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## Calculation Policy

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Position	Mathematics Lead
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# Thurnham CE Infant School

## *Progression towards a standard method of calculation*

### Introduction

The 2014 National Curriculum provides a structured and systematic approach to the teaching of calculation. This policy should be read in conjunction with our mathematics policy and the mathematics progression document. At Thurnham CE Infant School, we followed the White Rose Maths Hub (WRMH) scheme of learning (version 3) in KS1 and the WRMH for EYFS with the link to Numberblocks.

### Providing a context for calculation

This calculation policy is organised according to age appropriate expectations as set out in the National Curriculum 2014. We have a mastery approach, which focuses on fluency, reasoning and problem solving.

It is important that any type of calculation is given a real-life context or problem-solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods. It is also important for children to be confident to use mental and written strategies to explain their thinking.

At Thurnham you will see children using a Concrete, Pictorial, Abstract approach when performing calculations. In practice this means that right across the school there will be a range of resources for the children to use: children will use jottings or pictorial representations of calculations and mental methods to help them with their calculations.

### Aims

The aim of this policy is to ensure all children leave Thurnham CE Infants with a secure understanding of the four operations and can confidently use both written and mental calculation strategies in a range of contexts. We will facilitate this using our superpowers of **Brainpower**, **Resilience** and **Independence** and all our teaching and learning is underpinned by the Christian value of **Love**.

### Mathematical Vocabulary

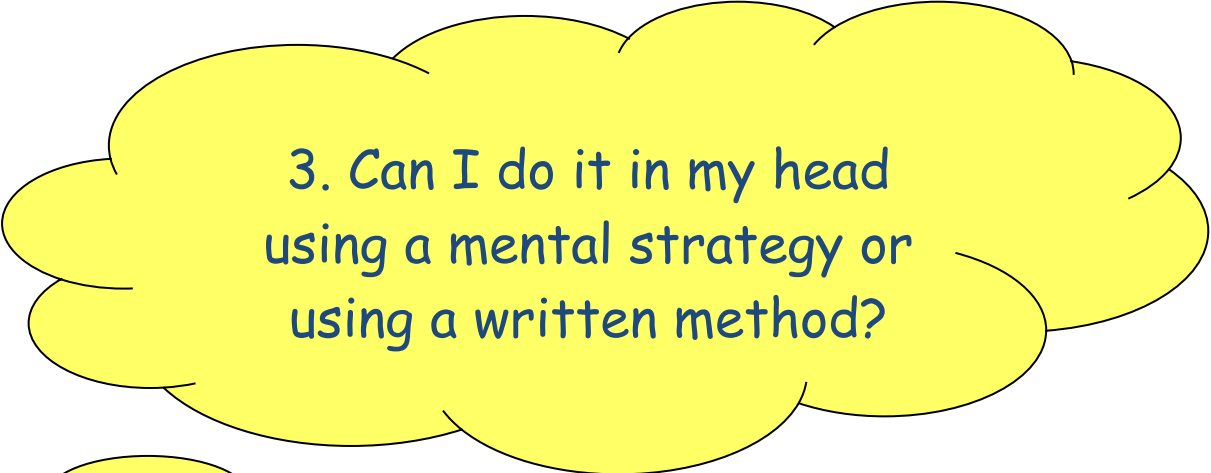
See *Appendix A* for relevant mathematical vocabulary by year group.

### Progression in Calculation

To develop efficient written calculation strategies children need:

- Secure mental methods which are developed from early years
- A solid understanding of the number system
- Practical hands on experience including a range of manipulatives
- Visual models and images including part-whole models, number lines and arrays
- Secure understanding of each stage before moving onto the next.

