use of jottings to aid a mental strategy;
- use of pencil and paper procedures;
- use of a calculator.

Through teaching and learning we ensure that children:

- Have a secure knowledge of number facts and a good understanding of the four operations.
- Understand the relationships between numbers.
- Are able to use this knowledge and understanding to carry out calculations mentally and to apply general statements when using one-digit and two-digit numbers and particular strategies to special cases involving bigger numbers.
- Make use of diagrams and informal jottings to help record steps and part answers when using mental methods that generate more information than can be kept in their heads.
- Have an efficient and reliable written method of calculation for each operation that children can apply with confidence when undertaking calculations that they cannot carry out mentally.
- Use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.

## **Objectives**

At Olive Hill Primary School, we follow the Primary National Curriculum for Mathematics, supported where appropriate by the Department for Education. The wording of learning objectives must be altered to suit the ability of the children to ensure they understand what they are learning at an age appropriate level.

## **General Progression**

- Establish mental methods based on a good understanding of place value.
- Use of informal jottings to aid mental calculations.
- Develop use of an empty number line to help mental imagery and aid recording.
- Use of partitioning and recombining to aid informal methods.
- Introduce expanded written methods.
- Develop expanded written methods into compact standard written form.

Up to Level 3 informal written recording is practised regularly and is an important part of learning and understanding. More formal written methods follow when a child is able to use a wide range of mental strategies (sometimes before Level 3 if children/a child are secure with informal methods).

This policy contains the key pencil and paper procedures that are to be taught throughout the school. It has been written to ensure consistency and progression throughout the school. Although the main focus of this policy is on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of mathematics. Mental calculation is not at the exclusion of written recording and should be seen as complementary to and not as separate from it. In every written method there is an element of mental processing. Written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

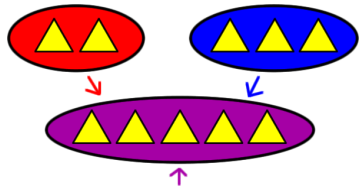
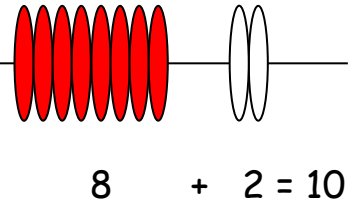



Methods are designed to be taught to the level the children are working at rather than in a specific year group e.g. in year 2, strategies for level 1, 2 and 3 could be taught according to the ability of the children. Despite children being taught levelled written methods; they should not be discouraged from using previously taught methods with which they are secure, while the new concepts are becoming embedded. The long term aim is for children to be able to select an efficient method of their choice that is appropriate for a given task.

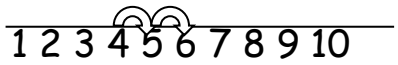

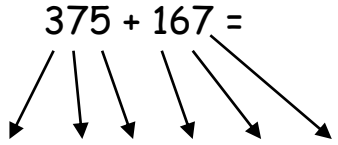
### Progression of Mental Skills

- 1:1 correspondence
- Counting forwards and backwards in 1's from any number.
- Say 1 more/1 less with numbers up to 10, 20.
- Number bonds to 5, 10 and 20.
- Doubling/halving up to 10, 20.
- Counting forwards and backwards in 2's, 5's and 10's from any number.
- Estimating numbers up to 100.
- Number facts up to 20.
- Understanding of place value and partitioning mentally.
- Rounding to the nearest 10, 100, 1000.
- Times tables - 2, 5, 10, 3, 6, 12, 4, 8, 9, 11, 7
- Inverse operations between + and - and  $\times$  and  $\div$
- Near multiples to 100.
- Number bonds to 100.
- Adjusting by 1 when adding 9 and 11 etc.

