Mornington Primary School

2017/2020

Upper KS2 Calculation Policy

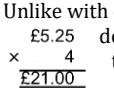
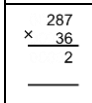
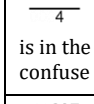
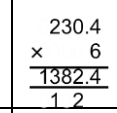
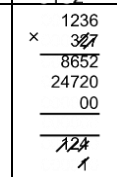
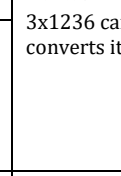
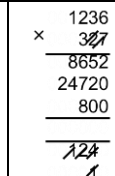
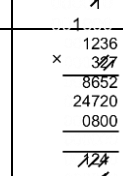
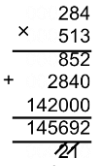
At Mornington we have recognised the specific need of many of our children is to have a clear and consistent method to solve problems relating to each of the four operations. Due to this we have, as a school, devised a calculation policy that clearly sets out the expectations of children in each of the year groups, the written method they should use to solve a given problem and the progression they should expect to encounter. In this document you will find guidance to the type of questions your child is likely to face, examples of how your child would be asked in school to solve the problem and therefore allow you to confidently support your child and the school when completing work at home and examples of the type of vocabulary your child will be experiencing.

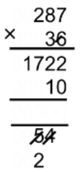
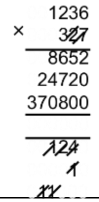
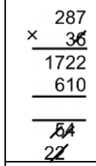
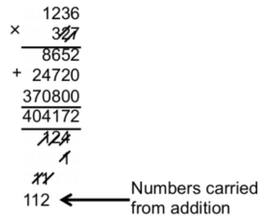
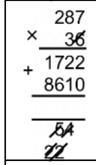
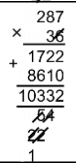
Addition			
	Year 5	Year 6	Year 7
Process	• Whole numbers up to 100,000 • Carrying • Decimals to 2 decimal places • Adding a list of numbers with knowledge of place value	• Decimals • Whole numbers up to 1,000,000 • Adding using a range of units (eg: kg, L, M, £) • Application of method through different real life situations	• Using methods of addition to solve multi-stage problems
Calc	358+73=431 3587+675=4262 125.14 + 125.34 = 150.48 26+348+6+3749= 4129	£35.80+£7.30=£43.10 174.9+117.25=292.15 1.61m+85cm+1.02m= The units will need to be converted so it could become: 1.61m+0.85m+1.02m=3.48m **Or** 161cm+85cm+102cm=348cm	£1.27+£3.95+25p=The units will need converting so it could become: £1.27+£3.95+£0.25=£5.47 **Or** 127p+395p+25p=£5.47 2000g+73kg = The units will need to be converted so it could become: 2000g+73000g=75,000g **Or** 2kg+73kg=75kg
Examples	3587 + 0675 4262 111 Here a zero has been used to show that for the second number there are no thousands. 125.14 + 125.34 250.48 1	174.9 ← + 117.25 292.15 11 Note there is no hundredths for the top number; a zero could be used as a placeholder.	£1.27 + £3.95 £0.25 £5.47 1 1 Note the units have been converted from 25p to £0.25 to match the rest of the numbers in the question.
Vocabulary	Add, addition, more, plus, increase, sum, total, altogether, score, double, near double, How many more to make…? Is the same as. =, equals sign Tens boundary, hundreds boundary, ones boundary, tenths boundary, inverse	Add, addition, more, plus, increase, sum, total, altogether, score, double, near double, How many more to make…? Is the same as. =, equals sign Tens boundary, hundreds boundary, ones boundary, tenths boundary, inverse	Add, addition, more, plus, increase, sum, total, altogether, score, double, near double, How many more to make…? Is the same as. =, equals sign Tens boundary, hundreds boundary, ones boundary, tenths boundary, hundredths boundary, inverse

