# Maths Calculation Policy


# 2022-23

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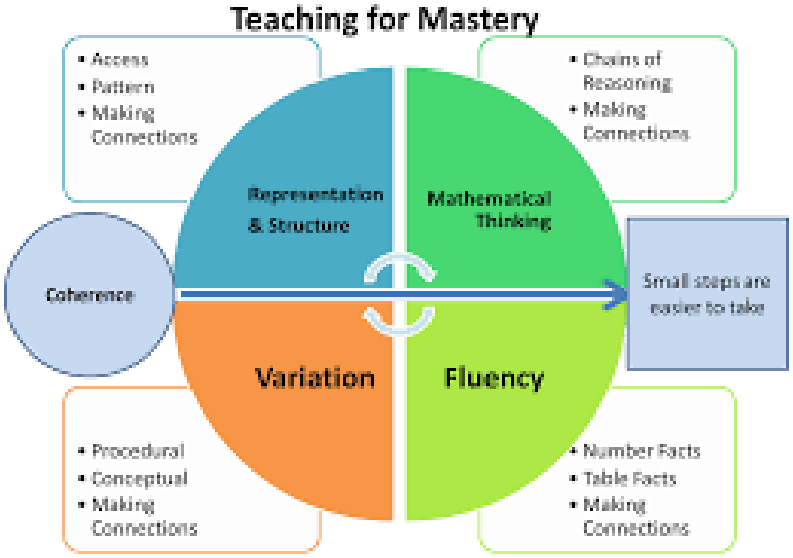
| **School name:** | Ribbon Academy |
| **Responsibility** | Mr D Frankish/ Mr S Houghton |
| **Last Review** | December 2022 |
| **Next Review** | July 2023 |

This calculation policy has been written by the Maths Leader in discussion with school staff. It outlines the expectations for written calculations in each year group at Ribbon Academy.

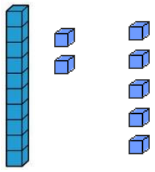
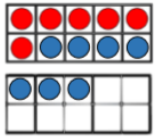
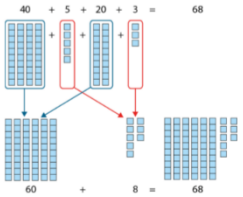
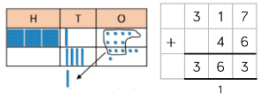
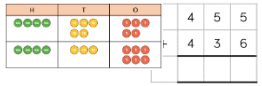
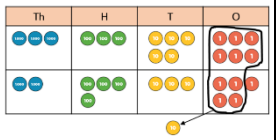
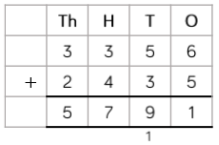
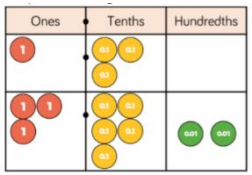
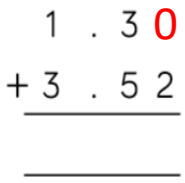
The policy is designed to ensure a consistent approach to calculation methods across the whole school. Teachers support children's understanding of a particular method before introducing them to the next stage. Each element of the calculation policy carefully considers 'The Big 5 Ideas' of Teaching for Mastery to ensure a deep understanding of the mathematical concept, procedure and relationships between numbers.



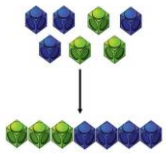
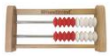
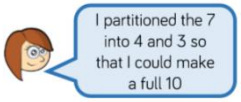
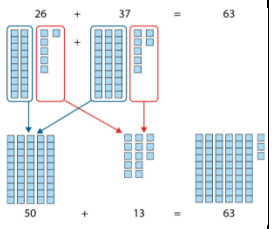

The objectives for each year group have been taken from the National Curriculum. Ideas for using concrete and pictorial representations to support pupils' understanding of abstract methods have been taken from the White Rose Scheme of Work and calculation guidance from the NCETM as well as real examples used within the Academy.

***Concrete –*** children use concrete objects and manipulatives to help them understand and explain what they are doing.
***Pictorial*** – children then build on this concrete approach by using pictorial representations, which can then be used to reason and solve problems.
***Abstract*** – with the foundations firmly laid, children can move to an abstract approach using numbers and key concepts with confidence.
The policy is divided into sections for each of the four operations: addition, subtraction, multiplication and division. There is also a separate section relating to using the four operations with fractions in KS2.