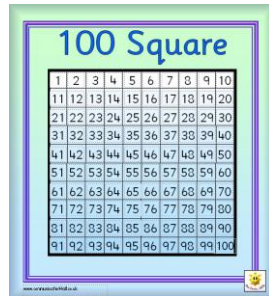


Olive Hill Primary School - Addition Written Methods

Level 1	Level 2	Level 3	Level 4	Level 5
<p>To be able to record calculations using pictures.</p>  <p>To be able to use bead strings to illustrate addition.</p> 	<p>To be able to use a drawn number line to count on in ones.</p> $12 + 5 = 17$ $+1 +1 +1 +1 +1$  <p>12                      17</p> <p>To be able to use a drawn number line to count on in tens.</p> $15 + 30 = 45$ $+ 10 + 10 + 10$  <p>15    25    35    45</p>	<p>To be able to partition a number through a multiple of ten.</p> $+ 4 + 3$  <p>16    20    23</p> <p>To be able to add near multiples of ten by adding in tens and then adjusting.</p> $45 + 19 =$ $45 + 20 = 65$ $65 - 1 = 64$	<p>To be able to carry numbers using the compact method of addition.</p> $\begin{array}{r} 625 \\ + 48 \\ \hline 673 \\ 1 \end{array}$ <p>To be able to add decimal amounts using the compact method.</p> $\begin{array}{r} 4.21 \\ + 3.87 \\ \hline 8.08 \\ 1 \end{array}$	<p>To be able to carry multiple numbers using the compact method of addition up to Th, H, T, U.</p> $\begin{array}{r} 7648 \\ + 1486 \\ \hline 9134 \\ 111 \end{array}$

<p>To be able to use a pre-prepared number line to count on.</p> $4 + 2 = 6$  <p>To be able to complete simple missing number sentences.</p> $3 + \underline{\quad} = 7$	<p>To be able to use a drawn number line to count on using partitioning.</p> $27 + 13 = 40$ $+ 10 \quad + 1 + 1 + 1$  <p>To be able to complete missing number sentences where the missing number is shown as a symbol.</p> $25 + \triangle = 30$ $\square + 10 = 50$	<p>To be able to add 9 and 11 by adding 10 and adjusting by 1.</p> $67 + 9 =$ $67 + 10 = 77$ $77 - 1 = 76$ <p>To be able to use methods of partitioning to solve more complex addition.</p> $375 + 167 =$  $300 \quad 70 \quad 5 \quad 100 \quad 60 \quad 7$ $5 + 7 = 12$ $70 + 60 = 130$ $300 + 100 = 400$ $400 + 130 + 12 = 542$		<p>To be able to add decimal amounts using the compact method in context e.g. money, measurements etc.</p> $16.4\text{kg} + 7.68\text{kg}$ $\begin{array}{r} 16.40 \\ + 7.68 \\ \hline 24.08 \\ 1 \quad 1 \end{array}$
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To be able to use a hundred square to count on in tens and ones.



To be able to add by partitioning and recombining.

$$43 + 13 =$$

T  $40 + 10 = 50$

U  $3 + 3 = 6$

$$50 + 6 = 56$$

To be able to use the expanded method to add amounts.

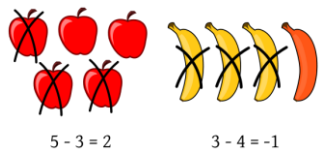
$$\begin{array}{r} 215 \\ + 176 \\ \hline 11 (5 + 6) \\ 80 (10 + 70) \\ \hline 300 (200 + 100) \\ 391 \end{array}$$

To be able to add multiples of 100 and 1000.

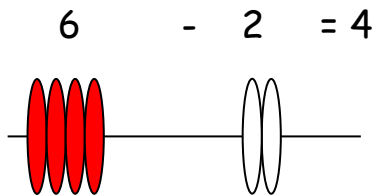
Vocabulary - add, addition, total, plus, more than, and, altogether, increase, equals, make, sum

## Olive Hill Primary School - Subtraction Written Methods

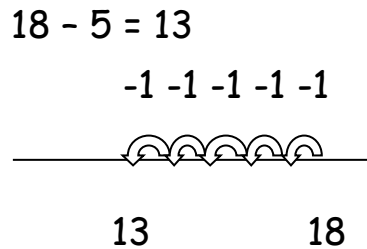
To be able to record calculations using pictures.



