



Brady Primary School

Calculation Policy



‘Inspiring teaching for ambitious learners’



Mental Calculations

These are the main mental calculations that children will be taught at Brady Primary School. Children will be given opportunity to learn and apply these strategies throughout the school, moving onto larger numbers and decimals as they progress. Direct teaching of these methods is incorporated into our programmes of study.

<p style="text-align: center;"><u>USE MATHS FACTS</u></p> <p>Once children know their maths facts they can use these with other calculations.</p> <p>e.g. $14 + 6 = 20$ (Number bonds) $100 - 35 = 65$ (Number bonds) $24 \div 6 = 4$ (Applying times tables knowledge) $40 \times 6 = 240$ (place value and times tables)</p> <p>When referring to using knowledge or place value the children should refer to making the number 10 times, 100 times and 1000 times bigger or smaller and relate this to moving the digits to the left or the right.</p> <p style="text-align: center;"><i>THE PHRASE 'ADD A ZERO' IS MATHEMATICALLY INACCURATE.</i></p>	<p style="text-align: center;"><u>PARTITION</u></p> <p>This should be used when partitioning makes the number easier to calculate. Both or just one of the numbers could be partitioned.</p> <p>e.g. $23 + 45 = 20 + 40 + 5 + 3$ $60 + 8 = 68$</p> <p>$23 + 45 = 23 + 40 + 5$ $63 + 5 = 68$</p> <p>$68 - 32 = 68 - 30 - 2$ $38 - 2 = 36$</p> <p>$540 + 280 = 540 + 200 + 80$ $740 + 80 = 820$</p> <p>$276 - 153 = 276 - 100 - 50 - 3 =$ $176 - 50 - 3 =$ $126 - 3 = 123$</p>	<p style="text-align: center;"><u>MAKE IT HAPPY!</u></p> <p style="text-align: center;">(Compensating near multiples of ten.)</p> <p>Make it happy comes from making the number a multiple of 1, 10, 100 or 1000 (happy because they are easy to calculate with).</p> <p>e.g. $34 + 9 = 43$ (becomes $34 + 10 = 44 - 1 = 43$) $58 + 71 = 129$ (becomes $58 + 70 = 128 + 1 = 129$) $5.7 + 3.9 = 9.6$ (becomes $5.7 + 4 = 9.7 - 0.1 = 9.6$) $39 \times 6 = 234$ (becomes $40 \times 6 = 240 - 6 = 234$)</p>
<p style="text-align: center;"><u>DODGY DOUBLES</u></p> <p style="text-align: center;">(Use near doubles)</p> <p>When children know their doubles they can use these to help them with certain calculations. For example:</p> <p>$18 + 16 = 34$ (double 16, add 2)</p>	<p style="text-align: center;"><u>BRIDGE IT!</u></p> <p style="text-align: center;">(Bridge through multiples of 1, 10, 100, 1000, minutes, hours and days.)</p> <p>e.g. $6 + 7 = 13$ (becomes $6 + 4 = 10 + 3 = 13$) $23 - 9 = 14$ (becomes $23 - 3 = 20 - 6 = 14$) $49 + 32 = 81$ (becomes $49 + 1 = 50 + 31 = 81$) $3.7 + 2.8 = 6.5$ (becomes $3.7 + 0.3 = 4 + 2.5 = 6.5$) $3:45\text{pm} + 35 \text{ minutes} = 4:20\text{pm}$ (becomes $3:45 + 15 \text{ minutes} = 4:00\text{pm}$, then $+ 20 \text{ minutes} = 4:20\text{pm}$)</p>	<p style="text-align: center;"><u>SMALL DIFFERENCE COUNT UP!</u></p> <p>If the children are subtracting and the numbers have a small difference they should count up from the smaller to the larger number.</p> <p>e.g. $26 - 23 =$ $141 - 139 =$ $1001 - 999 =$</p>



REASONS FOR USING WRITTEN METHODS

- ☐ To aid mental calculation by writing down some of the numbers and answers involved
- ☐ To make clear a mental procedure for the pupil
- ☐ To help communicate methods and solutions
- ☐ To provide a record of work to be done
 - ☐ To aid calculation when the problem is too difficult to be done mentally
- ☐ To develop and refine a set of rules for calculations

WHEN ARE CHILDREN READY FOR WRITTEN CALCULATIONS?

