Dear Parents,

This is an electronic copy of our calculation progression. It is followed throughout out our school and was made with guidance from Hampshire Maths Team. When supporting your child to complete maths homework tasks, please ensure you are using the correct method. If you would like a hard copy, please contact the school office and one will be sent home ASAP.

If you have any questions, do not hesitate to contact me

Mrs R Mars (Maths Manager)

Bishop's Waltham Junior School

Mathematics Calculation Progression (September 2016)

Addition

There is a large jump from the Year 2 to the Year 3 curriculum.

Year 2

Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:

- a two-digit number and ones
- a two-digit number and tens
- two two-digit numbers
- adding three one-digit numbers
- applying their increasing knowledge of mental and written methods

Year 3

- Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.

Method	Examples	Notes
Number-lines		Number-lines no longer used as a formal method, but can be used as jottings to support mental maths.
Partitioned Column Addition	Recognise that: 27 + 45 Is the same as 27 + 45	At this stage, it doesn't really matter whether the most significant numbers are being added first or last. Children must be aware that addition can be done in any order.
	20 7 + 40 5 60 12	Children need to be able to partition into tens and units (and then beyond).
	300 60 5 + 400 70 8 700 130 13	There is no value moving towards large numbers until children have a good mental grasp of what these numbers really mean. These sections can be referred to as "hundreds, tens and units" or "hundreds, tens and ones".
	300 60 5 + 400 70 8 700 130 13 800 40 3	Realise that 13 cannot fit into a units / ones column as it doesn't belong. Repartition to make an easier final line of working out.

Expanded Vertical Column Method	365 + 478 13 (5 + 8) 130 (60 + 70) 700 (300 + 400) 843	At this stage, children must be starting with the units / ones column. The additional notes in brackets are not part of the calculation, but they support the calculation. They will not always be necessary at all times or for all children.
Compact Method	365 + 478 843 1 1	Continue to model the language of place value (refer to hundreds, tens and units, etc). Important to have consistency about where the carried digits are positioned – we will draw a second horizontal line and put the carried digits underneath it to ensure they don't get missed. Crossing out these digits is discretionary – a good way to make sure they are not being forgotten or mis-counted.

Subtraction

Many children find subtraction difficult and it is often because they struggle with mental subtraction. It is important to focus on mental subtraction as much, if not more, than mental addition.

Key facts are:

- subtraction bonds to 10 and 20 e.g. 20 - 8
- halving all even numbers to 100
- being able to take a single digit number away from any number
- context and practical resources are even more important with subtraction and should be used or accessible during teaching and independent work

Method	Examples	Notes
Number-lines		Number-lines no longer used as a formal method, but can be used as jottings to support mental maths.
Partitioned Subtraction (no decomposition)	35 – 12 30 5 - 10 2 20 3	Partitioning is very important. Children should see calculations written horizontally and vertically and be able to change them independently. Use practical resources. Use numbers which involve no carrying. Using 'and' instead of '+' may reduced confusion between addition and subtraction. Partitioning is very important. Children should see calculations written horizontally and vertically- and be able to change them independently. Use practical resources.

<table>
<tr>
<td rowspan="3">Partitioned Subtraction With Decomposition / Repartitioning in Units

‘Repartitioning’ will be the term used with children</td>
<td>35 – 17

30 5 → 20 15
- 10 7 - 10 7
10 8 = 18</td>
<td rowspan="2">Because we can’t take 7 away from 5, repartition the top number by moving a ten across.

Use practical resources or a context to ensure children understand why repartitioning is necessary.

This is an interim step.</td>
</tr>
<tr>
<td>143 – 39

100 40 3
- 30 9
↓
100 30 13
- 30 9
100 0 4 = 104</td>
</tr>
<tr>
<td>242 - 157

200 40 2
- 100 50 7
↓
200 30 12
- 100 50 7
↓
100 130 12
- 100 50 7
80 5</td>
<td>It may be necessary to work this through more than once, moving tens into the units column, then moving hundreds into the tens column.

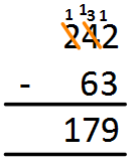
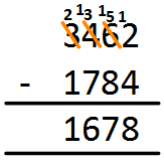
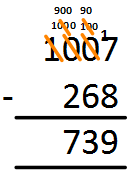
This will be more of a method to demonstrate than a method to practise.