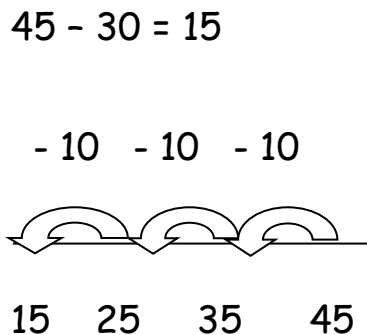
To be able to use bead strings to illustrate subtraction.



To be able to use a drawn number line to count back in ones.



To be able to use a drawn number line to count back in tens.



To be able to subtract near multiples of 10 by taking away in tens and adjusting.

$45 - 19 =$   
 $45 - 20 = 25$   
 $25 + 1 = 26$

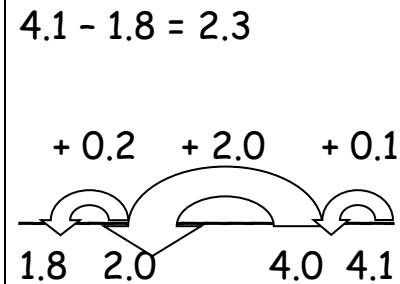
To be able to subtract 9 and 11 by subtracting 10 and adjusting by 1.

$67 - 9 =$   
 $67 - 10 = 57$   
 $57 + 1 = 58$

To be able to use compact decomposition to solve subtraction.

$$\begin{array}{r} 5 \ 1 \\ \cancel{6}47 \\ - 286 \\ \hline 361 \end{array}$$

To be able to use a number line to subtract decimal amounts (find the difference between).

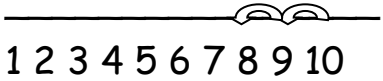

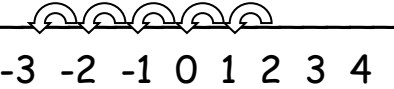


To be able to use compact decomposition to solve subtraction up to 4 digits.

$$\begin{array}{r} 2 \ 1 \ 1 \ 1 \\ \cancel{3}219 \\ - 1243 \\ \hline 1976 \end{array}$$

To be able to subtract decimals using the decomposition standard written method.

$$\begin{array}{r} 11 \ 8 \ 1 \\ \cancel{3}24.90 \\ - 7.25 \\ \hline 317.65 \end{array}$$

<p>To be able to use a pre-prepared number line to count back.</p> $10 - 2 = 8$  <p>1 2 3 4 5 6 7 8 9 10</p> <p>To be able to complete simple missing number sentences.</p> $10 - \underline{\quad} = 4$	<p>To be able to use a drawn number line to count back using partitioning.</p> $37 - 11 = 26$ <p style="text-align: center;">-1   -10</p>  <p style="text-align: center;">26 27 37</p> <p>To be able to complete missing number sentences where the missing number is shown as a symbol.</p> $65 - \triangle = 30$ $\square - 10 = 90$	<p>To be able to subtract using standard written method without decomposition.</p> $\begin{array}{r} 48 \\ - 16 \\ \hline 32 \end{array}$ <p>To be able to subtract multiples of 100 and 1000.</p> <p>To be able to find the difference between positive and negative numbers by counting back on a number line.</p>  <p style="text-align: center;">-3 -2 -1 0 1 2 3 4</p>		
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To be able to find a difference by counting back.