Addition and subtraction


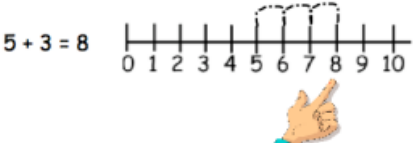



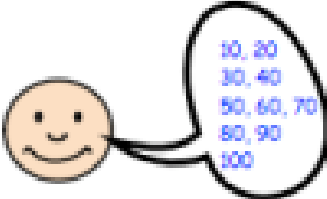
- Do they know addition and subtraction facts to 20?
- Do they understand place value and can they partition numbers?
- Can they add three single digit numbers mentally?
- Can they add and subtract any pair of two digit numbers mentally?
- Can they explain their mental strategies orally and record them using informal jottings?

Multiplication and Division

- Do they know the 2, 3, 4, 5 and 10 time table
- Do they know the result of multiplying by 0 and 1?
- Do they understand 0 as a place holder?
- Can they multiply two and three digit numbers by 10 and 100?
- Can they double and halve two digit numbers mentally?
- Can they use multiplication facts they know to derive mentally other multiplication facts that they do not know?
- Can they explain their mental strategies orally and record them using informal jottings?

The above lists are not exhaustive but are a guide for the teacher to judge when a child is ready to move from informal to formal methods of calculation.

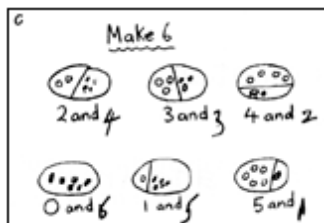
Calculation guidelines for Foundation Stage

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Children begin to record in the context of play or practical activities and problems.			
<p>Begin to relate addition to combining two groups of objects</p> <ul style="list-style-type: none"> ☐ Make a record in pictures, words or symbols of addition activities already carried out. ☐ Construct number sentences to go with practical activities ☐ Use of games, songs and practical activities to begin using vocabulary. ☐ Solve simple word problems using their fingers. ☐ Finding number bonds to 10. Extend with number bonds to 20. <div style="text-align: center; margin: 10px 0;">  <p>$5 + 1 = 6$</p> </div> <p>Start with five fingers / cubes / etc. Can you show me one more?</p> <p>More able children progress to using a number line. They jump forwards along the number line using finger.</p> <div style="text-align: center; margin: 10px 0;">  <p>$5 + 3 = 8$</p> </div>	<p>Begin to relate subtraction to 'taking away'.</p> <ul style="list-style-type: none"> ☐ Make a record in pictures, words or symbols of subtraction activities already carried out. ☐ Use of games, songs and practical activities to begin using vocabulary. ☐ Construct number sentences to go with practical activities. ☐ Relate subtraction to taking away and counting how many objects are left. <div style="text-align: center; margin: 10px 0;">  <p>$5 - 1 = 4$</p> </div> <div style="text-align: center; margin: 10px 0;">  <p>$5 - 1 = 4$</p> </div> <p>Start with five fingers / cubes / etc. Can you show me one less?</p> <p>More able progression:</p> <div style="text-align: center; margin: 10px 0;">  <p>$8 - 3 = 5$</p> </div> <p>Counting backwards along a number line using finger.</p>	<p>Real life contexts and use of practical equipment to count in repeated groups of the same size:</p> <ul style="list-style-type: none"> ☐ Count in twos; fives; tens ☐ Also chanting in 2s, 5s and 10s. <div style="text-align: center; margin: 20px 0;">  </div> <ul style="list-style-type: none"> ☐ Finding number doubles to 10 and then to 20 through practical activities. 	<p>Share objects into equal groups Use related vocabulary</p> <ul style="list-style-type: none"> ☐ Activities might include: ☐ Sharing of milk at break time ☐ Sharing sweets on a child's birthday ☐ Sharing activities in the home corner ☐ Count in tens/twos ☐ Separate a given number of objects into two groups (addition and subtraction objective in reception being preliminary to multiplication and division) <p>Count in twos, tens How many times? How many are left? Group Answer Right, wrong What could we try next? How did you work it out? Share out Half, halve</p>
<p>Early Learning Goal 'Using Quantities and Objects'. Children add and subtract two single digit numbers, and count on or back to find the answer.</p>			

