HOLLYMOUNT SCHOOL KS2 CALCULATION POLICY

Hollymount School

Inspiring Success

The Black Pear Trust

Overview of Hollymount School KS2 Calculation Policy

Hollymount's KS2 calculation policy outlines both the mental and written methods that should be taught from Year 3 to Year 6 and looks to build on the skills and understanding highlighted in the KS1 Calculation Policy. It is a progressive calculation policy that incorporates the formal written methods for all four operations- as outlined in the appendices of the National Curriculum.

It is our intention that the teaching of addition should precede subtraction and that these two operations should be taught successively. This is to ensure children are able to identify clear links between the two operations and understand and explain the inverse nature of them. This process should also be true for the teaching of multiplication and division.

It is our aim that all children have a secure understanding and accurate application of formal written methods for all four operations. Mental strategies should continually be encouraged, developed and revisited. The use of concrete and visual resources should be effectively used to support children's relational understanding of calculation (both mental and written).

When calculating, children should be able to independently choose whether to use mental or written methods. There will be occasions when examples that can be completed mentally may be shown and modelled as a written method; this is to support and develop children's understanding of the written-process.

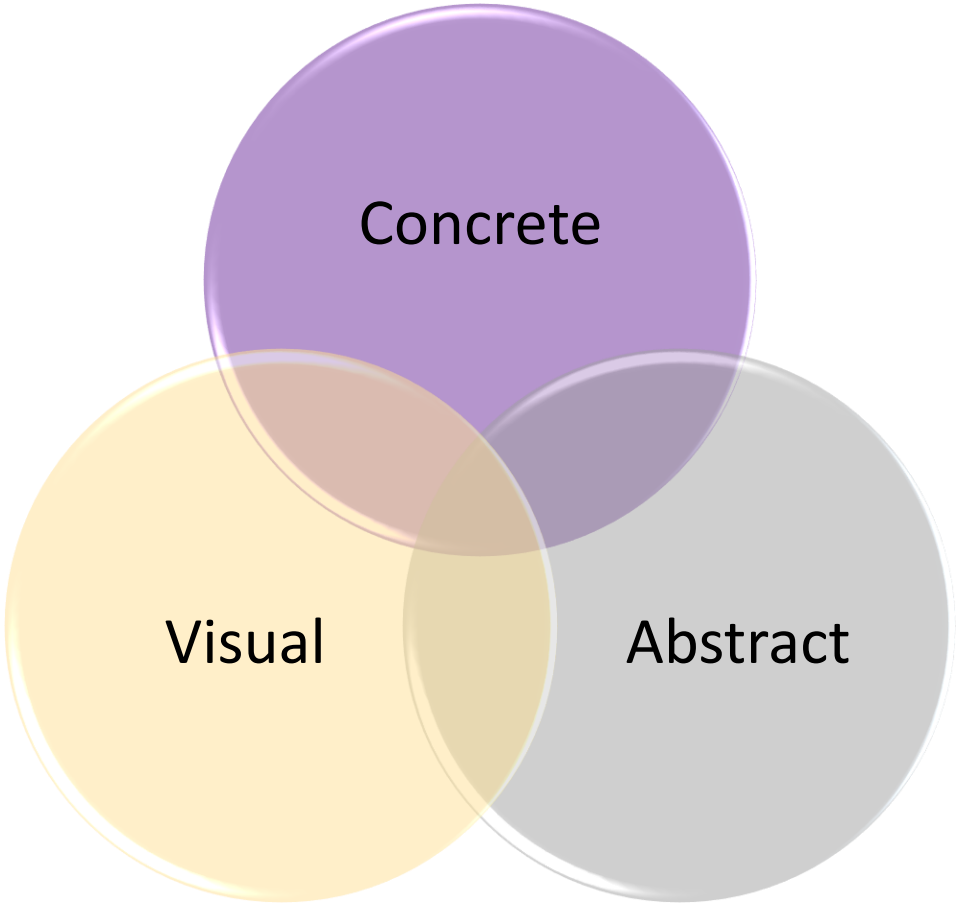
Although other representations-both visual and concrete- are accessible and can be used, teachers at Hollymount School are encouraged to use base-ten when introducing new concepts in calculation. This will allow children to work confidently with a concrete resource and ensure consistency of teaching and learning across year groups. Alternative visual and concrete resources may be used to support children with specific needs, as part of intervention, to address a misconception or to allow children to gain a 'greater-depth' understanding.