This method is very time consuming as so much repartitioning has to go on. Once children understand, they can quickly move on to a more compact format.</td>
</tr>
<tr>
<td>Expanded Subtraction With Decomposition / Repartitioning</td>
<td>242 – 127

200 $\overset{30}{\cancel{40}}$ $^{1}2$
- 100 20 7
100 10 5

242 – 157

$\overset{100}{\cancel{200}}$ $\overset{1}{\overset{30}{\cancel{40}}}$ $^{1}2$
- 100 50 7
80 5</td>
<td>‘Give’ and ‘take’ is better language than borrowing – when you borrow something, you have to give it back, and we don’t!</td>
</tr>
</table>

Compact Subtraction with Decomposition	242 – 63 	Don't move on to this until their understanding of partitioning is fully secure. Should be taught alongside expanded subtraction to begin with so children can see where the numbers come from. May need to go back to practical methods at the start. Children should be able to explain the method using correct vocabulary, especially regarding place value
	3462 – 1784 	
	1007 – 268 	Things get tricky when there are lots of zeroes – this will need to be specifically taught.

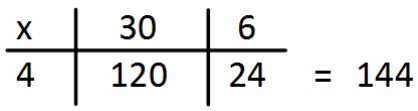
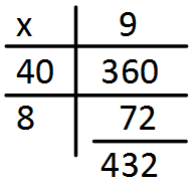
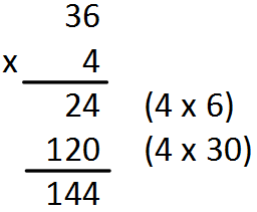
Year Group Progression (+ and -)

Year Three	Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.
Year Four	Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.
Year Five	Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction).
Year Six	Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why . Solve problems involving addition, subtraction, multiplication and division.

Multiplication

Children are likely to enter Year 3 having had experience of multiplication through learning 2,5 and 10x tables, practical apparatus and pictorial references and arrays. They are unlikely to have had much experience with written calculations.

Times tables are crucial- success in formal written methods of multiplication is very difficult without knowledge of tables.

Method	Examples	Notes
Multiplication with Partitioning	36 x 4 30 x 4 = 3 x 10 x 4 = 3 x 4 x 10 = 10 x 3 x 4 30 x 4 = 120 6 x 4 = 24 So 36 x 4 = 144	Children need to know that multiplication is commutative – can be done in any order.
Grid Method TU x U	36 x 4  	Progression - 2x, 5x, 3x, 4x, 6x, 8x, 7x, 9x When using a new method, children should be working within a times table they know. Once they are more confident, new times tables can be introduced. Often a good idea is to work on a particular times table in class and then use it as the basis for the independent task.
	48 x 9  	Arranging the numbers in this format allows easier adding up as it links more clearly to Expanded Vertical Column Method or Compact Method.
Expanded Multiplication TU x U	36 x 4  	Introduced alongside grid method to begin with so children can see the links. A child achieving at expected level in Year 3 should be at this stage by the end of the year. The jottings in brackets are not part of the method, but they do support the method.

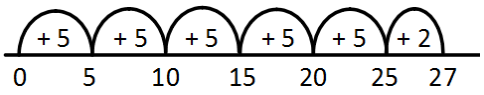
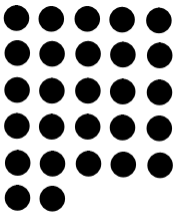
Expanded Multiplication HTU x U	236 x 4 24 (4 x 6) 120 (4 x 30) 800 (4 x 200) 944	Children should explore starting with most significant digits first (hundreds), and starting with least significant (units/ones). However, they need to move towards beginning with the least significant. Children may need a grid method reminder at first. Should also be aware of commutativity: 200 x 4 = 2 x 100 x 4 Children need to be able to multiply by 100 and understand the effect before they will be able to be successful with this method.
Expanded Multiplication Decimals	£3.60 x 4 £3.60 x 4 0 (4 x 0) £2.40 (4 x 60p) £12.00 (4 x £3) £14.40 5.4cm x 5 5.4cm x 5 2.0cm (5 x 0.4cm) 25.0cm (5 x 5cm) 27.0cm	Should be done in the context of money or measures - lots of practical resources. An expected level Year 4 child should be at this stage at the end of the year- very basic decimal work with practical resources. Children should be exposed to complex problems - word problems, puzzles, open ended etc. Writing the '0' line is not necessary, but may help some understand the process.
Expanded Column Method ThHTU x U	4326 x 7 42 (7 x 6) 140 (7 x 20) 2100 (7 x 300) 28000 (7 x 4000) 30282 1	By this stage you would expect children to know or be able to derive quickly all multiplication facts to 12 x 12. As this stage is relatively time consuming you would expect to move quite quickly to the more compact method. Carrying skills will have already been covered through work in addition.
Short Multiplication	4326 x 7 30282 2 1 4	Skills in this will be dependent on skills from teaching addition.