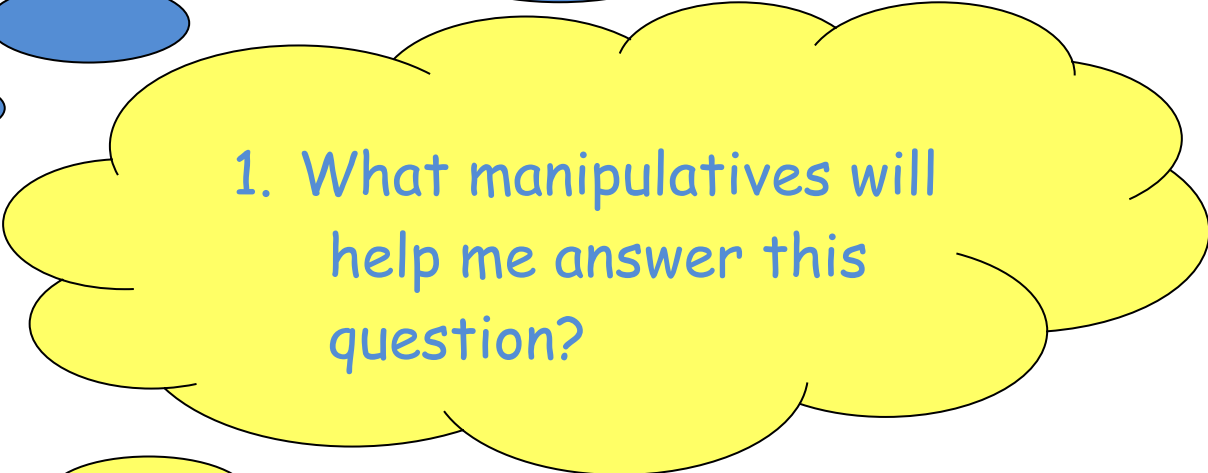
Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved:



3. Can I do it in my head  
using a mental strategy or  
using a written method?



2. Could I use some  
jottings to help me?



1. What manipulatives will  
help me answer this  
question?

## A Pathway to Teaching Calculation Methods

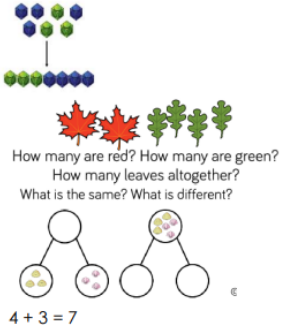
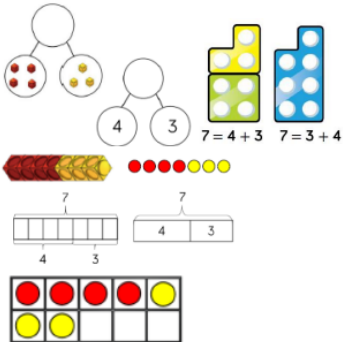
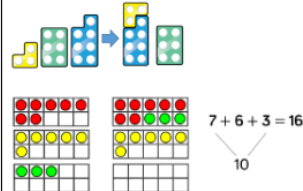

Expanded methods should be viewed as steps towards a standard method and not as methods in themselves. Before beginning to record in a more refined written format, children must have had significant practical work reinforced with appropriate manipulative, models and images. Teachers will guide pupils to refine their written methods of recording by modelling and asking questions such as “What is the same? What’s different?” Learning will be well planned to ensure pupils are encouraged to use and apply what they have learnt to problem solving tasks. As children move along the pathway it is vital that they practice, reinforce, consolidate, use and apply NOT simply move onto the next step.

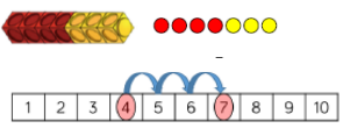

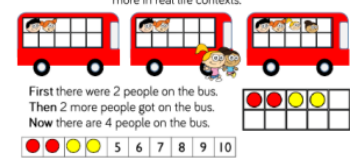
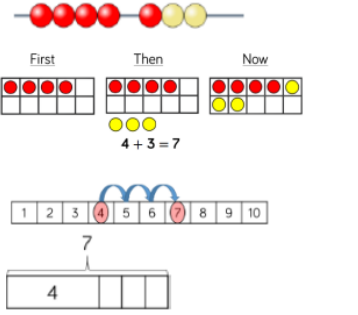
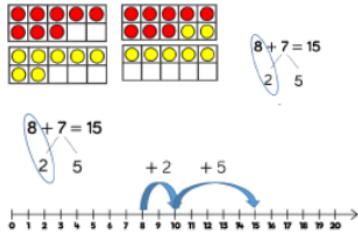
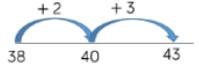
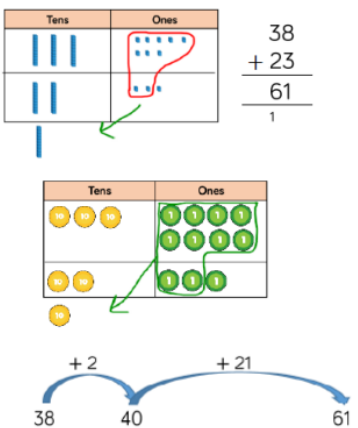
The tables below explain the statutory expectations, rapid recall /mental calculations and non-statutory guidance for the teaching and progression for each of the four calculation methods at Thurnham CE Infant School.