Addition guidelines

Band 1

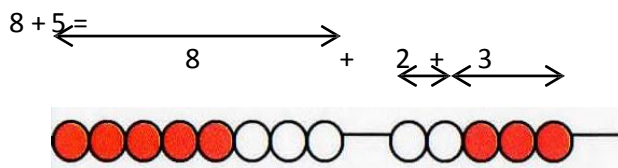
Using pictures:



Children need to use practical resources alongside pictures to support their calculation of addition problems.

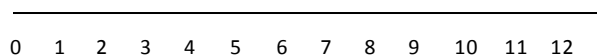
Then children need to begin relating the use of practical resources to number lines when calculating addition problems.

Bead strings or bead bars can be used to illustrate addition, including bridging through ten. For example when calculating $8 + 5$ children can count on two and then count on three:



Children to begin using **number lines** to count on in ones.

$$7 + 4 =$$



Methods will need to be modelled by the class teacher.

Band 2

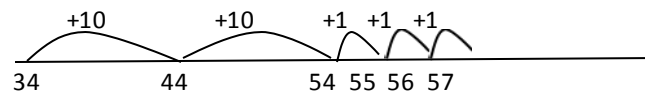
STAGE 1: J10 method for addition

(Using an empty number line. Using jumps of 10 or jumps of a multiple of 10)

When using a number line to support addition calculations children make 'jumps' at sizes which support place value. For example: jumping in tens, before progressing to jumps of multiples of ten.

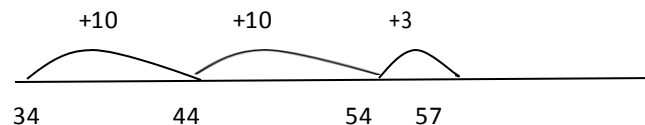
Start with the larger number. Count on in tens and then ones:

$$34 + 23 = 57$$



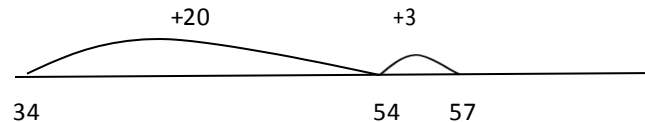
Children to be taught to become more efficient by adding units in one jump:

$$34 + 23 = 57$$



Next the children should begin to add the tens in one jump:

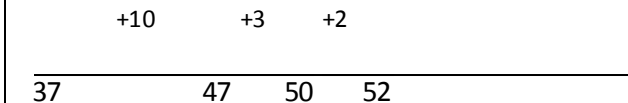
$$34 + 23 = 57$$



STAGE 1 continued ...

Children now need to be introduced to bridging through a multiple of 10:

$$37 + 15 = 52$$



STAGE 2: Partitioning

(this will lead onto the column method)

Partitioned numbers are then written under one another (remind children of the importance of lining up digits according to their place value)


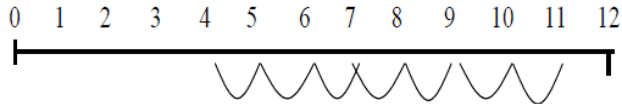
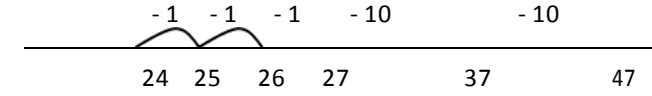
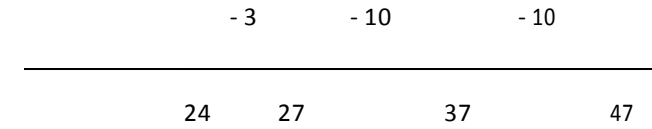
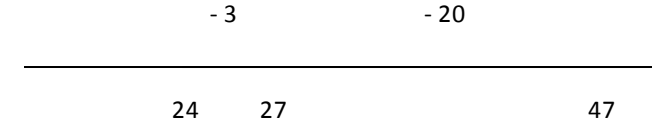
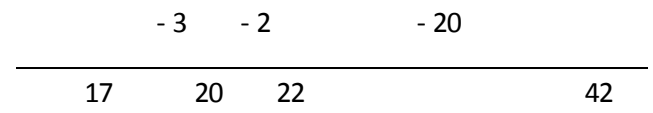
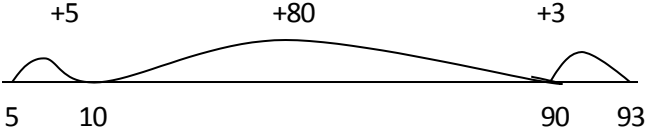
$$\begin{array}{r} 47 \\ + 76 \\ \hline 110 + 13 = 123 \end{array}$$



