

Stocksbridge Junior School



*Learning Together*

# Calculation Guide for Parents

## Year 3

## **Introduction**

At the centre of the mastery approach to the teaching of Mathematics is the belief that all pupils have the potential to succeed. They should have access to the same curriculum content and, rather than being extended with new learning, they should deepen their conceptual understanding by tackling challenging and varied problems. Similarly, with calculation strategies, pupils must not simply rote learn procedures but demonstrate their understanding of these procedures through the use of concrete materials and pictorial representations. This document outlines the different calculation strategies that should be taught and used in Years 1 to 6, in line with the requirements of the 2014 Primary National Curriculum.

## **Purpose**

The purpose of this document is threefold. Firstly, it outlines the structures for calculations, which ensure pupils are exposed to both standard and non-standard problems. Secondly, it makes parents aware of the strategies that pupils are formally taught within each year group, which will support them to perform mental and written calculations. Finally, it supports teachers and parents in identifying appropriate pictorial representations and concrete materials to help develop understanding.

## **How to use the document**

For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The purpose of using multiple representations is to give pupils a deep understanding of a mathematical concept and they should be able to work with and explain concrete, pictorial and abstract representations, and explain the links between different representations. Depth of understanding is achieved by moving between these representations. For example, if a child has started to use a pictorial representation, it does not mean that the concrete cannot be used alongside the pictorial. If a child is working in the abstract, depth can be evidenced by asking them to exemplify their abstract working using a concrete or pictorial representation and to explain what they have done using the correct mathematical vocabulary.

# Progression in calculations

## Year 3

### National Curriculum objectives linked to addition and subtraction

**These objectives are explicitly covered through the strategies outlined in this document:**


- add and subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds
- add and subtract numbers with up to four digits, using formal written methods of columnar addition and subtraction (four digits is Year 4)
- find 10 or 100 more or less than a given number
- find 1 000 more or less than a given number (Year 4)
- estimate the answer to a calculation and use inverse operations to check answers

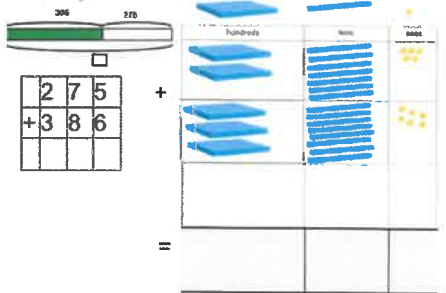
**The following objectives should be planned for lessons where new strategies are being introduced and developed:**

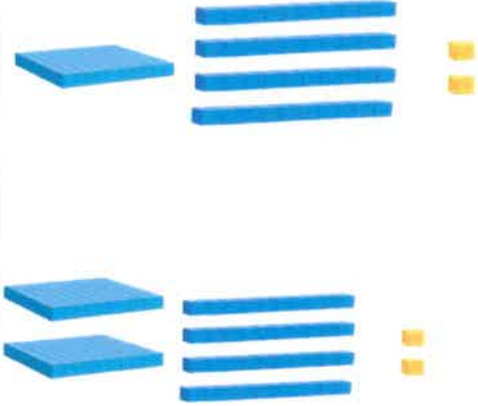
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction

**Teachers should refer to definitions and guidance on the [structures for addition and subtraction](#) to provide a range of appropriate real-life contexts for calculations.**