	<b>Addition</b>		
<b>FS</b>	ELG: Number Children at the expected level of development will: <ul style="list-style-type: none"> <li>- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.</li> </ul>		
	Statutory expectations	Rapid recall /mental calculations	Non-statutory guidance
<b>Y1</b>	Add (and subtract) one-digit and two-digit numbers to 20 ( $9 + 9$ , $18 - 9$ ), including zero  Read/write/interpret statements involving addition (+), subtraction (-) and equals (=) signs.	Represent/use number bonds (and related subtraction facts) within 20.  Missing number problems (e.g. $16 = ? + 9$ )	<i>Memorise/reason with bonds to 10/20 in several forms (e.g. <math>9 + 7 = 16</math>; <math>16 - 7 = 9</math>; <math>7 = 16 - 9</math>). Pupils should realise the effect of adding or subtracting zero - establishes +/- as related operations.</i>  <i>Pupils combine and increase numbers, counting forwards and backwards.</i>
<b>Y2</b>	TU + U TU + tens TU + TU U + U + U  [Show addition of two numbers can be done in any order.]	Recall and use addition facts to 20 fluently. Derive and use related facts up to 100.  Solve problems by applying increasing knowledge of mental methods.	<i>Pupils extend understanding of the language of + to include <b>sum</b>.</i> <i>Practise + to 20 to derive facts such as using <math>3 + 7 = 10</math> to calculate <math>30 + 70 = 100</math>, <math>100 - 70 = 30</math> and <math>70 = 100 - 30</math>. Check calcs, including by adding numbers in a different order to check +</i> <i>Establishes commutativity and associativity of addition.</i>

**What will this look like?**


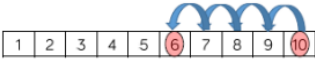

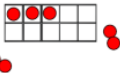
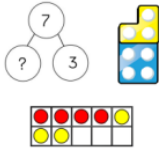
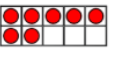
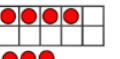
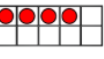
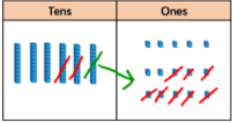
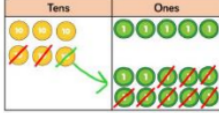
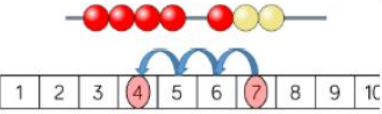


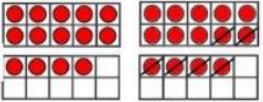

# Addition

	Reception	Year 1	Year 2
<b>Objective</b>	Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer	Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs  Represent and use number bonds and related subtraction facts within 20  Add and subtract one-digit and two-digit numbers to 20, including zero  Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \_ - 9$ .	Add and subtract up to two two-digit numbers using concrete objects, pictorial representations progressing to formal written methods (column method)  Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot  Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems
<b>Developing Conceptual Understanding</b>	<p><b>Combining two groups to make a whole</b></p> <p><b>Aggregation (where parts are combined together to make whole):</b> part whole model, numicon and tens frames</p>  <p>How many are red? How many are green? How many leaves altogether? What is the same? What is different?</p> <p><math>4 + 3 = 7</math></p>	<p><b>Adding to 10, children explore both aggregation and augmentation.</b></p> <p><b>Aggregation (where parts are combined together to make whole):</b> part whole model, bar model, numicon and tens frames</p>  <p><math>7 = 4 + 3</math> <math>7 = 3 + 4</math></p>	<p><b>Add three 1-digit numbers.</b> Look for number bonds to 10 or doubles to add the numbers more efficiently.</p>  <p><math>7 + 6 + 3 = 16</math></p> <p><b>Add 1-digit and 2-digit numbers to 100.</b> Count on from the larger number. Apply knowledge of number bonds <math>8 + 5 = 13</math> so <math>38 + 5 = 43</math>.</p> 