The expectation is that year 3 children will use the base-ten resources- outlined in this policy- extensively as they are introduced to formal written methods. This will continue into year 4. In year 5, as children become increasingly secure with their formal written methods base-ten will more likely be used as part of an intervention/booster programme. Alternative provision will be considered for those children who reach year 6 and are not secure with their methods.

The aim of the concrete representatives is for children to gain a relational understanding of all four operations and the abstract nature of formal methods. Children are expected to work with greater numbers throughout their time at primary school- up to 10 000 000. It is recognised that base-ten would be an impractical resource to use when working with such numbers. However, if children have a secure understanding of place value alongside their understanding of the four operations, greater numbers should not inhibit children's calculation- as mental and written methods remain the same.

CVA

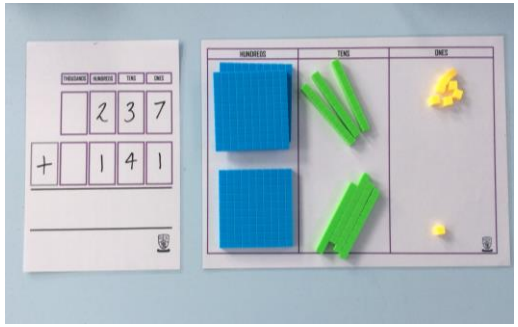
Switching between the concrete, visual and abstract should not be a linear nor a one-way process. Combining different strategies/resources simultaneously and revisiting the concrete and visual (particularly for discussion purposes) is imperative in providing all children with a deep understanding.

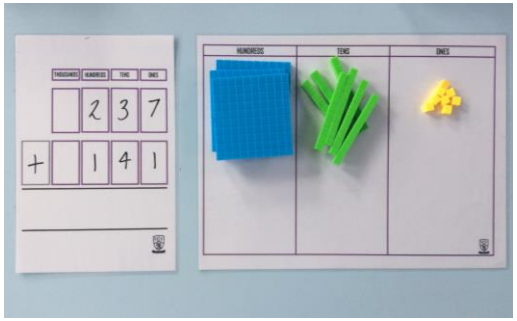


DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION

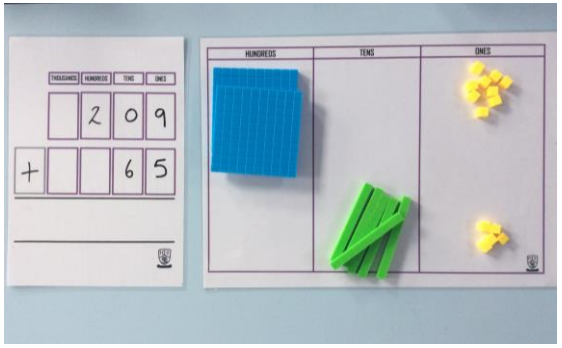
Key representations to support understanding of addition and subtraction

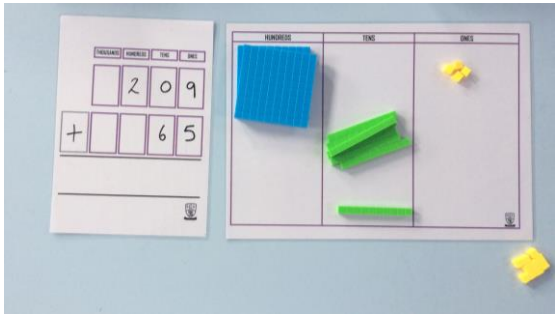
Addition without regrouping:

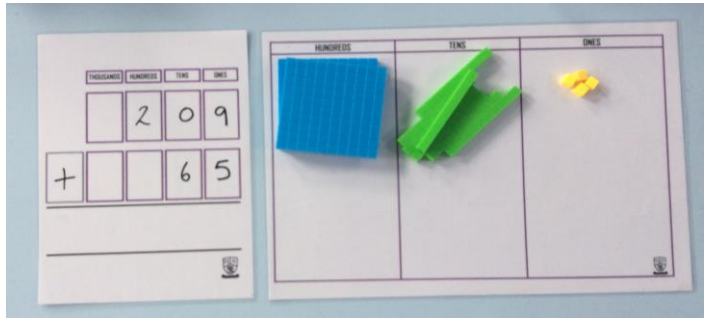




Addition with regrouping:





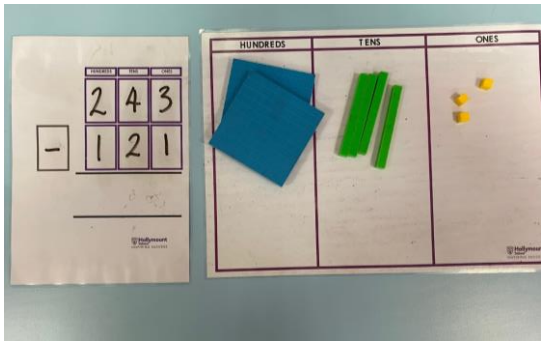


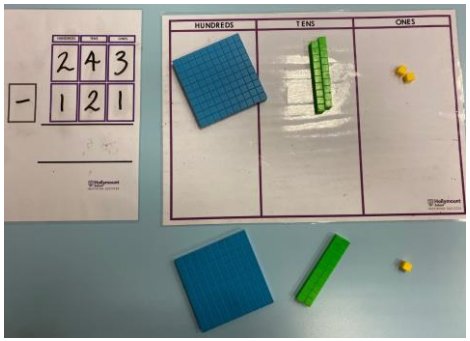
Note:

Children, when appropriate, can and should use visual representations (drawings) of these concrete resources to support their understanding of mental and written calculations.

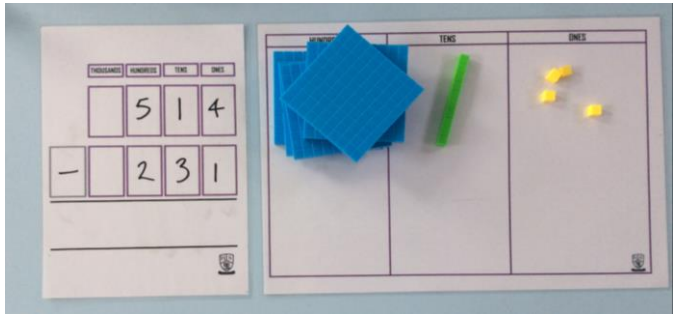
Key representations to support understanding of addition and subtraction continued…

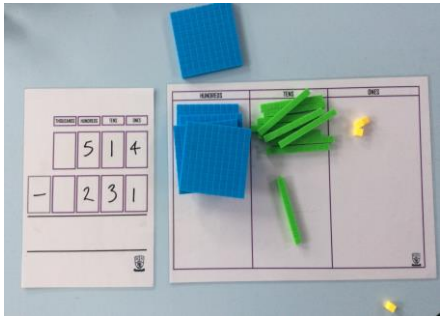
Subtraction without regrouping:

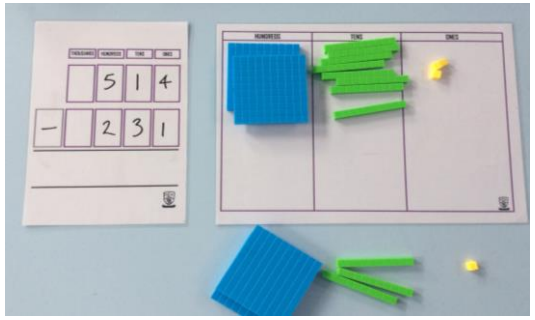




Subtraction with regrouping:



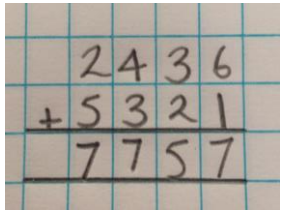
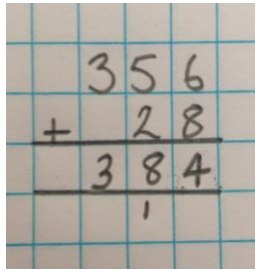
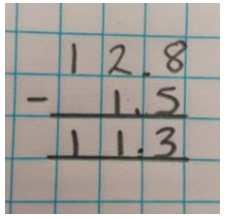
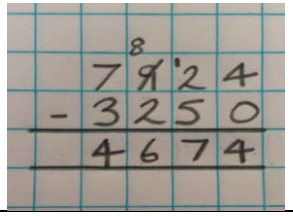