Subtraction			
	Year 5	Year 6	Year 7
Process	• Column subtraction • Decomposition • Zeros in the middle of the top line • Extension: decimals to 2 decimal places	• Column subtraction with zeros along the top line • Decimals to 2 decimal places • Decomposition method using a variety of units • Application of method through different real life situations	• Use of method to solve a range of numerical problems • Increase the number of decimal places
Calc	2184-156=2028 4008-2995=1013 300.4-62.1=238.3	5000-3465=1535 200-34.2=165.8 3.5m-60cm=The units will need to be converted so it could become: 3.5m-0.60m=2.9m **Or** 350cm-60cm=290cm	£25.32-£2.32=£23 7kg-325g= The units will need to be converted so it could become: 7000g-325g=6675g **Or** 7kg-0.325kg=6.675kg
Examples	71 - 2184 0156 2028	99 4 5 10 10 - 3 4 6 5 1 5 3 5 - 200 34.2 This is how the calculation should be lined up. - 200.0 034.2 It may help pupils to add the decimal and zero to the top line and the zero in the H column. It is easier to line up now. 99 1 2 10 10 - 0 3 4 . 2 1 6 5 . 8	£25.32 - £2.32 £23.00 9 9 6 7 10 10 - 3 2 5 6 6 7 5g or 9 9 6 7 10 10 - 0 . 3 2 5 6 . 6 7 5kg
	With this calculation the O subtraction can be completed without taking from any other columns. For the T column 0-9 cannot be completed without taking from another column. The next column, H, is also a zero, there are no H to take from. Continue to move across, from right to left, until you get to the first number greater than 0. Here the Th column has the number 4. "1" is taken from here, which is one lot of a thousand. 3 - 4 0 0 8 2 9 9 5 3	- 200 34.2 This is how the calculation should be lined up. - 200.0 034.2 It may help pupils to add the decimal and zero to the top line and the zero in the H column. It is easier to line up now.	9 9 6 7 10 10 - 3 2 5 6 6 7 5g Or
	3 9 - 4 10 0 8 2 9 9 5 3 The T column now becomes 10. So the calculation can be completed. 10-9=1	99 1 2 10 10 - 0 3 4 . 2 1 6 5 . 8	9 9 6 7 10 10 - 0 . 3 2 5 6 . 6 7 5kg

	$\begin{array}{r} ^{3}\cancel{4}\,^{1}\cancel{0}^{9}\,^{1}0\;8 \\ -\;2\;9\;9\;5 \\ \hline 1\;0\;1\;3 \end{array}$ Using the new numbers above each column the rest fo the calculations can be completed. $\begin{array}{r} ^{2}\cancel{3}\,^{1}\cancel{0}\,^{1}0\,.\,4 \\ -\;0\;6\;2\,.\,1 \\ \hline 2\;3\;8\,.\,3 \end{array}$ Follow the same process to take from the H column and pass it down to the O.		
Vocabulary	Subtract, subtraction, take (away), minus, decrease, leave, How many are left/left over? How many more/fewer is…than…? How much more/less is…than…? Difference between Half, halve Equals sign, equals, Is the same as… Tens boundaries, hundreds boundaries, ones boundaries, tenths boundaries, inverse	Subtract, subtraction, take (away), minus, decrease, leave, How many are left/left over? How many more/fewer is…than…? How much more/less is…than…? Difference between Half, halve Equals sign, equals, Is the same as… Tens boundaries, hundreds boundaries, ones boundaries, tenths boundaries, inverse	Subtract, subtraction, take (away), minus, decrease, leave, How many are left/left over? How many more/fewer is…than…? How much more/less is…than…? Difference between Half, halve Equals sign, equals, Is the same as… Tens boundaries, hundreds boundaries, ones boundaries, tenths boundaries, inverse, consistent units