Addition guidelines continued

Band 3	Band 4	Band 5												
<p><u>STAGE 3: Expanded method in columns</u></p> <p>Adding the tens first:</p> $\begin{array}{r} 47 \\ + 76 \\ \hline 110 \text{ (40 + 70)} \\ \underline{13} \text{ (7 + 6)} \\ 123 \end{array}$ <p>Adding the ones first:</p> $\begin{array}{r} 47 \\ + 76 \\ \hline 13 \text{ (7 + 6)} \\ \underline{110} \text{ (40 + 70)} \\ 123 \end{array}$ <p><u>STAGE 4: Column method</u></p> <p>Condensed to:</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">47</td> <td style="text-align: center;">258</td> <td style="text-align: center;">366</td> </tr> <tr> <td style="text-align: center;">+ 76</td> <td style="text-align: center;">+ 87</td> <td style="text-align: center;">+458</td> </tr> <tr> <td style="text-align: center;"><u>123</u></td> <td style="text-align: center;"><u>345</u></td> <td style="text-align: center;"><u>824</u></td> </tr> <tr> <td style="text-align: center;">11</td> <td style="text-align: center;">11</td> <td style="text-align: center;">11</td> </tr> </table> <p style="text-align: center;">Extend to decimals in the context of money.</p>	47	258	366	+ 76	+ 87	+458	<u>123</u>	<u>345</u>	<u>824</u>	11	11	11	<p><u>STAGE 4: Column method continued ...</u></p> <p>Extend to numbers with at least four digits:</p> $3587 + 675 = 4262$ $\begin{array}{r} 3587 \\ + 675 \\ \hline \underline{4262} \\ 111 \end{array}$ <p>Extend to decimals with the same number of decimal places:</p> $13.6 + 4.7 =$ $\begin{array}{r} 13.6 \\ + 4.7 \\ \hline \underline{18.3} \\ 1 \end{array}$ <p><i><u>Addition of decimals:</u> You may want to use the 'expanded method' (as per Band 3). However, when teaching addition involving decimals you should always start by adding the least significant digit first, as this will support children in their understanding of place value.</i></p> <p>Opportunities should be provided for children to add several numbers with varying digits:</p> $1202 + 45 + 367 =$	<p>Extend children's experiences of addition to include numbers with any number of digits, including decimals to one or two places.</p> <p>e.g.</p> $124.9 + 117.25 = 242.15$ $\begin{array}{r} 124.9 \\ + 117.25 \\ \hline \underline{242.15} \\ 11 \end{array}$
47	258	366												
+ 76	+ 87	+458												
<u>123</u>	<u>345</u>	<u>824</u>												
11	11	11												