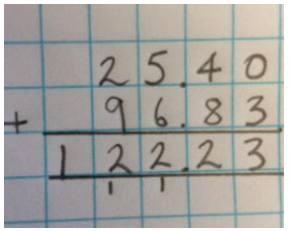
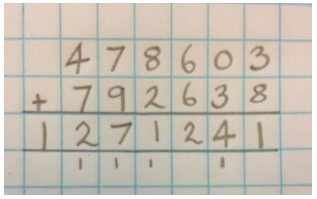
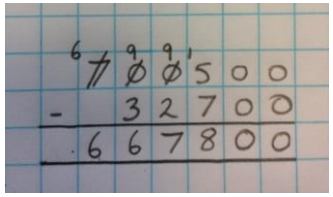
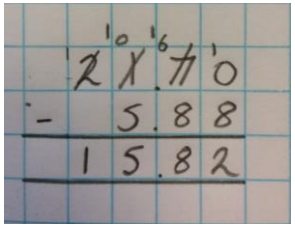
Note:

Children, when appropriate, can and should use visual representations (drawings) of these concrete resources to support their understanding of mental and written calculations.

Year 3 and Year 4

Objectives:	Mental Methods:	Written Methods:
Year 3 - add and subtract numbers mentally: *3 digit number and 1s* *3 digit number and 10s* *3 digit number and 100s* - add and subtract numbers with up to 3 digits using formal written methods of columnar addition and subtraction **Year 4** - secure and extend mental method - select whether a calculation can be done mentally, with a jotting or using a formal written method - add and subtract numbers with up to 4 digits using formal written methods of column addition and subtraction where appropriate. **Children should build a secure understanding of commutative law and inverse operations to support their mental and written methods.**	Counting forwards or backwards (e.g. in 100): 1636 – 500 = 1136 1536 1436 1236 1136 Doubling: 26 + 26 = 52 6 + 6 = 12 20 + 20 = 40 40 + 12 = 52 Bridging 10: 425 + 8 = 433 425 + 5 = 430 430 + 3 = 433 Partitioning: 234 + 35 = 269 230 + 30 = 260 4 + 5 = 9 260 + 9 = 269 Rounding: 425 + 90 = 515 425 + 100 = 525 525 – 10 = 515 146 – 9 = 137 146 – 10 = 136 136 + 1 =137 Commutative Law: 12 + 17 = 29 17 + 12 = 29 Inverse: 22 + 13 = 35 35 – 13 = 22 35 – 22 = 13	Addition without regrouping:  Addition with regrouping:  Subtraction without regrouping:  Subtraction with regrouping: 

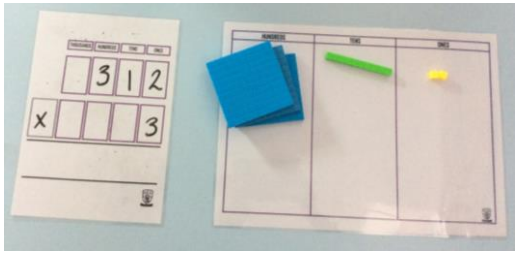
Year 5 and Year 6

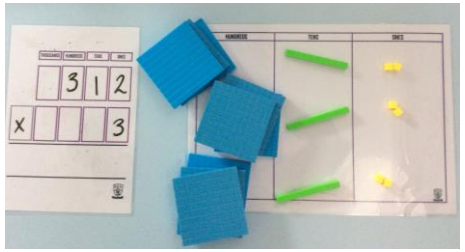
Objectives:	Mental Methods:	Written Methods:
Year 5 - add and subtract numbers with 4 and more digits using formal written methods of columnar addition and subtraction - add and subtract mentally with increasingly large numbers **Year 6** There are no additional statutory requirements- that directly link to calculation methods- for addition and subtraction in year 6 **Children should continue to build a secure understanding of commutative law and inverse operations to support their mental and written methods.**	Children will continue to develop the mental methods they have been taught in years 3 and 4 by improving fluency and precision. Furthermore, they will now apply these methods when working with increasingly larger numbers and decimal numbers. Counting forwards or backwards (e.g. in 1 000 000): 13 456 083 – 4 000 000 = 9 456 083 12 456 083 11 456 083 10 456 083 9 456 083 Doubling: 1500 + 1500 = 3000 1000 + 1000 = 2000 500 + 500 = 1000 Partitioning: 14.3 + 3.2 = 17.5 14 + 3 = 17 0.2 + 0.3 = 0.5 17 + 0.5 = 17.5 Rounding to check answers: 13.93 + 7.04 = 20.97 14 + 7 = 21 1248 –196 = 1052 1250 – 200 = 1050 Commutative Law: 250 + 350 = 600 350 + 250 = 600 Inverse: 6.5 + 13.5 = 20 20 – 6.5 = 13.5 20 – 13.5 = 6.5	Addition with multiple regrouping:   Subtraction with multiple regrouping:  