Multiplication

	Year 5	Year 6	Year 7
Process	• Column multiplication (HTO x TO) • Long multiplication • Decimals x whole number (2dp) - eg money	• 4 digit numbers by 3 digit numbers (THTO x HTO) • Decimals x whole number (2dp) • Application using a variety of units	• Consolidate long multiplication • Decimal x decimal multiplication (the decimal point placement determined by estimation) • Application in a range of problems
Cal	£5.25x4=£21.00 287x36=10332	230.4x6=1382.4 1236x327=404172	2.84x5.13=14.5692
Examples	Unlike with other calculations, the whole number being multiplied by does not need to be aligned in the O column, but simply to the far right.  When multiplying by a two digit number you will need to make two lines of calculations. Ignore the digit in the T column (3). We begin with multiplying the O of the bottom number by each digit of the top number. In this case 6x7=42. Note the 2 is in the first line, in the O column. The 4 is in the T column right at the bottom of the calculation, so as not to confuse it with other digits.  The next step is to multiply the 6 by the T of the top number. So 6x8=48 +4 (that was carried from the previous calculation) =52. The 2 is placed in the T column and the 5 is carried to the H (again at the bottom). The 4 can be crossed out to show it has been used.  The 6 is now multiplied by the final digit of the top line (2). So 6x2=12 +5 (carried from the previous calculation) =17 which is written on the rest of the line. That line is complete and is essentially 6x287=1722  Just to make it clear that the 6 has been used it has been crossed out. The next IMPORTANT step is that a zero is placed on the second answer line, in the O column. This is to show that the next set of multiplications are multiplied by 10's. In this case we are multiplying by 30. By putting the zero in first, all answers are effectively moved one place over and so multiplied by ten. This allows the calculation to be completed by multiplying by 3.	 Note: When multiplying by a whole number keep the decimal point in line with the one from the question.  To get to this stage follow the steps from year 5. 7x1236=8652 and 20x1236=24720 have both been calculated. The digits crossed out at the bottom are the carried numbers used when calculating the above numbers. IMPORTANT in the same way that a zero was added when multiplying by 10's, now that it is being multiplied by 100's two zeros are used to move the digits two places. Now 3x1236 can be calculated – the placement of the zeros automatically converts it to 300x1236.  3x6=18 the 8 is placed in the next available slot, H column, the 1 is carried to the Th column.  3x3=9 +1 (carried from the previous calculation) =10. The 0 in the Th column, the 1 carried to the TTh column.  3x2=6 +1(carried from the previous calculation) =7.	In order to calculate a decimal number multiplied by a decimal number the first step would be to estimate the answer. 2.84x5.13 This can be rounded to help with the estimation: 3x5=15 Therefore the answer will be approximately 15. In order to calculate remove the decimals and multiply 284x513. (see year 5 and 6 for detailed explanations)  The resulting answer is 145692. Due to the earlier estimation of 15, a decimal can be placed: 14.5692

	 3x7=21 the one is placed in the next available space (T) and the 2 in the H column.	 Next 3x1=3 So the final line represents 300x1236=370800	
	 3x8=24 +2 (carried from the previous calculation) =26. The 6 is placed in the H column and the 2 carried to under the Th column.	 The final stage is to add the three answers together.	
	 3x2=6 +2 (carried from the previous calculation) = 8. That line is complete and is essentially 30x287=8610.		
	 So the calculations of 6x287 and 30x287 have been calculated. The question asks for 36x287. The final step is to add the two answers together to get the final answer.		
Vocabulary	Lots of… Groups of…. ×, times, multiply, multiply by, multiplication, multiple of, product Once, twice, three times…ten times Times as (big, long, wide….etc) (Eg 3 times as big) Repeated addition, array Row, column Double	Lots of… Groups of…. ×, times, multiply, multiply by, multiplication, multiple of, product Once, twice, three times…ten times Times as (big, long, wide….etc) (Eg 3 times as big) Repeated addition, array Row, column Double	Lots of… Groups of…. ×, times, multiply, multiply by, multiplication, multiple of, product Once, twice, three times…ten times Times as (big, long, wide….etc) (Eg 3 times as big) Repeated addition, array Row, column Double, Estimate, rounding