### Y3 Addition & Subtraction

Strategy & guidance	CPA														
<p><b>Add and subtract numbers mentally, including:</b></p> <ul style="list-style-type: none"> <li>• a three-digit number and ones;</li> <li>• a three-digit number and tens;</li> <li>• a three-digit number and hundreds</li> </ul> <p><i>Pupils learn that this is an appropriate strategy when they are able to use known and derived number facts or other mental strategies to complete mental calculations with accuracy.</i></p> <p><i>To begin with, some pupils will prefer to use this strategy only when there is no need to regroup, using number facts within 10 and derivations. More confident pupils might choose from a range of mental strategies that avoid written algorithms, including (but not exhaustively):</i></p> <ul style="list-style-type: none"> <li>• known number facts within 20,</li> <li>• derived number facts,</li> <li>• ‘Make ten’,</li> <li>• round and adjust</li> </ul> <p><i>See Year 2 guidance for exemplification of these – the use of concrete manipulatives other than Dienes blocks is important in reinforcing the use of these strategies.</i></p> <p><i>It is important that pupils are given plenty of (scaffolded) practice at choosing their own strategies to complete calculations efficiently and accurately. Explicit links need to be made between familiar number facts and the calculations that they can be useful for and pupils need to be encouraged to aim for efficiency.</i></p>	<p>It is important to model the mental strategy using concrete manipulatives in the first instance and pupils should be able to exemplify their own strategies using manipulatives if required, with numbers appropriate to the unit they are working on (3-digit numbers in Units 1 &amp; 4; 4-digit numbers in Unit 13). However, pupils should be encouraged to use known facts to derive answers, rather than relying on counting manipulatives or images.</p> <p><u>No regrouping</u></p> <table> <tr> <td><math>345 + 30</math></td> <td><math>274 - 50</math></td> </tr> <tr> <td><math>1128 + 300</math></td> <td><math>1312 - 300</math></td> </tr> <tr> <td><math>326 + 342</math></td> <td><math>856 - 724</math></td> </tr> </table> <div style="display: flex; align-items: center; margin-top: 10px;">  <div style="margin-left: 10px; color: red;"> <p>I know <math>4 + 3 = 7</math>, so 4 tens plus 3 tens is equal to 7 tens. <math>345 + 30 = 375</math>.</p> </div> </div> <p><u>With some regrouping</u></p> <table> <tr> <td><math>416 + 25</math></td> <td><math>232 - 5</math></td> </tr> <tr> <td><math>383 + 130</math></td> <td><math>455 - 216</math></td> </tr> <tr> <td><math>611 + 194</math></td> <td><math>130 - 40</math></td> </tr> <tr> <td><math>1482 + 900</math></td> <td><math>2382 - 500</math></td> </tr> </table>	$345 + 30$	$274 - 50$	$1128 + 300$	$1312 - 300$	$326 + 342$	$856 - 724$	$416 + 25$	$232 - 5$	$383 + 130$	$455 - 216$	$611 + 194$	$130 - 40$	$1482 + 900$	$2382 - 500$
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Strategy & guidance	CPA						
<p><b>Written column method for calculations that require regrouping with up to 4-digits</b></p> <p><i>Dienes blocks should be used alongside the pictorial representations during direct teaching and can be used by pupils both for support and challenge. Place value counters can also be introduced at this stage.</i></p> <p><i>This work revises and reinforces ideas from Key Stage 1, including the focus on place value – see Year 2 exemplification.</i></p> <p><i>Direct teaching of the columnar method should require at least one element of regrouping, so that pupils are clear about when it is most useful to use it. Asking them ‘Can you think of a more efficient method?’ will challenge them to apply their number sense / number facts to use efficient mental methods where possible.</i></p> <p><i>As in Year 2, pupils should be given plenty of practice with calculations that require multiple separate instances of regrouping. In Year 3 they become more familiar with calculations that require ‘regrouping to regroup’. Understanding must be secured through the considered use of manipulatives and images, combined with careful use of language.</i></p> <p><i>Pupils should be challenged as to whether this is the most efficient method, considering whether mental methods (such as counting on, using known number facts, round and adjust etc.) may be likelier to produce an accurate solution.</i></p> <p><i>Pupils requiring support might develop their confidence in the written method using numbers that require no regrouping.</i></p> <p><i>See Unit materials for extra guidance on this strategy.</i></p>	<p>As for the mental strategies, pupils should be exposed to concrete manipulatives modelling the written calculations and should be able to represent their written work pictorially or with concrete manipulatives when required.</p> <p>Again, they should be encouraged to calculate with known and derived facts and should not rely on counting images or manipulatives.</p>  <p><b>5 + 6 = 11 so I will have 11 ones which I regroup for 1 ten and 1 one.</b></p> <p><u>Regrouping (including multiple separate instances)</u></p> <table data-bbox="869 1265 1316 1444"> <tbody> <tr> <td>672 + 136</td> <td>734 – 82</td> </tr> <tr> <td>468 + 67</td> <td>831 - 76</td> </tr> <tr> <td><b>275 + 386</b></td> <td>435 – 188</td> </tr> </tbody> </table> <p><u>‘Regrouping to regroup’</u></p> <p>204 – 137</p> <p>1035 - 851</p>	672 + 136	734 – 82	468 + 67	831 - 76	<b>275 + 386</b>	435 – 188
672 + 136	734 – 82						
468 + 67	831 - 76						
<b>275 + 386</b>	435 – 188						