Subtraction guidelines

Band 1	Band 2	
<p>Using pictures:</p>  <p>Children should use practical resources to support calculation. Teachers need to demonstrate / model use of resources.</p> <p>Bead strings and bead bars can be used to illustrate subtraction, including bridging through ten by counting down to 10 and then down beyond (below) ten. For example when calculating $13 - 5$ you can count down 3 to 10 and then counting down 2 more to 8.</p> <p>Children should now begin to use number lines to support their own calculations—using a numberline to count back in ones.</p> <p>$11 - 7 = 4$</p>  <p>The number line should also be used to show that $6 - 3$ means 'the difference between 6 and 3' or 'the difference between 3 and 6,' and how many jumps apart they are.</p>	<p>STAGE 1: J10 method for subtraction (Using an empty number line. Using jumps of 10 or jumps of a multiple of 10)</p> <p>When using a number line to support addition calculations children make 'jumps' at sizes which support place value. For example: jumping in tens, before progressing to jumps of multiples of ten.</p> <p>Counting back: First count back in tens and ones.</p> <p>$47 - 23 = 24$</p>  <p>Children to be taught to become more efficient by subtracting units in one jump:</p> <p>$47 - 23 = 24$</p>  <p>Next the children should begin to subtract the tens in one jump:</p> <p>$47 - 23 = 24$</p> 	<p>STAGE 1 continued ...</p> <p>Children now need to be introduced to bridging through a multiple of 10 as this will help them become more efficient:</p> <p>$42 - 25 = 17$</p>  <p>STAGE 3: COUNTING ON</p> <p>Understand when it is sensible to 'count back' and when it is sensible to 'count on'. For example:</p> <p>$93 - 5 = 88$</p> 



Subtraction guidelines continued

Band 3

STAGE 3: Expanded method leading to the column method

No adjustment or decomposition is needed.

The Expanded Method:

$$563 - 241 = 322$$

$$\begin{aligned} &500 + 60 + 3 \\ &- 200 + 40 + 1 \\ \hline &300 + 20 + 2 = 322 \end{aligned}$$

This leads to ...

$$\begin{array}{r} 563 \\ - 241 \\ \hline 322 \end{array}$$

The Adjustment method

(i.e. from the hundreds to the tens or partitioning the hundreds):

$$\begin{aligned} &500 + 60 + 3 \\ &- 200 + 70 + 1 \text{ Leads to ...} \end{aligned}$$

$$\begin{aligned} &400 + 160 + 3 \\ &- 200 + 70 + 1 \text{ Leads to ...} \end{aligned}$$

$$\begin{aligned} &400 \quad 160 \\ &500 + 60 + 3 \\ &- 200 + 70 + 1 \text{ Leads to ...} \end{aligned}$$

STAGE 3: The Adjustment method continued ...

$$\begin{array}{r} \\ 563 \\ - 271 \\ \hline 292 \end{array}$$

Example:

563 – 278 (adjustment from the hundreds to the tens, and from the tens to the units).

$$\begin{array}{r} 500 + 60 + 3 \\ - 200 + 70 + 8 \end{array} \quad \text{leads to} \quad \begin{array}{r} 400 + 150 + 13 \\ - 200 + 70 + 8 \\ \hline 200 + 80 + 5 \end{array}$$

$$\begin{array}{r} 400 \quad 150 \quad 13 \\ 500 + 60 + 3 \\ - 200 + 70 + 8 \\ \hline 200 + 80 + 5 \end{array} \quad \text{leads to} \quad \begin{array}{r} \\ 563 \\ - 278 \\ \hline 285 \end{array}$$

Example:

503 – 278 (dealing with zeros when adjusting).

$$\begin{array}{r} 500 + 0 + 3 \\ - 200 + 70 + 8 \end{array} \quad \text{leads to} \quad \begin{array}{r} 400 + 90 + 13 \\ - 200 + 70 + 8 \\ \hline 200 + 20 + 5 \end{array}$$

$$\begin{array}{r} 400 \quad 90 \quad 13 \\ 500 + 0 + 3 \\ - 200 + 70 + 8 \\ \hline 200 + 20 + 5 \end{array} \quad \text{leads to} \quad \begin{array}{r} \\ 503 \\ - 278 \\ \hline 225 \end{array}$$

Band 4

Continue to develop compact decomposition with larger numbers, each containing different numbers of digits.

Once secure with the above children need to be introduced to calculating subtractions that include decimals, initially only use decimals with the same number of digits.

Important note: Some children will need to progress through the number line, onto the expanded method before using the compact method for decomposition. This will enable them to understand the place value of digits involved in the calculation.

When using the column method children must understand the importance of lining up digits so they are over / under corresponding digits:

$$\begin{array}{r} \\ 5764.0 \\ - 821.6 \\ \hline 4942.4 \end{array}$$

Band 5

Continue to develop compact decomposition with larger numbers with varying amounts of digits, and decimals with differing numbers of digits.