Division

	Year 5	Year 6	Year 7
Process	• Secure knowledge of short division ("bus shelter method") • Using single digit divisors (the number you are dividing by) up to 4-digits • Extension: Dividing a decimal by a whole number	• Introduction of long division • Two digit divisors (the number you are dividing by) • Dividing a decimal by a whole number • Application of long and short division methods using a variety of units	• Higher divisors for long division (the number you are dividing by) • Dividing a decimal by a whole number (until a terminating or recurring decimal is obtained) • Application of long and short division methods through different real life situations
Calc	978÷3=326 325÷3=324 R1 2458 ÷ 2 = 1229	676÷8=84 R4 51.6÷3=17.2 254÷17=14 R16	394÷35=□□□R□ 51.5÷3=17.16
Examples	978÷3=326 3 2 6 3 ⟌ 9 7 1 8 325÷3=324 R1 1 0 8 R1 3 ⟌ 3 2 2 5	676÷8=84 R4 0 8 4 R4 8 ⟌ 6 6 7 3 6 51.6÷3=17.2 1 . 3 ⟌ 5 2 1 . 6 Note when the dividend is a decimal, line up the decimal in the answer. Here 3 divides into 5 once, with two left over, the two left over is transferred to the next digit, in this case it becomes 21. 21÷3=7 1 7 . 3 ⟌ 5 2 1 . 6 The decimal remains in place. 6÷3=2 giving the answer 17.2 1 7 . 2 3 ⟌ 5 2 1 . 6	394÷35=□□□R□ 0 35 ⟌ 3 9 4 3÷35 cannot be done. Now look at 39÷35. 0 35 ⟌ 3 9 4 - 3 5 0 4 Lining the numbers up underneath the dividend, carry out the subtraction 39-35=4. 0 1 35 ⟌ 3 9 4 - 3 5 0 4 One lot of 35 has been used. This is recorded above the dividend. 4 is not enough to carry out a second division. 0 1 35 ⟌ 3 9 4 - 3 5 0 4 4 The 4 from the dividend 394 has been brought down next to the 4 left over from the calculation. 0 1 35 ⟌ 3 9 4 - 3 5 0 4 4 - 3 5 Complete the subtraction of 44-35. 0 1 35 ⟌ 3 9 4 - 3 5 0 4 4 - 3 5 0 9 0 1 1 35 ⟌ 3 9 4 - 3 5 0 4 4 - 3 5 0 9 One more lot of 35 has been used, again this is recorded above the relevant dividend. 0 1 1 R9 35 ⟌ 3 9 4 - 3 5 0 4 4 - 3 5 0 9 There is nothing to add to the 9. This becomes the remainder.

<table>
<tr>
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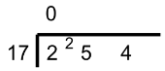
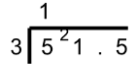
<td>254÷17=14 R16
 
When the divisor is a two-digit number the first dividend will always have a zero over it. (Tip: write out first 5 or so multiples of the divisor, this can be extended if needed)</td>
<td>51.5÷3=17.16
 
Complete the division in the same way as laid out in year 6.</td>
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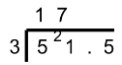
<td>  </td>
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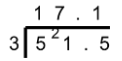
<td> 
When dividing with decimals it cannot have a remainder, the decimal represents the less than a whole. After completing 5÷3=1 there is still 2 left over and nothing else to divide it by.</td>
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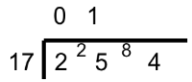
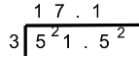
<td>Multiples of 17: 17, 34, 51, 68, 85
 