Strategy & guidance	CPA
<p><b>Find 10, 100 more or less than a given number</b></p> <p><i>As pupils become familiar with numbers up to 1000, place value should be emphasised and comparisons drawn between adding tens, hundreds (and, in the last unit of the Summer term, thousands), including use of concrete manipulatives and appropriate images.</i></p> <p><i>After initial teaching, this should be incorporated into transition activities and practised regularly.</i></p>	<p><math>142 + 100 = 242</math></p> 



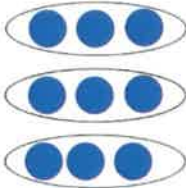
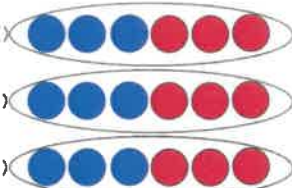
## National Curriculum objectives linked to multiplication and division

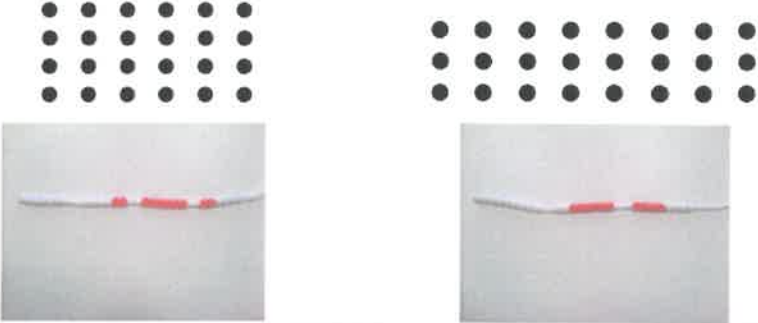
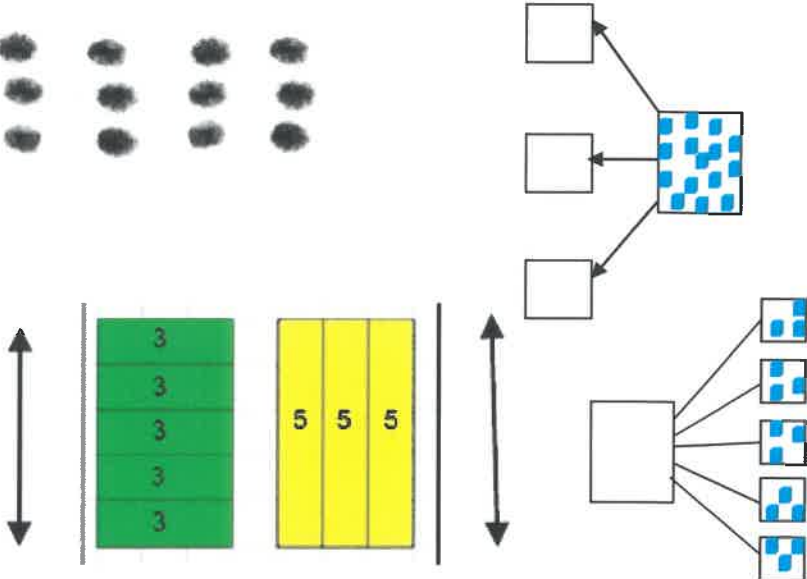
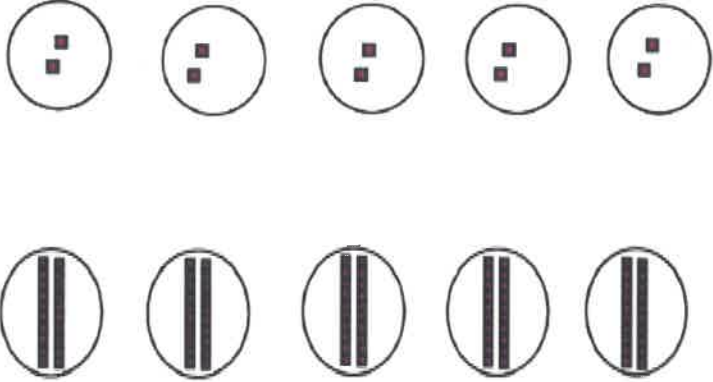
These objectives are explicitly covered through the strategies outlined in this document:

- count from 0 in multiples of 4, 8, 50 and 100
- recall and use multiplication and division facts for the 3, 4, 6, and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which  $n$  objects are connected to  $m$  objects














Teachers should refer to definitions and guidance on the [structures for multiplication and division](#) to provide a range of appropriate real-life contexts for calculations.

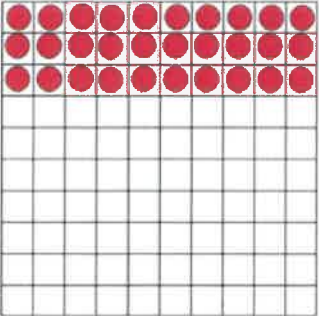
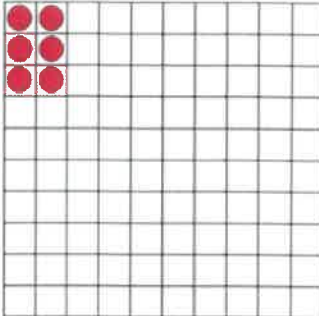






### Y3 Multiplication









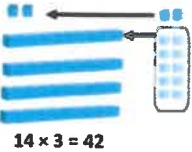





Strategy & guidance	CPA	
<p><b>Doubling to derive new multiplication facts</b></p> <p><i>Pupils continue to make use of the idea that facts from easier times tables can be used to derive facts from related times tables using doubling as a strategy.</i></p> <p><i>This builds on the doubling strategy from Year 2.</i></p>	<p><math>3 \times 3 = 9</math></p> 	<p><math>3 \times 6 = \text{double } 9 = 18</math></p> 

Strategy & guidance	CPA
<p><b>Skip counting in multiples of 2, 3, 4, 5, 6, 8 and 10</b></p> <p><i>Rehearsal of previously learnt tables as well as new content for Year 3 should be incorporated into transition activities and practised regularly.</i></p>	
<p><b>Use of part-part-whole model with arrays and bar models to establish commutativity and inverse relationship between multiplication and division</b></p> <p><i>In these contexts pupils are able to identify all the equations in a fact family.</i></p>	
<p><b>Ten times greater</b></p> <p><i>Pupils's work on this must be firmly based on concrete representations – the language of ten times greater must be well modelled and understood to prevent the numerical misconception of 'adding a zero'.</i></p>	



















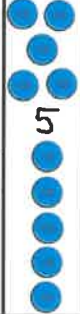
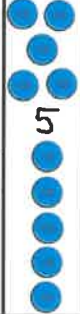
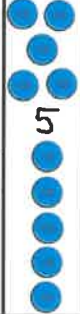


Strategy & guidance	CPA
<p><b>Multiplying by 10 and 100</b></p> <p><i>Building on the ten times greater work, pupils use appropriate Dienes blocks and place value counters to multiply 2, 3, 4, 5 and 10 by 10, 100 and 1000.</i></p>	<p><math>5 \times 1 = 5</math> </p> <p><math>5 \times 10 = 50</math> </p> <p><math>3 \times 1 = 3</math> </p> <p><math>3 \times 100 = 300</math> </p>
<p><b>Using known facts for multiplying by multiples of 10 and 100</b></p> <p><i>Pupils' growing understanding of place value, allows them to make use of known facts to derive multiplications using powers of 10.</i></p> <p><i>It is important to use tables with which they are already familiar (i.e. not 7 or 9 tables in Year 3)</i></p>	<p><math>5 = 1 \times 5</math> </p> <p><math>50 = 10 \times 5</math> </p> <p><math>500 = 100 \times 5</math> </p> <p><math>3 \times 2 = 6</math>  <math>30 \times 2 = 60</math>  <math>300 \times 2 = 600</math> </p> <p>  </p>