Multiplication guidelines

Band 1

Children will experience equal groups of objects and will count in twos and tens. They will begin to count in fives too.

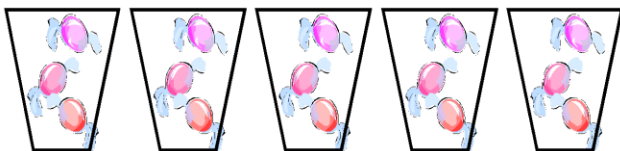
Children will work on practical problem solving activities involving equal sets or groups. For example:



Looking at columns
 $2 + 2 + 2$
 3 groups of 2

Looking at rows
 $3 + 3$
 2 groups of 3

There are 3 sweets in one bag.
 How many sweets are there in 5 bags?

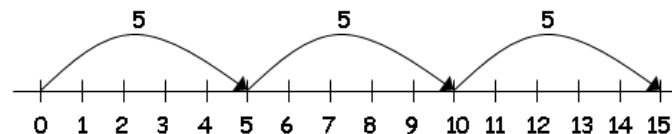


Band 2

STAGE 1: Repeated addition and using arrays.

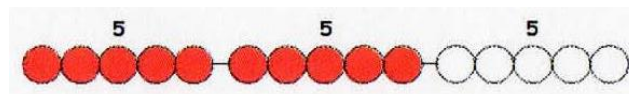
Class teachers should use a number line to model / illustrate repeated addition:

$$5 \times 3 = 5 + 5 + 5$$

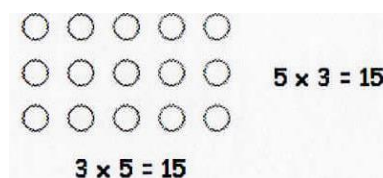


This can also be illustrated / modelled using a bead bar or bead string:

$$5 \times 3 = 5 + 5 + 5$$



Children should be able to model multiplication using an array. Knowledge of this will support with children as they move onto using the grid method.

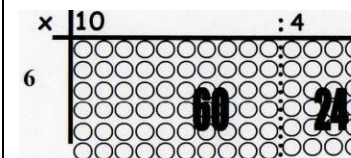


Band 3

STAGE 1 continued ...

Children will continue to use arrays, where appropriate these should lead to them using the grid method:

$$6 \times 14 = 84$$



$$\begin{array}{r} (6 \times 10) \\ 60 \end{array} + \begin{array}{r} (6 \times 4) \\ 24 \end{array} = 84$$

STAGE 2: The grid method

(initially 2-digit by 1-digit, leading to 3-digit by 1-digit numbers)

The grid method may be the main method used by children whose projected attainment at the end of Key Stage 2 is towards the lower end of Band 4.

$$38 \times 7 = (30 \times 7) + (8 \times 7) = 210 + 56 = 266$$

x	7
30	210
8	56
	266

STAGE 3: Expanded short multiplication

$30 + 8$	38
$\begin{array}{r} \times 7 \\ 210 \\ \underline{56} \\ 266 \end{array}$	$\begin{array}{r} \times 7 \\ 210 \\ \underline{56} \\ 266 \end{array}$

STAGE 4: Short multiplication

$$\begin{array}{r} 38 \\ \times 7 \\ \underline{266} \\ 5 \end{array}$$



Multiplication guidelines continued

Band 4

STAGE 5: Two - digit by two -digit multiplication

x	20	7	
50	1000	350	1350
6	120	42	162
			<u>1512</u>
			1

This progresses to ...

$$\begin{array}{r}
 56 \\
 \times 27 \\
 \hline
 1000 \quad (50 \times 20 = 1000) \\
 120 \quad (6 \times 20 = 120) \\
 350 \quad (50 \times 7 = 350) \\
 \underline{42} \quad (6 \times 7 = 42) \\
 1512 \\
 1
 \end{array}$$

This progresses to ...

$$\begin{array}{r}
 56 \\
 \times 27 \\
 \hline
 1120 \quad (56 \times 20) \\
 \underline{392} \quad (56 \times 7) \\
 1512 \\
 1
 \end{array}$$

In the final method children will need to apply knowledge of factorising 20 into 2 and 10; initially they will calculate $56 \times 2 = 112$ and then they will calculate 112×10 . For the second part of the calculation, $56 \times 7 = 392$ ($50 \times 7 = 350 + 6 \times 7 = 42$) children may need to make some jottings for support.