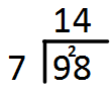
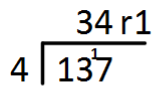
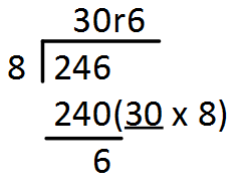
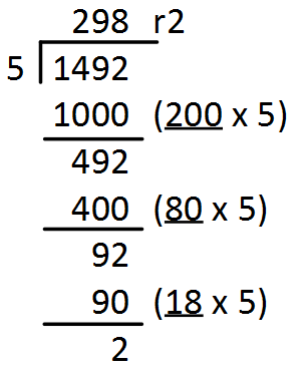
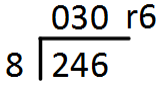
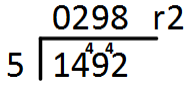
Multiplication TU x TU Grid followed by Expanded Long Multiplication	24 x 33 x | 20 | 4 30 | 600 | 120 = 720 3 | 60 | 12 = 72 = 792 24 x 33 12 (3 x 4) 60 (3 x 20) 120 (30 x 4) 600 (30 x 20) 792	Should be taught separately to begin with so place value issues are not confused. Most common misconception is children not completing all of the calculation e.g. only doing 20 x 30 and 4 x 3. Thinking of the original numbers as "20 and 4" and "30 and 3" may prevent children from missing out steps when they move from the Grid Method to Expanded Long Multiplication.
Long Multiplication	24 x 33 24 x 33 72 720 792	Children will need to be shown which calculations go where. Obviously they need to be proficient at compact addition before being successful at long multiplication. A child with expected progress should reach this level at the end of Year 5.

Division

Many children struggle with division. In order to ensure that they fully understand what division is they should be introduced to it practically, within a context e.g.

- Act it out
- Diagram/ array
- Linked to a table of multiples
- Recognition of importance of times tables.

Method	Examples	Notes
Informal methods of Division	27 ÷ 5 Number-lines  Sharing by arrays 	Children should round up or down depending on context. Number lines should count up not back- this is the complete opposite of what we have taught before. The reasoning is that by counting up, the links to times tables are much stronger. We must ensure we use the correct language e.g. one group of 5 etc. Should also be linked to fractions e.g. ¼ of 12.
Division of HTU ÷ U (using chunking)	68 ÷ 5 13 r3 5 ⟌68 50 (10 x 5) 18 15 (3 x 5) 3	Obviously good knowledge of times tables is crucial. We are aiming to teach the children to compact their chunking as much as possible.
	68 ÷ 3 22 r2 5 ⟌68 60 (20 x 3) 8 6 (2 x 3) 2	

Short Division TU ÷ U	98 ÷ 7  137 ÷ 4  or 34 $^{1}/_{4}$ or 34.25	Short division should be taught alongside chunking to begin with- children MUST understand the place value. Children at expected level in Year 4 should be able to complete this by the end of the year.
Division of HTU or ThHTU ÷ U	246 ÷ 8  1492 ÷ 5  	Should go back to chunking method to ensure understanding before moving onto more digits. Don't forget to use a context so rounding remainders up or down has meaning.
Short Division of HTU or ThHTU ÷ U	246 ÷ 8  1492 ÷ 5  	This is difficult! Children achieving at expected level should be able to complete this by the end of Year 5. We need to ensure children understand what they are doing and are not doing this process by rote.

Long Division HTU or ThHTU ÷ U	432 ÷ 15 028 r12 15 ⟌ 432 30 132 120 12	Some children may need to work out a list of multiples before they start. Long division is taught in Year 6. Answers should be in fractions, decimals or remainders depending on context.

Context in Division	There are very few questions in division that actually demand an answer in the form of a remainder. Consider this question: 36 ÷ 5. This could have all the following answers.

7 r1	I have 36 stickers. I put 5 on each page. How many pages are filled and how many stickers are left over?
7	Chocolate truffles are packaged 5 to a bag. If you have 36 truffles, how many complete bags will be filled?
8	36 children are going on a camping trip. Tents take 5 people each. How many tents are needed?
1	5 children share 36 marbles between them. How many marbles are left over?
7.2	36g of pasta was divided between 5 plates. What weight of pasta was put on each plate?
7 1/5	36 people each buy a slice of cake. Each whole cake can be cut into 5 slices. What fraction of cake is needed?

Year Group Progression (x and ÷)

Year Three	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 and progressing to formal written methods.
Year Four	
Year Five	Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context. Solve problems involving multiplication and division and a combination of these, including understanding the meaning of the equals sign.
Year Six	Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context.