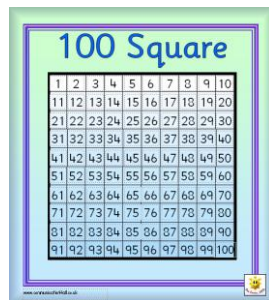
$$11 - 7$$



7 8 9 10 11

To be able to use a number line or hundred square to bridge through a multiple of 10.

$$22 - 5 = 17$$



To be able to subtract by partitioning and recombining the second number.

$$37 - 12 =$$

T  $37 - 10 = 27$

U  $27 - 2 = 25$

Vocabulary - subtract, subtraction, take-away, minus, less than, difference, decrease, leave, how many left

## Olive Hill Primary School -Multiplication Written Methods

To be able to count in 2's, 5's and 10's.

To be able to place objects in equal groups.



To be able to recall doubles and corresponding halves to at least 10.

Double 4 is 8  
Half of 8 is 4

To be able to understand that halving is the inverse of doubling and recall doubles and halves to at least 20.

Double 6 is 12  
Half of 12 is 6

To be able to record multiplication using  $\times$  and  $=$ .

To be able to multiply numbers by 10 and 100.

10	Th	H	T	U
Th				
			9	4
		9	4	0
	9	4	0	0
9	4	0	0	0

$\times 10$   $\div 10$

$94 \times 10 = 940$   
 $94 \times 100 = 9400$   
 $94 \times 1000 = 94000$

To be able to derive multiplication facts for the 3, 4, 5 and 6 times tables and the related division facts.

To be able to use the grid method for up to HTU.

$172 \times 46 =$

X	100	70	2
40	4000	2800	80
6	600	420	12

$4000 + 2800 + 80 = 6880$   
 $600 + 420 + 12 = 1032$   
 $6880 + 1032 = 7912$

To be able to use the grid method to include decimal numbers.

$4.9 \times 3 =$

X	4.0	0.9
3	12.0	2.7

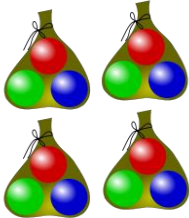
$12.0$   
 $+ 2.7$   


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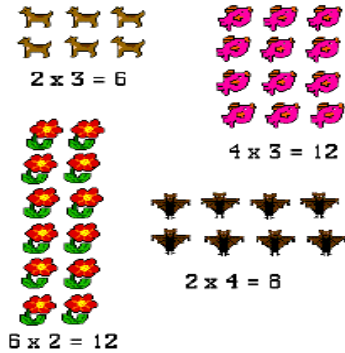
 $14.7$

To be able to derive multiplication facts for the 11 and 12 times tables and the related division facts.

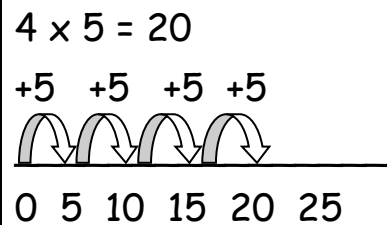


	<p>To be able to represent problems involving multiplication using pictures and symbols.</p> <p>There are 3 marbles in 1 bag. How many are there in 4 bags?</p>  <p>To be able to understand multiplication as repeated addition.</p> <p><math>3 \times 4 =</math>  <math>3 + 3 + 3 + 3</math> or  <math>4 + 4 + 4 = 12</math></p>	<p>To be able to complete number sentences where the missing numbers are shown by a symbol.</p> <p><math>4 \times \triangle = 28</math>  <math>\square \times 3 = 90</math></p> <p>To be able to partition numbers to simplify multiplication.</p> <p><math>13 \times 3 =</math>  <math>10 \times 3 = 30</math>  <math>3 \times 3 = 9</math>  <math>30 + 9 = 39</math></p>	<p>To be able to use expanded multiplication methods.</p> <p><math>32 \times 6 =</math></p> <table border="1" data-bbox="1352 472 1731 778"> <tr><td></td><td>3</td><td>2</td><td></td></tr> <tr><td>X</td><td><u>   </u></td><td><u>  6</u></td><td></td></tr> <tr><td></td><td>1</td><td>2</td><td>(2x6)</td></tr> <tr><td><u>  1</u></td><td><u>  8</u></td><td><u>  0</u></td><td>(30x6)</td></tr> <tr><td>1</td><td>9</td><td>2</td><td>(32x6)</td></tr> </table> <p>To be able to derive multiplication facts for the 7, 8 and 9 times tables and the related division facts.</p>		3	2		X	<u>   </u>	<u>  6</u>			1	2	(2x6)	<u>  1</u>	<u>  8</u>	<u>  0</u>	(30x6)	1	9	2	(32x6)	<p>To be able to use the compact method of multiplication for HTU x U.</p> <p><math>342 \times 7 =</math></p> $\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \end{array}$ <p>21</p> <p>To be able to use the compact method of multiplication for TU x TU.</p> <p><math>24 \times 37 =</math></p> $\begin{array}{r} 24 \\ \times 37 \\ \hline 168 \\ 720 \\ \hline 888 \end{array}$
	3	2																						
X	<u>   </u>	<u>  6</u>																						
	1	2	(2x6)																					
<u>  1</u>	<u>  8</u>	<u>  0</u>	(30x6)																					
1	9	2	(32x6)																					

To be able to understand multiplication as an array.



To be able to understand multiplication as repeated addition using a number line.



To be able to solve problems involving multiples of 10, 100 and 1000.

$$6 \times 20$$

↓

$$2 \times 10$$

$$= 6 \times 2 \times 10$$

$$= 120$$

To be able to use the grid method to solve more complex problems using HTU.

$72 \times 38 =$

X	70	2
30	2100	60
8	560	16

$2160$   
 $+ 576$   


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 $2736$   
 1

To be able to use the compact method of multiplication for TU x U.

$24 \times 5 =$

$$\begin{array}{r}
 24 \\
 \times 5 \\
 \hline
 120 \\
 2
 \end{array}$$

To be able to use the long method of multiplication.

$124 \times 26 =$

$$\begin{array}{r}
 \phantom{1}2 \\
 124 \\
 \times 26 \\
 \hline
 744 \\
 2480 \\
 \hline
 3224 \\
 \hline
 11
 \end{array}$$

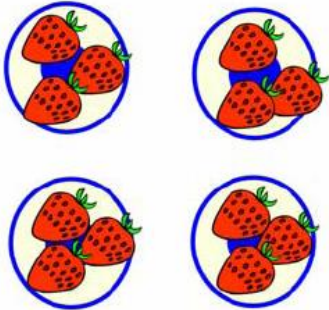
	<p>To be able to derive multiplication facts for the 2, 5 and 10 times tables and begin to derive related division facts.</p> $6 \times 5 = 30$ $30 \div 5 = 6 \text{ or}$ $30 \div 6 = 5$ <p>To recognise <math>\times</math> as the inverse of <math>\div</math>.</p>			
<p>Vocabulary - multiply, multiplication, multiple, times, lots of, groups of, product, 10 times...</p>				

Olive Hill Primary School -Division Written Methods

To be able to count in 2's, 5's and 10's.

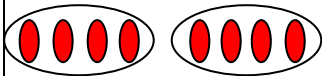
To be able to share items into equal groups.

$$12 \div 4 = 3$$



To be able to understand the concept of division and sharing and grouping.

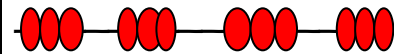
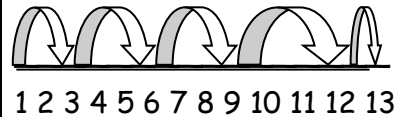
$$8 \div 4 = 2$$



To be able to represent problems using pictures and symbols.

To be able to understand division as repeated addition with remainders.

$$13 \div 3 =$$



To be able to divide by chunking (HTU).

$$972 \div 36 =$$

$$\begin{array}{r} 27 \\ 36 \overline{) 972} \\ \underline{720} \quad 20 \times 36 \\ 252 \\ \underline{252} \quad 7 \times 36 \\ 0 \end{array}$$

To be able to use the compact division method showing the remainder as a decimal.

$$3859 \div 6 =$$

$$\begin{array}{r} 643.17 \\ 6 \overline{) 3859.00} \\ \underline{321} \phantom{14} \\ 643 \phantom{14} \\ \underline{638} \phantom{14} \\ 59 \phantom{14} \\ \underline{54} \phantom{14} \\ 14 \\ \underline{12} \\ 20 \\ \underline{18} \\ 20 \\ \underline{18} \\ 20 \\ \underline{18} \\ 20 \end{array}$$

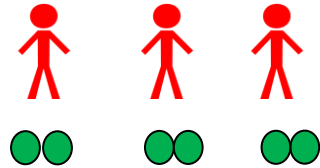
To be able to express the remainder as a fraction.

$$496 \div 11 =$$

$$\begin{array}{r} 45 \text{ r } 1 \\ 11 \overline{) 496} \\ \underline{45} \phantom{0} \\ 46 \\ \underline{44} \\ 26 \\ \underline{22} \\ 46 \\ \underline{44} \\ 2 \end{array}$$

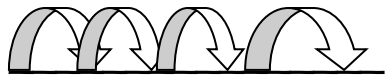
$$\text{Answer} = 45 \frac{1}{11}$$

There are 6 sweets each person has 2 sweets. How many people get 2 sweets?

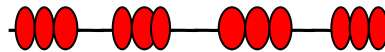


To be able to understand division as repeated addition.

$$12 \div 3 =$$



1 2 3 4 5 6 7 8 9 10 11 12

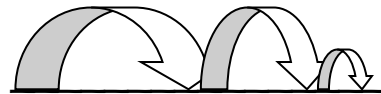


To be able to divide using a blank number line and grouping the divisor.

$$72 \div 5 =$$

How many lots of 5 in 72?

10 lots of 5 = 50    4 lots of 5 = 20    2 left over



0                      50                      70 72

$$10 + 4 = 14 \text{ r}2$$

To be able to complete number sentences where the missing numbers if shown by a symbol.

$$35 \div \triangle = 7$$

$$\square \div 10 = 8$$

To be able to use the long method of division.

$$432 \div 15 =$$

$$\begin{array}{r} 28 \text{ r } 12 \\ 15 \overline{) 432} \\ \underline{300} \quad (15 \times 20) \\ 132 \\ \underline{120} \quad (15 \times 8) \\ 12 \end{array}$$

To be able to use the long method of division and express the remainder as a fraction.

$$432 \div 15 =$$

$$\begin{array}{r} 28 \\ 15 \overline{) 432} \\ \underline{300} \quad (15 \times 20) \\ 132 \\ \underline{120} \quad (15 \times 8) \\ 12 \end{array}$$

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

$$\text{Answer} = 28 \frac{4}{5}$$

	<p>To be able to record division using <math>\div</math> and <math>=</math>.</p> <p>To recognise <math>\div</math> as the inverse of <math>\times</math>.</p>	<p>To be able to use the short method of division.</p> $98 \div 7 =$ $\begin{array}{r} 14 \\ 7 \overline{) 98} \end{array}$ <p>To be able to use the compact division method (bus stop method) with a remainder.</p> $357 \div 6 =$ $\begin{array}{r} 59 \text{ r}3 \\ 6 \overline{) 357} \end{array}$		<p>To be able to use long method of division and express the remainder as a decimal.</p> $432 \div 15 =$ $\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \phantom{0} \\ 132 \\ \underline{120} \phantom{0} \\ 120 \\ \underline{120} \\ 0 \end{array}$
<p>Vocabulary - divide, division, divided by, share, sharing, equal, how many, remainder, factor, chunking</p>				

# Appendix 1