Strategy & guidance	CPA												
<p><b>Multiplication of 2-digit numbers with partitioning (no regrouping)</b></p> <p><i>Children should always consider whether partitioning is the best strategy – if it is possible to use strategies such as doubling (some may use doubling twice for <math>\times 4</math>), they need to choose the most efficient strategy.</i></p> <p><i>Children may wish to make jottings, including a full grid as exemplified here – but grid method is not a formal method and its only purpose is to record mental calculations. This supports the development of the necessary mental calculating skills but does not hinder the introduction of formal written methods in Year 4. Concrete manipulatives are essential to develop understanding.</i></p>	<div style="text-align: center;"> <p><math>3 \times 12</math> <math>12 = 10 + 2</math></p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><math>3 \times 10</math></p>  </div> <div style="text-align: center;"> <p><math>3 \times 2</math></p>  </div> </div> <p style="text-align: center;">Now add the total number of tens and ones</p> <div style="display: flex; justify-content: center; gap: 20px;"> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td style="padding: 5px;"><math>\times</math></td><td style="padding: 5px;"><b>10</b></td><td style="padding: 5px;"><b>2</b></td></tr> <tr><td style="padding: 5px;"><b>3</b></td><td style="padding: 5px;"></td><td style="padding: 5px;"></td></tr> </table> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td style="padding: 5px;"><math>\times</math></td><td style="padding: 5px;"><b>10</b></td><td style="padding: 5px;"><b>2</b></td></tr> <tr><td style="padding: 5px;"><b>3</b></td><td style="padding: 5px;"><b>30</b></td><td style="padding: 5px;"><b>6</b></td></tr> </table> </div> <p style="text-align: center; font-weight: bold; font-size: 1.2em;"><math>3 \times 12 = 36</math></p> </div>	$\times$	<b>10</b>	<b>2</b>	<b>3</b>			$\times$	<b>10</b>	<b>2</b>	<b>3</b>	<b>30</b>	<b>6</b>
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Strategy & guidance	CPA																						
<p><b>Multiplication of 2-digit numbers with partitioning (regrouping)</b></p> <p><i>Using concrete manipulatives and later moving to using images that represent them, supports pupils' early understanding, leading towards formal written methods in Year 4.</i></p> <p><i>Once again, this is a mental strategy, which they may choose to support with informal jottings, including a full grid, as exemplified here.</i></p> <p><i>Pupils must be encouraged to make use of their known multiplication facts and their knowledge of place value to calculate, rather than counting manipulatives.</i></p>	<table border="1" data-bbox="571 331 842 510"> <tr> <td>×</td> <td>10</td> <td>4</td> </tr> <tr> <td>3</td> <td></td> <td></td> </tr> <tr> <td></td> <td>30</td> <td>12</td> </tr> </table> <table border="1" data-bbox="558 577 855 770"> <tr> <td>×</td> <td>40</td> <td>5</td> </tr> <tr> <td>3</td> <td></td> <td></td> </tr> </table>	×	10	4	3				30	12	×	40	5	3			<table border="1" data-bbox="890 331 1150 499"> <tr> <td>×</td> <td>10</td> <td>4</td> </tr> <tr> <td>3</td> <td>30</td> <td>12</td> </tr> </table>  <p><math>14 \times 3 = 42</math></p> 	×	10	4	3	30	12
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### Y3 Division

Strategy & Guidance	CPA															
<p><b>Dividing multiples of 10, 100 and 1000 by 10, 100 and 1000 using scaling down</b></p> <p><i>Pupils use the strategy of 'scaling down', representing numbers with concrete manipulatives and making the value ten times smaller.</i></p>	<table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%; padding: 5px;">hundreds</th> <th style="width: 33%; padding: 5px;">tens</th> <th style="width: 33%; padding: 5px;">ones</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;"> 3</td> <td style="padding: 5px;"> 3</td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;">0</td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"> 3</td> </tr> </tbody> </table> <div style="margin-left: 20px; margin-top: 20px;"> <p><b><math>3 \times 10 = 30</math></b></p> <p><b><math>30 \div 10 = 3</math></b></p> </div>	hundreds	tens	ones					 3	 3			0			 3
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<p><b>Dividing multiples of 10, 100 and 1000 by 10, 100 and 1000 using grouping</b></p> <p><i>Pupils divide by 10, 100 and 1000 by making groups of the divisor.</i></p>	<p><math>500 \div 100 = \square</math></p> <p>My whole is 500 and the value of the equal parts is 100. How many parts are there?</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 12.5%; padding: 5px;">thousands</th> <th style="width: 12.5%; padding: 5px;">hundreds</th> <th style="width: 12.5%; padding: 5px;">tens</th> <th style="width: 12.5%; padding: 5px;">ones</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;"> 5</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">0</td> </tr> </tbody> </table>	thousands	hundreds	tens	ones		 5	0	0							
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