Progress to multiplying decimals to 1 decimal place. For example 45.3×6

Band 5

STAGE 6: Two - digit by three - digit multiplication

Estimating should be encouraged as it will allow children to check the reasonableness of their answer.

289 x 29 is approximately ...
 $300 \times 30 = 9000$

x	20	9	
200	4000	1800	5800
80	1600	720	2320
6	120	54	174
			<u>8294</u>
			1

This leads to ...

$$\begin{array}{r}
 286 \\
 \times 29 \\
 \hline
 4000 \quad (200 \times 20) \\
 1600 \quad (80 \times 20) \\
 120 \quad (6 \times 20) \\
 1800 \quad (200 \times 9) \\
 720 \quad (80 \times 9) \\
 \underline{54} \quad (6 \times 9) \\
 8294 \\
 1
 \end{array}$$

This leads to ...

$$\begin{array}{r}
 286 \\
 \times 29 \\
 \hline
 5720 \quad (286 \times 20) \\
 \underline{2574} \quad (286 \times 9) \\
 8294 \\
 1
 \end{array}$$

Division guidelines

Band 1

Children will:

- understand groups
- share items out
- experience division through play and problem solving activities (*appropriate to Band expectations*)
- count in groups of twos and tens, later they should move onto groups of fives.

Band 2

Sharing Equally

Children need to have secure counting skills before they begin to use this method.

6 sweets are shared equally between 2 people. How many do they each get?



Should participate in practical activities involving sharing, distributing cards when playing a game, putting objects onto plates / cups / hoops, etc.

Grouping or Repeated Subtraction

How many pairs of socks are there?

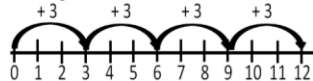


There are 6 sweets. How many people can have 2 sweets each?



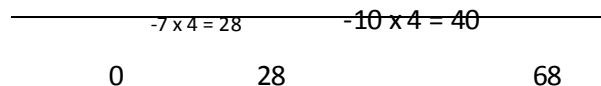
Repeated Subtraction and Addition using a number line or a bead bar

$$12 \div 3 = 4$$



Band 3

Expanded Number line Chunking and Estimating to find a suitable multiple to subtract



$$\text{Answer: } 68 \div 4 = 17 \text{ (10 + 7)}$$

Children may need to return to this method when attempting to divide larger numbers at Band 4 before they move onto vertical recording.

STAGE 1: Mental division using partitioning

To use this method children must have a secure understanding of the times tables facts related to the division they are working on. Additionally they must have a good understanding of partitioning.

Recording mental division using partitioning:

$$\begin{aligned} 64 \div 4 &= (40 + 24) \div 4 \\ &= (40 \div 4) + (24 \div 4) \\ &= 10 + 6 = 16 \end{aligned}$$

STAGE 1 continued ...

$$\begin{aligned} 87 \div 3 &= (60 + 27) \div 3 \\ &= (60 \div 3) + (27 \div 3) \\ &= 20 + 9 = 29 \end{aligned}$$

Remainders after division can be recorded in a similar manner:

$$\begin{aligned} 96 \div 7 &= (70 + 26) \div 7 \\ &= (70 \div 7) + (26 \div 7) \\ &= 10 + 3 \text{ r}5 = 13 \text{ r}5 \end{aligned}$$

STAGE 2: Short division of TU \div U

$$\begin{aligned} 81 \div 3 &= (60 + 21) \div 3 \\ &= (60 \div 3) + (21 \div 3) \\ &= 20 + 7 \\ &= 27 \end{aligned}$$

The short division method is recorded like this:

$$\begin{array}{r} 20 + 7 \\ 3 \overline{)60 + 21} \end{array}$$

This is then shortened to:

$$\begin{array}{r} 27 \\ 3 \overline{)81} \end{array}$$



Review

This policy will be reviewedby Any alterations that come from this review will be discussed with the Headteacher and ratified by the teaching staff and appropriate governing body sub-committee.

Chair of Governors Date

Headteacher Date