25÷17=1 with 8 left over.</td>
<td> 
To find out the remaining decimal a zero is used (as technically there is an infinite number of zeros already there). The 2 is carried across and now there is 20÷3.</td>
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<tr>
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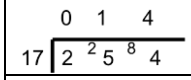
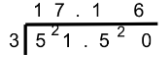
<td>Multiples of 17: 17, 34, 51, 68, 85
  84÷17=4 with 16 left over.</td>
<td> 
20÷3=6 this will leave 2 left over and the process will repeat and repeat, infinitely.</td>
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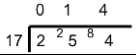
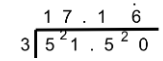
<td>  The 16 left over is the remainder.</td>
<td> 
To represent that this is happening a dot is placed over the 6 to show that it is recurring (repeated).</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Halve, Share, share equally
One each, two each, three each…
Group in pairs, threes….tens
Equal groups of…
divide, divided by, divided into
Left, left over, reminder, factor, quotient, divisible by, inverse</td>
<td>Halve, Share, share equally
One each, two each, three each…
Group in pairs, threes….tens
Equal groups of…
divide, divided by, divided into
Left, left over, reminder, factor, quotient, divisible by, inverse</td>
<td>Halve, Share, share equally
One each, two each, three each…
Group in pairs, threes….tens
Equal groups of…
divide, divided by, divided into
Left, left over, reminder, factor, quotient, divisible by, inverse, recurring, terminating</td>
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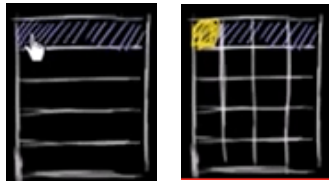
Fractions and Percentages.			
This is to develop and support a conceptual understanding of calculating with fractions and percentages.			
	Year 5	Year 6	Year 7
Process	• Add and subtract fractions with the same denominator and denominations that are multiples of the same number. • Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams. • Write percentages as a fraction with denominator as 100.	• Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions. • Multiply simple pairs of proper fractions, writing the answer in the simplest form. • Divide proper fractions by whole numbers.	• Work interchangeably with terminating decimals and their corresponding fractions. • Interpret fractions and percentages as operators. • Interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%
Calc	4/9 + 11/12 = 1 and 13/36 4/3 – 1/5 = 1 and 2/15 2/3 x 6 = 4 30% = 30/100	3/4 + 2/6 = 13/12 = 1 and 1/12 4/3 – 1/5 = 1 and 2/15 2 and 2/3 + 1 and 1/4 = 3 and 11/12 5/6 x 2/3 = 5/9 1/5 ÷ 4 = 1/20	
Examples	4/9 + 11/12 = Find a common denominator for example 36, then multiply the numerator by the same number the denominator was multiplied by (making an equivalent fraction) 9 x 4 = 36 so 4 x 4 = 16 so it becomes 16/36. Do the same for the other fraction. 12 x 3 = 36, so 11 x 3 = 33 therefore we now have 33/36. We can now add them → 16/36 + 33/36 = 49/36 Simplify the fraction to 1 whole and 13/36. 4/3 – 1/5 = Similar to addition, find a common denominator - 15, then multiply the numerator by the same number the denominator was multiplied by (making an equivalent fraction) 3 x 5 = 15 so 4 x 5 = 20 so it becomes 20/15. Do the same for the other fraction. 5 x 3 = 15, so 1 x 3 = 3 therefore we now have 3/15. Now subtract → 20/15 – 3/15 = 17/15 Simplify the fraction to 1 whole and 2/15. 2/3 x 6 = 4 Multiply the numerator by 6 only = 12. 12/3 simplified = 4 whole.	5/6 x 2/3 = Multiply the numerators together and then multiply the denominators together. So, 5 x 2 = 10 6 x 3 = 18 Therefore 10/18 which can be simplified to 5/9. 1/5 ÷ 4 = 4 is the same as 4/1 so the sentence can be changed to 1/5 ÷ 4/1 This can be changed to a multiplication if we switch the 4/1 to 1/4 So, 1/5 x 1/4 = 1/20 this is the answer.  1/5 ÷ 4 = 1/20	
Vocabulary	Add, subtract, fractions, same, like, simplify, convert, denominator, numerator, whole, part, equivalent, multiply, proper fraction, whole numbers, percentages, multiples.	Add, subtract, fractions, same, like, simplify, convert, denominator, numerator, whole, part, equivalent, multiply, proper fraction, whole numbers, percentages, multiples, divide.	