<p>I have 4 apples and I pick 3 more, how many have I got altogether?</p> <p><b>Counting on</b></p>  <p><b>Augmentation (increasing a number):</b> bead string, bar model, ten frame, number track <math>7 + 3 =</math></p>  <p><b>Add two single digit numbers</b></p> <p>Use first, then now to tell simple maths stories to practise adding more in real life contexts.</p>  <p><b>Number bonds to 10</b></p>	<p><b>Augmentation (increasing a number):</b> bead string, bar model, ten frame, number track</p>  <p><b>Add 1 digit and 2 digits to 20 (focus on partitioning)</b></p> 	 <p><b>Add two 2-digit numbers to 100.</b> Use formal column method when calculating alongside base 10 or place value counters. Use a blank number line to encourage children to jump to multiples of 10 to become more efficient.</p> 
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# Subtraction

	Reception	Year 1	Year 2
<b>Objective</b>	Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer	Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs  Represent and use number bonds and related subtraction facts within 20  Add and subtract one-digit and two-digit numbers to 20, including zero  Solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = - 9$ .	Add and subtract up to two two-digit numbers using concrete objects, pictorial representations progressing to formal written methods (column method)  Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot  Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
<b>Developing Conceptual Understanding</b>	<p><b>Count back to find the answer</b></p>  <p><math>10 - 4 = 6</math></p>  <p><b>Subtract two single-digit numbers</b></p> <p>Use first, then now to tell simple maths stories to practise taking away in familiar contexts.</p>  <p>First there were 5 people on the bus. Then 2 people got off the bus. Now there are 3 people on the bus.</p> 	<p><b>Subtract 1-digit numbers within 10</b></p> <p><b>Partitioning</b></p>  <p><b>Reduction</b></p> <p>First:  Then:  Now:  <math>7 - 3 = 4</math></p>	<p><b>Subtract 1 and 2 digit numbers to 100. Use formal column methods alongside base 10 and place value counters. Use blank number lines to count on to find the difference. Encourage them to jump in multiples of 10 to become more efficient.</b></p>  $\begin{array}{r} 51 \\ - 28 \\ \hline 37 \end{array}$ 
		 <p><b>Difference</b></p>   <p><b>Subtract 1 and 2-digit numbers to 20</b></p> <p>When crossing 10, it is important to highlight that ten ones equal one ten. Children should be encouraged to find number bond to 10 when partitioning the subtracted number.</p>  	
<b>With Jotting...or in Your Head</b>	Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer	Represent and use number bonds and related subtraction facts within 20	<p>Add and subtract numbers mentally, including:</p> <ul style="list-style-type: none"> <li>- A two-digit number and ones</li> <li>- A two-digit number and tens</li> <li>- Two two-digit numbers</li> <li>- Adding three one-digit numbers</li> </ul> <p>Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100</p>

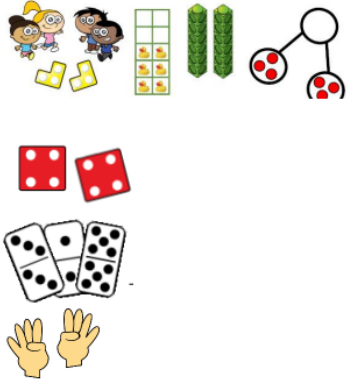
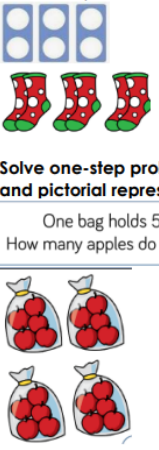
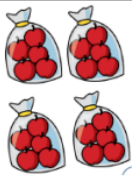
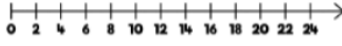



## Multiplication

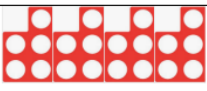

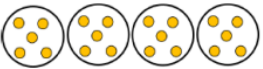

FS	To solve problems including doubling, halving and sharing.		
	Statutory expectations	Rapid recall /mental calculations	Non-statutory guidance
Y1	Solve one-step problems using concrete objects, pictorial representations and arrays ( <i>with the support of the teacher</i> ).		<i>Doubling numbers/quantities.</i>  <i>Count on/back in 2s, 5s and 10s.</i>
Y2	Calculate statements for multiplication within the multiplication tables and write them using the multiplication and equals signs.  [Show multiplication of two numbers can be done in any order.]	Recall and use multiplication facts for the 2, 5 and 10 multiplication tables, (including recognising odd and even numbers).  <i>Use commutativity/inverse relations to develop multiplicative reasoning (e.g. <math>4 \times 5 = 20</math> and <math>20 \div 5 = 4</math>).</i>	<i>Pupils ... practise to become fluent in the 2/5/10 multiplication tables and connect them to each other.</i>  <i>They connect the 10x table to place value, and the 5x table to divisions on the clock face.</i>  <i>They begin to use other multiplication tables and recall facts, including using related division facts to perform written and mental calculations.</i>

**What will this look like?**



# Multiplication



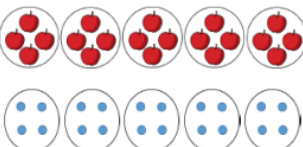


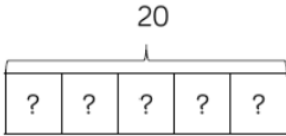

	Reception	Year 1	Year 2
Objective	They solve problems, including doubling, halving and sharing	Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication ( $\times$ ), division ( $\div$ ) and equals (=) signs  Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot  Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts
Developing Conceptual Understanding	<b>Doubling</b> Use language of <i>four add four equals 8</i>  	<b>Count in 2, 5 and 10</b>    <b>Solve one-step problems using concrete and pictorial representation.</b> One bag holds 5 apples. How many apples do 4 bags hold?  	<b>Count in multiples forwards and backwards.</b>       <b>Repeated addition</b> 

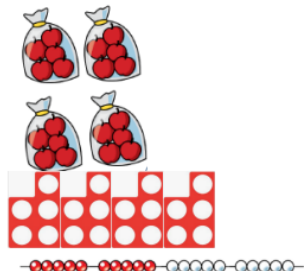
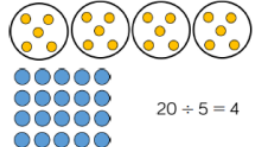
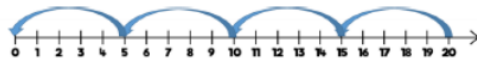
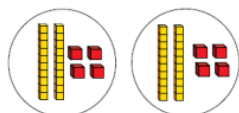
			$5 \times 2 = 2 \times 5$   One bag holds 5 apples. How many apples do 4 bags hold?    $5 + 5 + 5 + 5 = 20$ $4 \times 5 = 20$ $5 \times 4 = 20$
With Jotting...or in Your Head		Count in multiples of twos, fives and tens	Recall and use $\times$ and $\div$ facts for the 2, 5 and 10 x tables, including recognising odd and even numbers.

Division			
FS	To solve problems including doubling, halving and sharing.		
	Statutory expectations	Rapid recall /mental calculations	Non-statutory guidance
Y1	Solve one-step problems using concrete objects, pictorial representations and arrays ( <i>with the support of the teacher</i> ).	Recognise/find/name $\frac{1}{2}$ as one of two equal parts of an object, shape or quantity.  Recognise/find/name $\frac{1}{4}$ as one of four equal parts of an object, shape or quantity.	<i>Find simple fractions of objects, numbers and quantities.</i>  <i>Count on/back in 2s, 5s and 10s.</i>
Y2	Calculate statements within the multiplication tables and write them using the division and equals signs.  [Show division of two numbers <u>cannot</u> be done in any order.]  Find $\frac{1}{3}$ , $\frac{1}{4}$ , $\frac{2}{4}$ , $\frac{3}{4}$ of a length/objects/quantity. Write simple fractions e.g. $\frac{1}{2}$ of 6 = 3.	Recall & use division facts for the 2, 5 and 10 multiplication tables.  Recognise/find/name/write fractions $\frac{1}{3}$ , $\frac{1}{4}$ , $\frac{2}{4}$ , $\frac{3}{4}$ of a (length, shape), set of objects or quantity.  Write simple fractions eg $\frac{1}{2}$ of 6 = 3 and recognise equivalence of two quarters and one half.  <i>Use commutativity/inverse relations to develop multiplicative reasoning (eg <math>4 \times 5 = 20</math> and <math>20 \div 5 = 4</math>).</i>	<i>Begin to use other multiplication tables/recall facts, including related division facts to perform written/mental calculations.</i>  <i>Work with materials/contexts where division relate to grouping/sharing quantities. They begin to relate these to fractions/measures (eg <math>40 \div 2 = 20</math>, 20 is a half of 40).</i>  <i>They connect unit fractions to equal sharing and grouping, to numbers and to measures.</i>

**What will this look like?**

# Division

	Reception	Year 1	Year 2
<b>Objective</b>	They solve problems, including doubling, halving and sharing.	Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher	Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication ( $\times$ ), division ( $\div$ ) and equals (=) signs  Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot  Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.
<b>Developing Conceptual Understanding</b>	<b>Sharing and use language of half</b>  	<b>Sharing</b> There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?   <b>Grouping</b> There are 20 apples altogether. They are put in bags of 5. How many bags are there? 	<b>Sharing</b> There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?  $20 \div 5 = 4$   <b>Grouping</b> There are 20 apples altogether. They are put in bags of 5. How many bags are there? 

			 $20 \div 5 = 4$  <p>Divide 2-digits by 1-digit (sharing with no exchange)</p> $48 \div 2 = 24$  <table border="1" data-bbox="979 1579 1219 1677"> <thead> <tr> <th colspan="2">Tens</th> <th colspan="4">Ones</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>10</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>10</td> <td>10</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Tens		Ones				10	10	1	1	1	1	10	10	1	1	1	1
Tens		Ones																			
10	10	1	1	1	1																
10	10	1	1	1	1																
With Jotting...or in Your Head		Count in multiples of twos, fives and tens	Recall and use $\times$ and $\div$ facts for the 2, 5 and 10 $\times$ tables, including recognising odd and even numbers.																		

## Appendix A

### Mathematical Vocabulary

#### NUMBER

##### COUNTING, PROPERTIES OF NUMBERS AND NUMBER SEQUENCES

number, zero, one, two, three... to twenty and beyond, zero, ten, twenty... one hundred, zero, one hundred, two hundred... one thousand none how many...? count, count (up), to count on, (from, to) count back, (from, to) count in ones, twos, threes, fours, fives... count in tens, more, less, many, few, tally, odd, even, every other, how many times? multiple of, sequence, continue, predict, pattern, pair, rule, =, <, > signs

##### PLACE VALUE AND ORDERING

units, ones, tens, hundreds, digit, one-, two- or three-digit number 'teens' number, place, place value, stands for, represents, exchange, the same number as, as many as, equal to, of two objects/amounts: greater, more, larger, bigger less, fewer, smaller, of three or more objects/amounts: greatest, most, biggest, largest, least, fewest, smallest, one more, ten more one less, ten less, compare, order, size, first, second, third... tenth... twentieth twenty-first, twenty-second... last, last but one, before, after next between, half-way between, above, below

##### ESTIMATING

guess how many, estimate, nearly, roughly, close to, about the same as, just over, just under, exact, exactly, too many, too few, enough, not enough, round, nearest, round to the nearest ten

##### FRACTIONS

part, equal parts, fraction, one whole, one half, two halves, one quarter, two... three... four quarters

##### ADDITION AND SUBTRACTION

+, 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...? – 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, inverse, part whole.

##### MULTIPLICATION AND DIVISION

lots of, groups of  $\times$ , times, multiply, multiplied by multiple of once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array row, column double, halve share, share equally one each, two each, three each... group in pairs, threes... tens equal groups of  $\div$ , divide, divided by, divided into left, left over

##### MEASUREMENT

(GENERAL) measure, size, compare, measuring, scale, guess, estimate, enough, not enough, too much, too little, too many, too few, nearly, roughly, about, close to, about the same as, just over, just under

## LENGTH

length, width, height, depth, long, short, tall, high, low, wide, narrow, deep, shallow, thick, thin, longer, shorter, taller, higher... and so on longest, shortest, tallest, highest... and so on far, further, furthest, near, close, metre (m), centimetre (cm) ruler, metre stick, tape measure

## MASS

weigh, weighs, balances, heavy/light, heavier/lighter, heaviest/lightest, kilogram (kg), half-kilogram, gram (g) balance, scales, weight

## CAPACITY

capacity, full, half full, empty, holds, contains, litre (l), half-litre, millilitre (ml), container

## TIME

time, days of the week: Monday, Tuesday... months of the year: January, February... seasons: spring, summer, autumn, winter, day, week, fortnight, month, year, weekend, birthday, holiday, morning, afternoon, evening, night, midnight, bedtime, dinnertime, playtime, today, yesterday, tomorrow, before, after next, last, now, soon, early, late, quick, quicker, quickest, quickly, fast, faster, fastest, slow, slower, slowest, slowly, old, older, oldest, new, newer, newest, takes longer, takes less time, how long ago? how long will it be to...? how long will it take to...? hour, minute, second, o'clock, half past, quarter to, quarter past, clock, watch, hands, digital/analogue clock/watch, timer, how often? always, never, often, sometimes, usually, once, twice

## TEMPERATURE

degrees °C

## MONEY

coin, penny (p), pence, pound (£), price, cost, buy, bought, sell, sold, spend, spent, pay, change, dear, costs, more, cheap, costs less, cheaper, how much...? how many...? total

## GEOMETRY

### SHAPE AND SPACE

shape, pattern, flat, curved, straight, round, hollow, solid, corner, point, pointed face, side, edge, end sort make, build, draw, surface, edges, vertices, faces

### 3D SHAPES

cube, cuboid, pyramid, sphere, cone, cylinder

### 2D SHAPES

circle, circular, triangle, triangular, square, rectangle, rectangular, star, pentagon, hexagon, octagon

## PATTERNS AND SYMMETRY

size, bigger, larger, smaller, symmetrical, line of symmetry, fold, match, mirror line, reflection, pattern, repeating pattern

## POSITION, DIRECTION AND MOVEMENT

position over, under, underneath, above, through, to, from, towards, away from, clockwise, anti-clockwise, movement, slide, roll, whole turn, half turn, quarter turn, right angle, straight line, stretch, bend

## STATISTICS

Organising, data, count, tally, sort, vote, graph, block graph, pictogram, represent, group, set, same, different, list, table, label, title, most popular, most common, least popular, least common

## MAKING DECISIONS AND REASONING

pattern, puzzle, calculate, calculation, mental calculation jotting, answer, right, correct, wrong what could we try next? how did you work it out? number sentence, sign, operation, symbol

## INSTRUCTIONS

Listen, join in, say, recite, think, imagine, remember, start from, start with, start at, look at, point to, show me, put, place, fit, arrange, rearrange, change, change over, split, separate, carry on, continue, repeat, what comes next? Predict, describe, the pattern, describe the rule, find, find all, find different, investigate, choose, decide, collect, use, make, build, tell me, describe, name, pick out, discuss, talk about, explain, explain your method, explain how you got your answer, give an example of... show how you... read, write, record, write in figures, present, represent, trace, copy, complete, finish, end, fill in, shade, colour, label, tick, cross, draw, draw a line between, join (up), ring, arrow,

cost, count, tally, calculate, work out, solve, answer, check

## GENERAL

same, different, missing number/s, number facts, number pairs, number bonds,

number line, number track, number square, hundred square, number cards, number grid, abacus, counters, cubes, blocks, rods, die, dice, dominoes, pegs, peg board, geo-strips, same way, different way, best way, another way, in order, in a different order, not, all, every, each