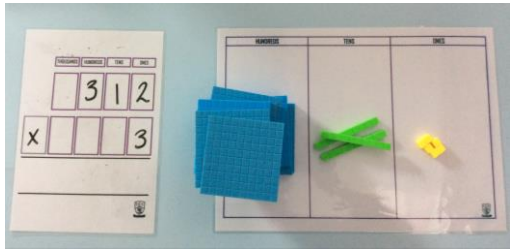
DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION

Key representations to support understanding of multiplication and division

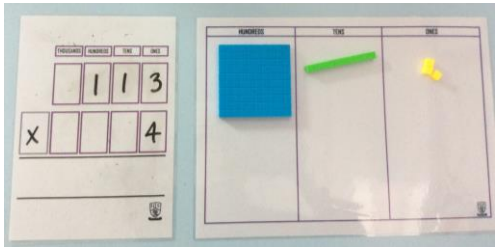
Multiplication without regrouping:

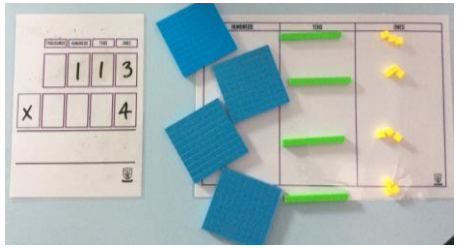


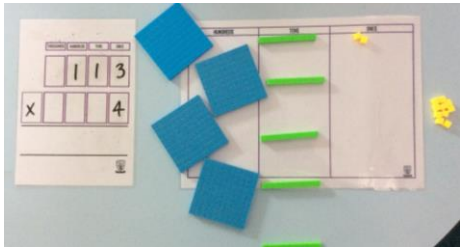


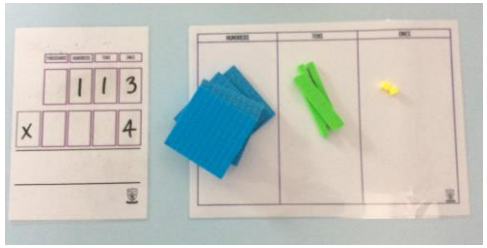


Multiplication with regrouping:







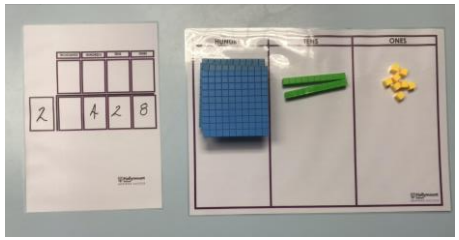


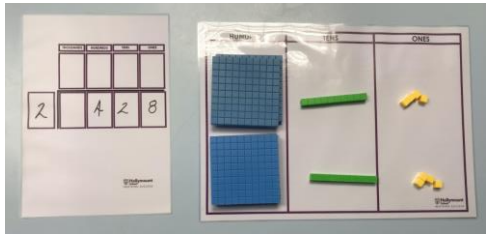
Note:

Children, when appropriate, can and should use visual representations (drawings) of these concrete resources to support their understanding of mental and written calculations.

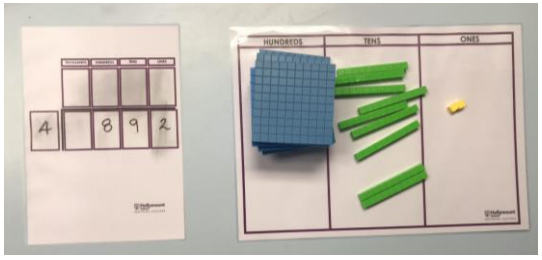
Key representations to support understanding of multiplication and division continued…

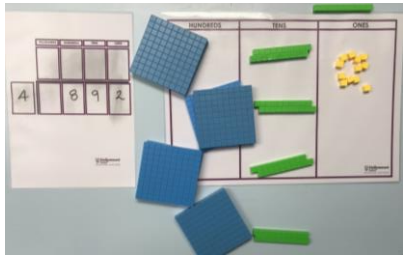
Division without regrouping:

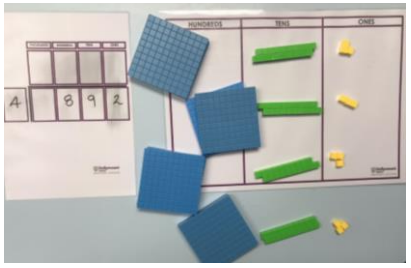




Division with regrouping:



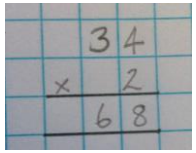
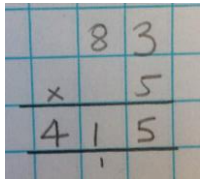
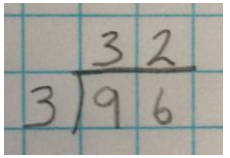
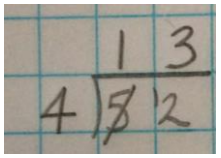
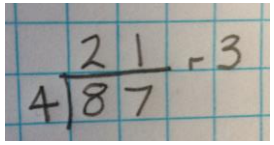




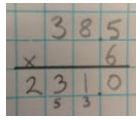
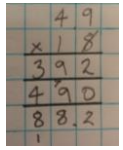
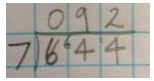
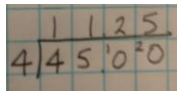
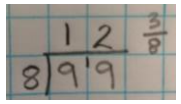
Note:

Children, when appropriate, can and should use visual representations (drawings) of these concrete resources to support their understanding of mental and written calculations.

Year 3 and Year 4

Objectives:	Mental Methods:	Written Methods:
Year 3 - recall and use multiplication and division facts for the 3, 4 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 and progressing to formal written methods **Year 4** - recall multiplication and division facts for multiplication tables up to 12 × 12 - multiply two-digit and three-digit numbers by a one-digit number using formal written layout **Children should build a secure understanding of commutative law and inverse operations to support both their mental and written methods.**	By the end of year 4 children will be able to recall their times-tables 0-12. Rote recall will play a part in children's learning however they will understand the principals behind multiplication and division in their answers. Teachers will not teach patterns as a method of learning times-tables however will encourage children to explore identifying patterns for themselves. Counting forward/repeated addition to support multiplication: 3 x 4 = 12 4 x 4 = 12 + 4 Counting backwards to support multiplication: 3 x 4 = 12 2 x 4 = 12 - 4 Commutative law (multiplication): 9 x 6 = 54 6 x 4 = 54 Inverse operations: 8 x 7 = 56 56 ÷ 8 = 7 56 ÷ 7 = 8 Place Value: 20 + 20 + 20 + 20 = 80 therefore 20 x 4 = 80 200 + 200 + 200 + 200 = 800 therefore 200 x 4 = 800 2000 + 2000 + 2000 + 2000 = 8000 therefore 2000 x 4 = 8000	Short multiplication without regrouping:  Short multiplication with regrouping:  Short division without regrouping:  Short division with regrouping:  Short division with remainders: 

Year 5 and Year 6

Objectives:	Mental Methods:	Written Methods:
Year 5 - multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers - 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 **Year 6** - multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication - 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 - divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context **Children should continue to build a secure understanding of commutative law and inverse operations to support both their mental and written methods.**	Children will continue to develop the mental methods they have been taught in years 3 and 4 by improving fluency and precision. Furthermore, they will now apply these methods when working with increasingly larger numbers and decimal numbers. Children will aim to develop their retention skills so that they can complete calculations that have multiple steps, e.g. 3 x 4 x 5 This includes calculations that involve mixed operations, e.g. 7 + 3 x 6. In these instances, for children to be successful, they will need to apply their understanding of the order in which operations should be completed. Therefore for the above example, (3x6) = 18, 18 + 7 =25 Counting forward/repeated addition to support multiplication: 6 x 250 = 1500 7 x 250 = 1500 + 250 Counting backwards to support multiplication: 7 x 600 = 4200 6 x 600 = 3600 Rounding to support estimation: 244 x 4 = 966 250 x 4 = 1000 1236 ÷ 4 = 309 1200 ÷ 4 = 300 Children should be encouraged/independently choose to use a written method if working with numbers they are not confident in calculating mentally with accuracy.	Short multiplication with multiple regrouping:  Long multiplication:  Short division with multiple regrouping:  Division with a remainder (displayed as a decimal):  Division with a remainder (displayed as a fraction):  Long division: