

# **Calculation Guidelines 2019/2020**

**Addition**

**Subtraction**

**Multiplication**

**Division**

**Visit: [www.craneswater.portsmouth.sch.uk](http://www.craneswater.portsmouth.sch.uk)**

# Craneswater calculation guidelines

## Progression towards a written method

1. Establish mental methods, based on a good understanding of place value in numbers.
2. Present calculations in a horizontal format, with jottings supported through use of concrete manipulatives
3. Show children how to set out written calculations vertically, initially using expanded layouts that record their mental methods
4. As children become more confident, refine the written record into a more compact/standard method.
5. Extend to larger numbers and to decimals (including those with differing number of digits)
6. Apply taught through methods through problem solving and reasoning activities.

## Place value key concepts:

- Numbers are made up of digits
- Every digit has a value (see below)

<u>1000s</u>	<u>100s</u>	<u>10s</u>	<u>1s</u>	●	<u>Tenths</u>	<u>Hundredths</u>	<u>Thousandths</u>
	<u>3</u>	<u>2</u>	<u>6</u>				

### For example:

3 hundreds - 300

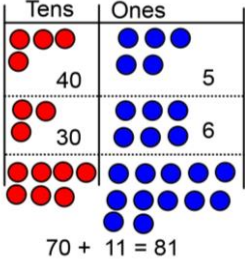
2 tens - 20

6 ones - 6

## Stages of development in Addition

### Key Terminology:

- More, increased by, sum, total
- Regrouping (12 ones is the same as 1 ten and 2 ones)
- Carrying (moving a digit across to its correct place value column)
- When a new method is taught, the current method should be written alongside.

Mental method with jotting	Expanded with partitioning	Expanded written method	Standard written method
$45 + 36$  <b>Partitioning:</b> $40 + 30 = 70$ $5 + 6 = 11$ $70 + 11 = 81$  <b>Can be supported</b> $45 + 36$  <b>through use of counters</b>	$45 + 36$  <b>Line up in place value columns:</b> $40 + 5$ $30 + 6$ $70 + 11$  $= 81$	$45 + 36$  <b>Add up from right</b> $45$ $+ 36$ $11 (5 + 6)$ $70 (40 + 30)$ $81$	$45 + 36$  $45$ $+ 36$ $81$ $1$  <b>NB - Children must be secure in the previous methods, in order to understand the purpose of 'carrying'</b>  $5 + 6 = 11$ <b>which is the same as 1 ten and 1 one.</b>

How to challenge and progress further:

- Increase the number size
- Numbers with different number of digits (for example  $432 + 6,224$ )
- Introduce decimal numbers
- Adding more than 2 numbers together
- Adding amounts of money
- Missing digit problems

$$\begin{array}{r} 72.8 \\ + 54.6 \\ \hline 127.4 \\ 11 \end{array}$$

$$\begin{array}{r} \text{£ } 23.59 \\ + \text{£ } 7.55 \\ \hline \text{£ } 31.14 \\ 111 \end{array}$$

$$\begin{array}{r} \square 7 \square \\ + 75 \\ \hline 251 \end{array}$$

# Stages of Development in subtraction

## Key Terminology:

- Less, decrease by, difference, take away, minus
- Exchanging (for example a ten can be exchanged for ten ones)
- When a new method is taught, the current method should be written alongside.

Mental Method with Jotting	Expanded written method (no exchange)Written Method	Expanded Written Method	Standard Written Method								
<p>Subtraction using objects or counters:</p> <p>28 - 17</p> <p>28 - 17</p> <table border="1"> <tr> <td>Tens</td> <td>Ones</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td>20</td> <td>8</td> </tr> <tr> <td>10 left</td> <td>1 left</td> </tr> </table> <p>= 11</p> <p>Finding smaller differences by counting up:</p> <p>28 - 17</p> <p>Use a blank number line</p>	Tens	Ones			20	8	10 left	1 left	<p>Record in a vertical format using diennes or counters to support.</p> <p>159 - 33</p> $\begin{array}{r} 100 \quad 50 \quad 9 \\ - \quad 30 \quad 3 \\ \hline 20 \quad 6 \end{array}$	<p>Record in a vertical formal using diennes or counters to support understanding of exchanging:</p> <p>121 - 76</p> $\begin{array}{r} 100 \quad 20 \quad 1 \\ - \quad 70 \quad 6 \\ \hline \end{array}$ <p>There aren't enough 1s to subtract 6 from, so exchange a ten for 10 ones</p> $\begin{array}{r} 10 \quad 11 \\ 100 \quad 20 \quad 1 \\ - \quad 70 \quad 6 \\ \hline 5 \end{array}$ <p>You now have 11 ones and can subtract 6.</p> <p>You were left with 10 in your tens columns. Now exchange a hundred so you have 110 in the tens column</p> $\begin{array}{r} 0 \quad 110 \quad 11 \\ 100 \quad 20 \quad 1 \\ - \quad 70 \quad 6 \\ \hline 40 \quad 5 \\ = 45 \end{array}$	<p>Once children are secure in exchanging they can move onto the standard method:</p> <p>121 - 76</p> $\begin{array}{r} 11 \quad 1 \\ 121 \\ - 76 \\ \hline 45 \end{array}$ <p>Use of decimals:</p> $\begin{array}{r} 5 \quad 12 \quad 1 \\ 2 \quad 6 \quad 3 \quad . \quad 0 \\ - 2 \quad 6 \quad . \quad 5 \\ \hline 2 \quad 3 \quad 6 \quad . \quad 5 \end{array}$
Tens	Ones										
20	8										
10 left	1 left										

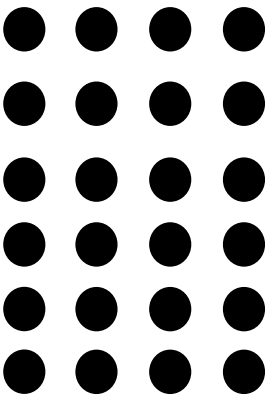
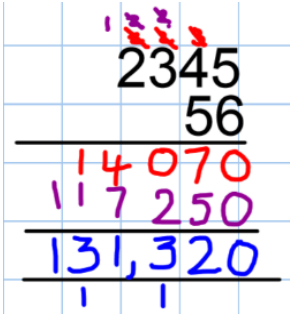
How to challenge and progress further:

- Increase the number size
- Numbers with different number of digits (for example 6,224 - 432)
- Exchanging across more than one column
- Introduce decimal numbers
- Subtracting amounts of money
- Missing digit problems

# Stages of development in Multiplication

## Key Terminology:

- Lots of, times, groups of, multiply, product
- Carry over
- Zero as a place holder

Times tables as arrays	Informal Written Method	Expanded Written Method	Standard Written Method															
<p><math>4 \times 6 = 24</math></p> <p><math>6 \times 4 = 24</math></p> 	<p>The grid method helps children to understand the value of what they are multiplying:</p> <p><math>12 \times 7</math></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>x</td><td>10</td><td>2</td></tr> <tr><td>7</td><td>70</td><td>14</td></tr> </table> <p><math>70 + 14 = 84</math></p> <p>This method works particularly well when multiplying TUxTU</p> <p>e.g. <math>32 \times 14</math></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>x</td><td>30</td><td>2</td></tr> <tr><td>10</td><td>300</td><td>20</td></tr> <tr><td>4</td><td>120</td><td>8</td></tr> </table> <p><math>300 + 120 + 20 + 8 = 448</math></p> <p><b>(NB - children must be secure in place value to multiply multiples of 10)</b></p>	x	10	2	7	70	14	x	30	2	10	300	20	4	120	8	<p>Taught alongside the grid method:</p> <p><math>12 \times 7</math></p> $\begin{array}{r} 12 \\ \times 7 \\ \hline 14 \text{ (7 x 2)} \\ 70 \text{ (7 x 10)} \\ \hline 84 \end{array}$ <p><math>32 \times 14</math></p> $\begin{array}{r} 32 \\ \times 14 \\ \hline 8 \text{ (4 x 2)} \\ 120 \text{ (4 x 30)} \\ 20 \text{ (10 x 2)} \\ 300 \text{ (10 x 30)} \\ \hline 448 \end{array}$	<p>Efficient multiplication:</p>  <p>'Carry overs' to be recorded at the top.</p> <p>Zero used as a place holder when moving across to the tens digit.</p>
x	10	2																
7	70	14																
x	30	2																
10	300	20																
4	120	8																

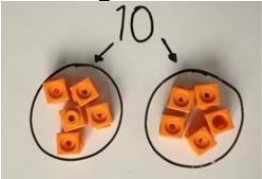
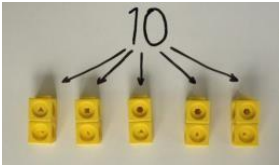
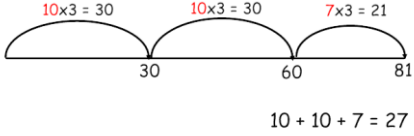
How to challenge and progress further:

- Increase the number size (up to 4 digit x 2 digit)
- Introduce decimal numbers
- Multiplying amounts of money
- Missing digit problems

# Stages of development in Division

## Key Terminology:

- Share, groups, quotient
- Remainder, fraction remainder

Understanding sharing and grouping	Using a number line	Vertical chunking	Short Division (bus stop) Extending to long division
<p><b>Use of concrete manipulatives for 'sharing'</b></p>  <p>I have 10 cubes and I can share them into 2 groups. There are 5 in each group.</p> <p><b>Use of concrete manipulatives for 'grouping'</b></p>  <p>I have 10 cubes and I can divide them into groups of 2. There are 5 groups</p>	<p><math>81 \div 3</math></p> <p>Use chunks of 10 lots Use knowledge of times tables</p> 	<p><b>Subtracting more efficient chunks:</b></p> <p><math>81 \div 3</math></p> $\begin{array}{r} 81 \\ - 60 \text{ (} 20 \times 3 \text{)} \\ \hline 21 \\ - 21 \text{ (} 7 \times 3 \text{)} \\ \hline \end{array}$ <p><b>= 27</b></p> <p>Begin to apply to dividing by 2 digit numbers</p> <p><math>368 \div 16 = 23</math></p> $\begin{array}{r} 368 \\ - 320 \text{ (} 20 \times 16 \text{)} \\ \hline 48 \\ - 48 \text{ (} 3 \times 16 \text{)} \\ \hline \end{array}$ <p><b>= 23</b></p>	<p><b>Short Division:</b></p> <p>Children need to be secure in their understanding of place value and times tables</p> $\begin{array}{r} 29 \text{ r}1 \\ 3 \overline{) 828} \end{array}$ <p><b>Long Division:</b></p> $\begin{array}{r} 0318 \text{ r}5 \\ 20 \overline{) 6365} \\ \underline{-60} \phantom{0} \phantom{0} \phantom{0} \\ 36 \phantom{0} \phantom{0} \phantom{0} \\ \underline{-20} \phantom{0} \phantom{0} \phantom{0} \\ 165 \phantom{0} \\ \underline{-160} \\ 5 \end{array}$ <p>The remainder can also be interpreted as <math>\frac{5}{20}</math></p>

How to challenge and progress further:

- Increase the number size (up to 4 digit  $\div$  2 digit)
- Extend remainders into decimal answers
- Dividing money
- Missing digit problems

## Things you can do at home to help your child in maths:

Mental maths strategies underpin many aspects of mathematics.

The key to mental maths is little and often. 5 or 10 mins regularly is much more effective than sitting down for 30mins. Keep mental maths fun and varied.

Children do not need to write anything down, but they may wish to make simple jottings.

- Chanting times tables and their division facts up to 12 x 12  
e.g.  $6 \times 8 = 48$        $48 \div 6 = 8$

Children should have quick recall of times tables and not need to do any working out or count up through the times table.

- Counting forwards and backwards in steps of: 1s, 2s, 5s, 10s, 20s, 50s, 100s, 1000s, 0.1, 0.01 (start at different numbers to further extend)
- Partitioning numbers - e.g.  $26 = (20 + 6)$
- Number bonds to 10, 20, 50, 100, 1000, 1 (decimals)

e.g.  $17 + 3 = 20$        $11 + 9 = 20$

Also include inverses, e.g.  $20 - 8 = 12$

Children should have quick mental recall of these.

- Quick fire addition and subtraction of single digits, e.g.  $23 + 9$ ,  $24 - 7$ ,  $18 + 8$   
Encourage mental strategies such as add 10, subtract 1 for adding 9 to a number.  
Use known number bonds to help
- Adding / subtracting small quantities of money  
Extending to questions such: How much change? How much more do I need? What coins do I need to make this total?
- Telling the time and asking questions such as, how much longer until....?  
Reading timetables such as bus/train/TV listings is also useful.  
Children should also become familiar with the 12/24 hour clock and their conversions.
- Measuring and weighing, e.g. cooking/reading from scales
- Playing card games such as 'sevens' and 'pontoons'