# Written Calculation Guidance - Addition

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Use quantities and objects to add two single digit numbers and count on to find the answer.**<br><br>**Find one more than a number (up to 20) using concrete equipment.** | **Add 1-digit and 2-digit numbers to 20, including zero.**<br><br>**To read, write and interpret mathematical symbols involving the addition and equals symbols.**<br><br>**To identify one more than a number (calculating not counting).** | **Add two 2-digit numbers.** | **Add numbers with up to 3-digits, using formal written methods of columnar addition and subtraction.** | **Add numbers with up to 4-digits using the formal written methods of columnar addition and subtraction where appropriate.** | **Add whole numbers with more than 4-digits, including using formal written methods (columnar addition and subtraction.**<br><br>**Add decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places (up to 3 d.p ) and complements of 1 (for example, 0.83 + 0.17 = 1).** | **Using knowledge of the order of operations to carry out calculations involving all four operations.** |
| **Concrete** | Use of concrete resources to explore addition in different contexts and using different structures:<br><br>Concept boards:<br><br>  <br><br>*Aggregation:*<br>*Three green cubes add four blue cubes – how many cubes altogether?* | Use of bead strings, Base 10, tens frames and other concrete objects:<br><br>*12 + 5 = 17*<br><br>  <br><br>  <br><br>*6 + 7 = ?*<br><br>  | Use partitioning to add two 2-digit numbers (builds upon prior learning of adding two multiples of 10 and two single digit numbers)<br><br>No bridging:<br><br>*45 + 23*<br><br>  | Use of Base 10 and place value counters to add HTO + TO, HTO + HTO etc. When there are 10 ones in the 1s column- we exchange for 1 ten, when there are 10 tens in the 10s column- we exchange for 1 hundred:<br><br>*317 + 46 = ?*<br><br>  <br><br>*455 + 436 = ?*<br><br>  | Use of place value counters alongside abstract method to consolidate understanding:<br><br>*3356 + 2435 = 5791*<br><br>  <br><br>  | Continue to use apparatus and practical resources alongside formal written method e.g. place value counters:<br><br>*1.3 + 3.52 = ?*<br><br>  <br><br>  | |

# Written Calculation Guidance - Addition

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| NC Objectives | **Use quantities and objects to add two single digit numbers and count on to find the answer.**<br><br>**Find one more than a number (up to 20) using concrete equipment.** | **Add 1-digit and 2-digit numbers to 20, including zero.**<br><br>**To read, write and interpret mathematical symbols involving the addition and equals symbols.**<br><br>**To identify one more than a number (calculating not counting).** | **Add two 2-digit numbers.** | **Add numbers with up to 3-digits, using formal written methods of columnar addition and subtraction.** | **Add numbers with up to 4-digits using the formal written methods of columnar addition and subtraction where appropriate.** | **Add whole numbers with more than 4-digits, including using formal written methods (columnar addition and subtraction.**<br><br>**Add decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places (up to 3 d.p ) and complements of 1 (for example, 0.83 + 0.17 = 1).** | **Using knowledge of the order of operations to carry out calculations involving all four operations.** |
| | *Seven cubes altogether.*<br>  <br>*Augmentation:*<br>*First there were four people on the bus, then three got on. Now there are seven people on the bus.*<br>  <br><br>*Rekenreks for showing parts of a whole number, adding, subtracting and manipulatin g*<br>  |  <br><br>*Rekenreks for showing parts of a whole number, adding, subtracting and manipulating.*<br>  | Bridging through 10:<br>  <br> | | | | |

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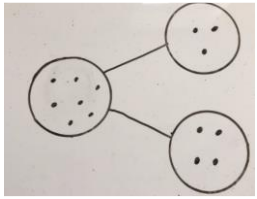
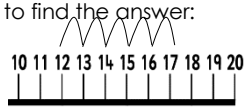
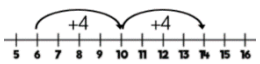
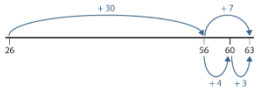
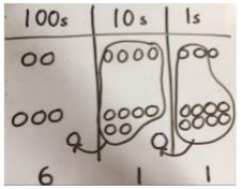
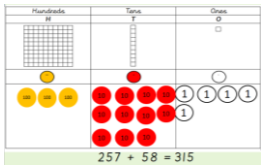
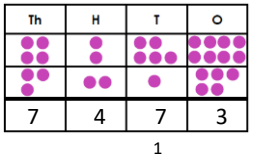
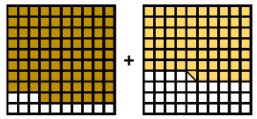
| **Pictorial** | Children to represent concrete materials using dots/ crosses/ other images. They can represent on a part-whole model too:<br><br>*3 + 4 = 7*<br><br>  | Children can use visual images and a number line to support addition. Start at the larger number and count on in ones or in one jump to find the answer:<br><br>  <br><br><br>Encourage 'bridging through 10' so that pupils are calculating rather than counting:<br><br>*6 + 8 =*<br><br>  <br> | Pupils can use dots and dashes to represent Base 10:<br><br>*57 + 84 = ?*<br><br>  <br><br>Use of a number line to explore adding the partitioned parts of one of the 2-digit numbers to the whole of the other 2-digit number:<br><br>*26 + 37 = ?*<br><br>  <br> | Children to represent the Base 10/ counters in a place value chart, circling when they make an exchange:<br><br>*243 + 368 = 611*<br><br>  <br><br><br>  <br> | Represent additions on a place value grid alongside formal column method:<br><br>*4258 + 3215 = 7473*<br><br>  <br><br><br>*I need to exchange ten ones for one ten* | Visual representation for addition of decimals using decimal squares:<br><br>*0.87 + 0.655 = 1.525*<br><br>  | |

# Written Calculation Guidance - Addition

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
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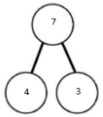
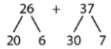
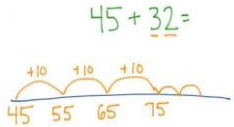
| **Abstract** | Children will form numbers but are not expected to form number sentences.<br><br>Recording can be in the form of pictures or verbal statements (use of the language 'first, then and now for augmentation).<br><br>Pupils can place numbers onto a structure provided by the teacher (e.g. part-whole model):<br><br>*Four is a part, three is a part and seven is the whole.*<br>  | Pupils are expected to form number sentences:<br>  <br><br>Place the larger number in your head and count on the smaller number to find your answer.<br><br>Recognise addition as commutative:<br><br>***12 + 5 = 17***<br><br>***5 + 12 = 17*** | Partitioning both addends:<br>  <br>20 + 30 = 50<br>6 + 7 = 13<br>50 + 13 = 63<br><br>Partitioning one addend:<br>  <br>26 + 30 = 56<br>56 + 7 = 63<br><br>Pupils draw their own abstract number line:<br>  | Pupils are introduced to the formal written column method, carrying underneath the answer box:<br><br>243<br>+368<br>611<br>1 1<br><br>Progressive Steps include:-<br><br>2d + 1d<br>2d + 2d<br>2d + 1d (exchange)<br>2d + 2d (exchange)<br><br>3d + 1d<br>3d + 2d<br>3d + 3d<br>3d + 1d (exchange)<br>3d + 2d (exchange)<br>3d + 3d (exchange) | Children to use the formal written method, carrying underneath the answer box:<br><br>2436<br>+ 1248<br>3684<br>1 | Children to use the formal written method, carrying underneath the answer box. Insert zeros for place holders:<br><br>0.870<br>+ 0.655<br>1.525<br>1 | Continue to practise formal column addition for larger numbers, including those with decimals. |

| Written Calculation Guidance - Subtraction | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **EYFS** | **YEAR 1** | **YEAR 2** | **YEAR 3** | **YEAR 4** | **YEAR 5** | **YEAR 6** |
| **NC Objectives** | Use quantities and objects to subtract two single digit numbers and count back to find the answer<br><br>One less<br><br>Begin to use appropriate vocabulary | Subtract 1-digit and 2-digit numbers to 20, including zero<br><br>To read, write and interpret mathematical symbols involving the subtraction and equals symbols.<br><br>To identify one less than a number (calculating not counting) | Subtract two 2-digit numbers | Subtract numbers with up to 3-digits, using formal written methods of columnar addition and subtraction | Subtract numbers with up to 4-digits using the formal written methods of columnar addition and subtraction where appropriate | Subtract whole numbers with more than 4-digits, including using formal written methods (columnar addition and subtraction<br><br>Subtract decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places (up to 3 d.p.) and complements of 1 (for example, 0.83 + 0.17 = 1). | Using knowledge of the order of operations to carry out calculations involving all four operations |

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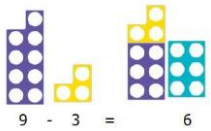
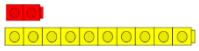
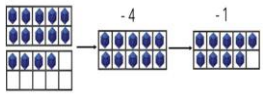
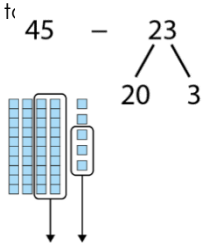
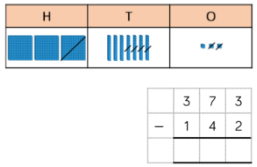
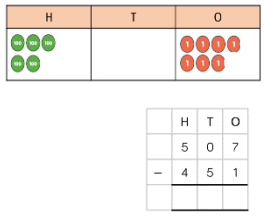
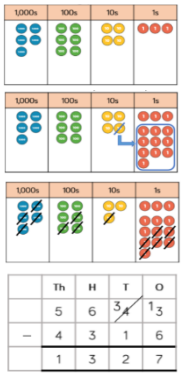
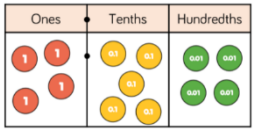
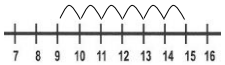
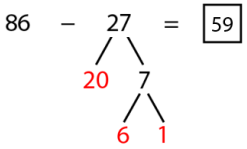
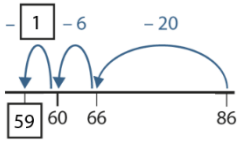
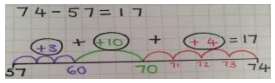
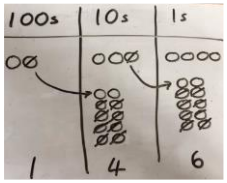
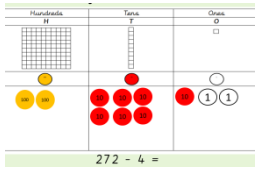
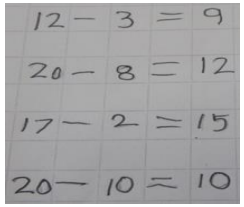
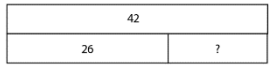
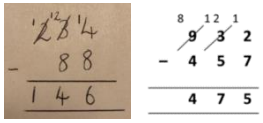
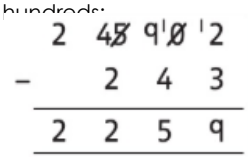
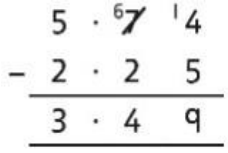
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Use quantities and objects to subtract two single digit numbers and count back to find the answer**<br><br>**One less**<br><br>**Begin to use appropriate vocabulary** | **Subtract 1-digit and 2-digit numbers to 20, including zero**<br><br>**To read, write and interpret mathematical symbols involving the subtraction and equals symbols.**<br><br>**To identify one less than a number (calculating not counting)** | **Subtract two 2-digit numbers** | **Subtract numbers with up to 3-digits, using formal written methods of columnar addition and subtraction** | **Subtract numbers with up to 4-digits using the formal written methods of columnar addition and subtraction where appropriate** | **Subtract whole numbers with more than 4-digits, including using formal written methods (columnar addition and subtraction**<br><br>**Subtract decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places (up to 3 d.p.) and complements of 1 (for example, 0.83 + 0.17 = 1).** | **Using knowledge of the order of operations to carry out calculations involving all four operations** |
| **Concrete** | Use physical objects to practically take away:<br><br>*Reduction:*<br>*There were 7 animals.*<br>*Two birds flew away.*<br>*How many animals were left?*<br>  <br>Use of numicon<br><br>*Difference: -*<br>  <br> | Use physical objects, counters, cubes, tens frames, numicon etc to show how objects can be taken away:<br>  <br>*10 – 8 = 2*<br>*10 – 2 = 8*<br><br>Make 14 on the tens frame. Take 4 away to make 10, take one more so you have taken 5:<br><br>*14 – 5 = 9*<br>  <br> | A 2-digit number can be subtracted from a 2-digit number by partitioning the subtrahend into tens and ones. Use Base 10 t<br>  <br> | Use Base 10 or place value counters for the column method, including exchanges:<br><br>*373 – 142 = ?*<br>  <br><br><br>*507 – 451 = ?*<br>  <br> | Continue to use place value counters:<br><br>*5643 – 4316 =*<br>  <br><br><br>*N.B. remember to show making exchanges across more than one column where there is zero as a place holder.* | Continue to use place value equipment when subtracting whole numbers with pupils who do not understand the abstract method.<br><br>When subtracting decimals, start with the use of place value counters alongside abstract algorithm:<br><br>*4.54 – 1.4 = ?*<br>  <br><br>4 . 5 4<br>– 1 . 4 0 | **BIDMAS**<br><br>100 – 6 x 3 + 2 = ?<br><br>100 – 6 x 3 + 2 =<br>↓<br>100 – 18 + 2 = ?<br>↓<br>100 - 20 = 80 |

# Written Calculation Guidance - Subtraction

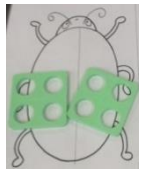
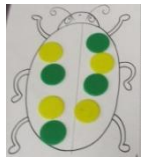
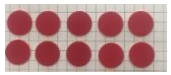
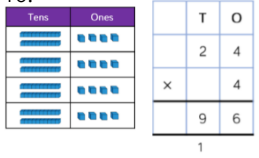
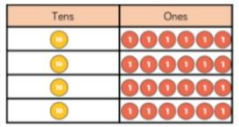
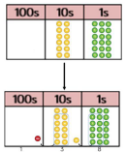
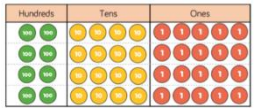
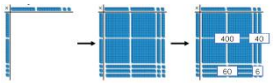
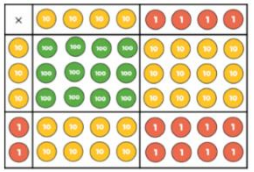
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Use quantities and objects to subtract two single digit numbers and count back to find the answer**<br><br>**One less**<br><br>**Begin to use appropriate vocabulary** | **Subtract 1-digit and 2-digit numbers to 20, including zero**<br><br>**To read, write and interpret mathematical symbols involving the subtraction and equals symbols.**<br><br>**To identify one less than a number (calculating not counting)** | **Subtract two 2-digit numbers** | **Subtract numbers with up to 3-digits, using formal written methods of columnar addition and subtraction** | **Subtract numbers with up to 4-digits using the formal written methods of columnar addition and subtraction where appropriate** | **Subtract whole numbers with more than 4-digits, including using formal written methods (columnar addition and subtraction**<br><br>**Subtract decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places (up to 3 d.p.) and complements of 1 (for example, 0.83 + 0.17 = 1).** | **Using knowledge of the order of operations to carry out calculations involving all four operations** |
| **Pictorial** | Reduction: -<br><br>Draw pictures and cross off as necessary:<br><br>*7-2 = 5*<br><br>  <br><br>Difference: -<br><br>Draw pictures of the two different groups to compare. | Cross out the objects to show what has been taken away:<br><br>*15 – 6 = 9*<br><br>  <br><br>Use a number line:<br><br>  <br><br><br>Children to present a tens frame pictorially and discuss what they did to bridge back through 10:<br><br>*14 – 5 = 9*<br><br>  | Use of a number line to subtract the tens and then subtract the units, bridging through 10 when necessary:<br><br>  <br><br><br>  <br><br><br>'Finding the difference' – pupils use a number line to jump from the smallest to the largest number:<br><br>  <br> | Pupils can represent the Base 10 and place value counters pictorially:<br><br>*234 – 88 = 146*<br><br>  <br><br><br>  <br> | Pupils can continue to represent place value counters pictorially. | Pupils can represent the place value counters pictorially. | |

# Written Calculation Guidance - Subtraction

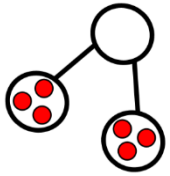
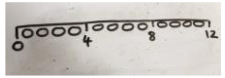
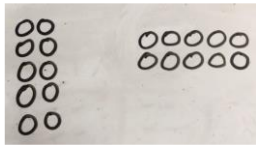
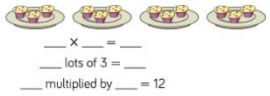
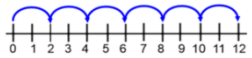
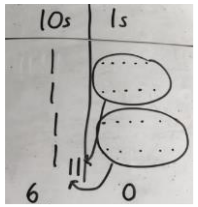
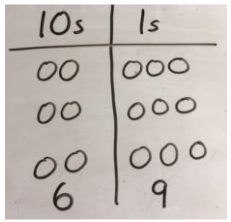
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| NC Objectives | **Use quantities and objects to subtract two single digit numbers and count back to find the answer**<br><br>**One less**<br><br>**Begin to use appropriate vocabulary** | **Subtract 1-digit and 2-digit numbers to 20, including zero**<br><br>**To read, write and interpret mathematical symbols involving the subtraction and equals symbols.**<br><br>**To identify one less than a number (calculating not counting)** | **Subtract two 2-digit numbers** | **Subtract numbers with up to 3-digits, using formal written methods of columnar addition and subtraction** | **Subtract numbers with up to 4-digits using the formal written methods of columnar addition and subtraction where appropriate** | **Subtract whole numbers with more than 4-digits, including using formal written methods (columnar addition and subtraction**<br><br>**Subtract decimals, including a mix of whole numbers and decimals, decimals with different numbers of decimal places (up to 3 d.p.) and complements of 1 (for example, 0.83 + 0.17 = 1).** | **Using knowledge of the order of operations to carry out calculations involving all four operations** |
| Abstract | As for addition, children are not expected to form number sentences at this stage. Understanding can be assessed using pictures or verbal statements. | Form number sentences to represent calculations:<br>  <br><br>Use mental strategies to recall one less. | Pupils to form number sentences:<br><br>**74 – 57 = 17**<br><br>Pupils can also place numbers on bar models and part-whole diagrams:<br>  <br> | Pupils are introduced to the formal column method. Pupils must understand what has happened when exchanges have been made:<br>  <br>Progression: -<br><br>2d - 1d<br>2d - 2d<br>2d - 1d (exchange)<br>2d - 2d (exchange)<br><br>3d - 1d<br>3d - 2d<br>3d - 3d<br>3d - 1d (exchange)<br>3d - 2d (exchange)<br>3d - 3d (exchange) | Pupils must be able to explain what has happened when they have made exchanges, particularly across two columns. Do not use commas to separate thousands from hundreds:<br>  | Represent subtraction as a formal column method. Ensure place value columns are lined up currently:<br>  | Pictorial strategies to be utilized to challenge thinking and deepen understanding and efficiency to continue the practise of formal column subtraction for larger numbers, including those with decimals. |

| Written Calculation Guidance - Multiplication | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **EYFS** | **YEAR 1** | **YEAR 2** | **YEAR 3** | **YEAR 4** | **YEAR 5** | **YEAR 6** |
| **NC Objectives** | Double in a practical way | Solve one step word problems by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.<br><br>Understand doubling numbers.<br><br>*TT:- x10, x5, x2* | Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs.<br><br>Show that multiplication is commutative.<br><br>*TT: - x10, x5, x2* | Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods<br><br>*TT:- x10, x5, x2, x4, x 8, x3* | Multiply 2-digit and 3-digit numbers by a 1-digit number using a written formal method (short multiplication).<br><br>TT:- All times tables | Multiply numbers up to 4-digits by a 1 or 2-digit number using a formal written method, including long multiplication for 2-digit numbers.<br><br>TT:- All times tables | Multiply multi-digit numbers up to 4-digits by a 2-digit whole number using the formal written method of long multiplication.<br><br>TT:- All times tables |

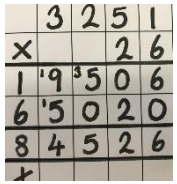
# Written Calculation Guidance - Multiplication

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Double in a practical way** | **Solve one step word problems by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.**<br><br>**Understand doubling numbers.**<br><br>***TT:- x10, x5, x2*** | **Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs.**<br><br>**Show that multiplication is commutative.**<br><br>***TT: - x10, x5, x2*** | **Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods**<br><br>***TT:- x10, x5, x2, x4, x 8, x3*** | **Multiply 2-digit and 3-digit numbers by a 1-digit number using a written formal method (short multiplication).**<br><br>**TT:- All times tables** | **Multiply numbers up to 4-digits by a 1 or 2-digit number using a formal written method, including long multiplication for 2-digit numbers.**<br><br>**TT:- All times tables** | **Multiply multi-digit numbers up to 4-digits by a 2-digit whole number using the formal written method of long multiplication.**<br><br>**TT:- All times tables** |
| **Concrete** | Build doubles using concrete resources:<br><br>*Double 4 is 8*<br><br>  <br>  | Use concrete resources to demonstrate doubling numbers as repeated addition:<br><br>*Double 5 is 10*<br><br>  <br><br>*2 + 2 = 4*<br><br>  <br><br>Concrete resources to demonstrate repeated addition/repeated addition:<br><br>*There are 3 equal groups with 4 in each group.*<br><br>  <br>  | Use concrete resources to add equal groups, linking multiplication to repeated addition:<br><br>*There are 3 equal groups with 5 in each group.*<br>*5 + 5 + 5 = 15*<br>*3 x 5 = 15*<br><br>  <br><br>Use arrays to illustrate commutativity (cubes, counters):<br><br>  <br>2 lots of 5<br><br>  <br>5 lots of 2<br><br>  | Pupils continue to use their understanding of repeated addition to represent a 2-digit number multiplied by a 1-digit number with concrete manipulatives. Explore multiplication with exchange:<br><br>Represent using Base 10:<br><br>  <br><br>Represent using place value counters:<br><br>  <br>  | Formal column method with place value counters:<br><br>*6 x 23 =*<br><br>  <br><br>*4 x 245 =*<br><br>  <br><br>  | Use Base 10 to represent the area model of multiplication, which will enable pupils to see the size and scale linked to multiplying by a 2-digit number:<br><br>*23 x 22 =*<br><br>  <br><br>Represent using place value counters:<br><br>*44 x 32 =*<br><br>  | Pictorial strategies to be utilized to challenge thinking and deepen understanding and efficiency |

# Written Calculation Guidance - Multiplication

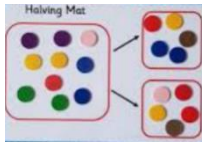
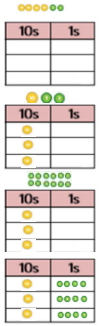
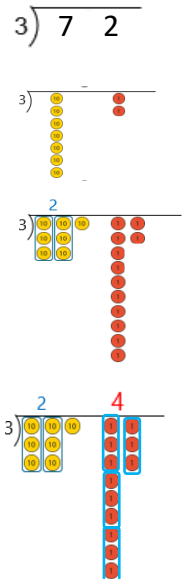
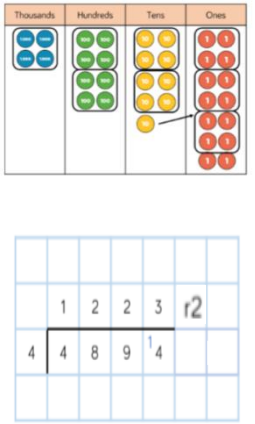
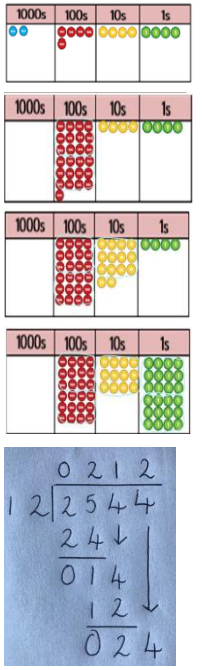
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Double in a practical way** | **Solve one step word problems by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.**<br><br>**Understand doubling numbers.**<br><br>***TT:- x10, x5, x2*** | **Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs.**<br><br>**Show that multiplication is commutative.**<br><br>***TT: - x10, x5, x2*** | **Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods**<br><br>***TT:- x10, x5, x2, x4, x 8, x3*** | **Multiply 2-digit and 3-digit numbers by a 1-digit number using a written formal method (short multiplication).**<br><br>**TT:- All times tables** | **Multiply numbers up to 4-digits by a 1 or 2-digit number using a formal written method, including long multiplication for 2-digit numbers.**<br><br>**TT:- All times tables** | **Multiply multi-digit numbers up to 4-digits by a 2-digit whole number using the formal written method of long multiplication.**<br><br>**TT:- All times tables** |
| **Pictorial** | Use visual images to support doubling:<br><br>*Double 3 is 6*<br><br>  <br><br>*Double 5 is 10*<br><br>  | Pupils make representations to show counting in multiples:<br><br>  <br><br>Pupils use pictures to add equal groups to find a total:<br><br>  <br><br>Number line to show repeated groups:<br><br>  <br><br>Children begin to make arrays by making equal groups and building them up in columns or<br><br>  <br><br>*2+2+2+2+2 = 10*<br>*5+5 = 10* | Pupils to represent arrays pictorially:<br><br>  <br><br>Use the multiplication symbol and pictures to calculate the total:<br><br>  <br><br>Use of a number line to represent repeated addition:<br><br>  <br><br>*2 x 6 = 12*<br>*6 x 2 = 12* | Pupils can represent concrete manipulatives pictorially:<br><br>Base 10<br>*4 x 15 = 60*<br><br>  <br><br>Place value counters<br>*3 x 23 = 69*<br><br>  | Pupils can represent place value counters pictorially. | Pupils can represent place value counters pictorially. | Pictorial strategies to be utilized to challenge thinking and deepen understanding and efficiency in order to continue to practise the methods of short and long multiplication for larger numbers, including for decimal numbers. |

# Written Calculation Guidance - Multiplication

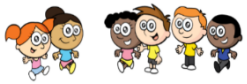
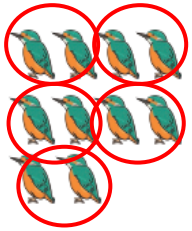
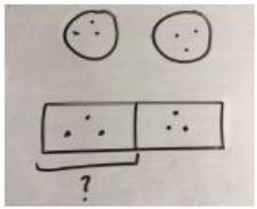
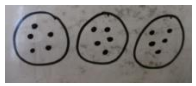
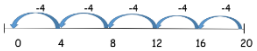
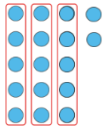
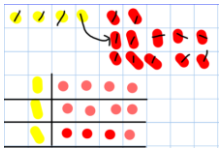
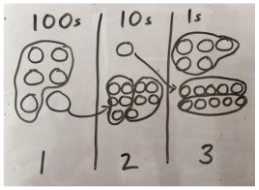
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Double in a practical way** | **Solve one step word problems by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.**<br><br>**Understand doubling numbers.**<br><br>***TT:- x10, x5, x2*** | **Calculate mathematical statements for multiplication within the multiplication tables and write them using the multiplication (×) and equals (=) signs.**<br><br>**Show that multiplication is commutative.**<br><br>***TT: - x10, x5, x2*** | **Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods**<br><br>***TT:- x10, x5, x2, x4, x 8, x3*** | **Multiply 2-digit and 3-digit numbers by a 1-digit number using a written formal method (short multiplication).**<br><br>**TT:- All times tables** | **Multiply numbers up to 4-digits by a 1 or 2-digit number using a formal written method, including long multiplication for 2-digit numbers.**<br><br>**TT:- All times tables** | **Multiply multi-digit numbers up to 4-digits by a 2-digit whole number using the formal written method of long multiplication.**<br><br>**TT:- All times tables** |
| **Abstract** | Pupils need to understand that doubling means 'twice as many'.<br><br>They are not expected to produce written number sentences at this stage. Encourage pupils to say their doubles as they build them:<br><br>**Double 4 is 8.**<br><br>Pupils can place numbers onto a structure provided by the teacher (e.g. part-whole model). | Pupils record their understanding in sentences, not through formal multiplication:<br><br>**2+2+2+2+2 = 10**<br>**5+5 = 10**<br><br>**Double 4 is 8**<br>**4 + 4 = 8** | Pupils record their work using the multiplication symbol, linking it to repeated addition:<br><br>***6 + 6 + 6 = 18***<br>***3 x 6 = 18***<br><br>Understand commutativity:<br><br>***5 x 3 = 15***<br>***3 x 5 = 15*** | Pupils record their work as a short multiplication, carrying underneath the answer box:<br><br>24 × 6 becomes<br><br>2 4<br>× 6<br>1 4 4<br>2<br><br>Answer: 144<br><br>If Y3 don't get taught 6s, this example will need to change. | Pupils record their work as a short multiplication, carrying underneath the answer box:<br><br>342 × 7 becomes<br><br>3 4 2<br>× 7<br>2 3 9 4<br>2 1<br><br>Answer: 2394 | Short multiplication:<br><br>2741 × 6 becomes<br><br>2 7 4 1<br>× 6<br>1 6 4 4 6<br>4 2<br><br>Answer: 16 446<br><br>Long multiplication (carrying within the calculation):<br><br>  | |

| Written Calculation Guidance - Division | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **EYFS** | **YEAR 1** | **YEAR 2** | **YEAR 3** | **YEAR 4** | **YEAR 5** | **YEAR 6** |
| **NC Objectives** | Halving and sharing in a practical way. | Solve one step word problems using arrays and other concrete materials.<br><br>*TT:- x10, x5, x2* | Solve problems using arrays and other concrete materials.<br><br>Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs<br><br>*TT:- x10, x5, x2* | Write and calculate mathematical statements for division using the times tables they know.<br><br>*TT:- x10, x5, x2, x4, x8, x3* | Pupils practise to become fluent in the formal written method of short division with exact answers.<br><br>TT:- All times tables | Divide numbers up to 4-digits by a 1-digit number using a formal written method of short division and interpret remainders.<br><br>TT:- All times tables | Use long division to divide a 4-digit number by a 2-digit number.<br><br>Use short division to divide a 4-digit number by a 2-digit number (where appropriate).<br><br>TT:- All times tables |

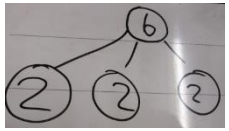
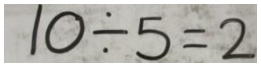
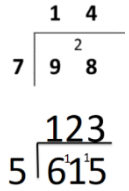
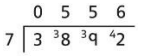
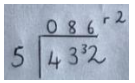
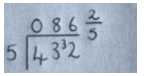
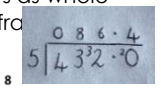
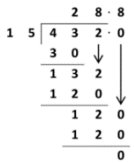
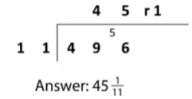
# Written Calculation Guidance - Division

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Halving and sharing in a practical way.** | **Solve one step word problems using arrays and other concrete materials.**<br><br>***TT:- x10, x5, x2*** | **Solve problems using arrays and other concrete materials.**<br><br>**Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs**<br><br>***TT:- x10, x5, x2*** | **Write and calculate mathematical statements for division using the times tables they know.**<br><br>***TT:- x10, x5, x2, x4, x8, x3*** | **Pupils practise to become fluent in the formal written method of short division with exact answers.**<br><br>**TT:- All times tables** | **Divide numbers up to 4-digits by a 1-digit number using a formal written method of short division and interpret remainders.**<br><br>**TT:- All times tables** | **Use long division to divide a 4-digit number by a 2-digit number.**<br><br>**Use short division to divide a 4-digit number by a 2-digit number (where appropriate).**<br><br>**TT:- All times tables** |
| **Concrete** | Pupils will halve quantities by sharing items into two equal groups:<br><br>*Half of 10 is?*<br><br>  <br><br>  <br><br>Once pupils can confidently halve small quantities, they can explore sharing between 3 or 4 people:<br><br>*Share the fruit equally into 3 bowls*<br><br>  | Use concrete resources to explore division by developing their understanding of equal grouping and sharing equally:<br><br>Grouping (quotative division)<br>*How many equal groups of 2 can you make with the mittens? There are 4 groups of 2 mittens.*<br><br>  <br><br>Sharing (partitive division)<br>*Share the muffins equally between the two plates.*<br>*8 cakes shared equally between two plates is 4.*<br><br>  | Continue to use concrete materials to explore division through grouping and sharing.<br><br>Grouping (quotative)<br>*Crayons come in packs of 20 We need to put 5 in each pot. How many pots will we need?*<br><br>  <br><br>*20 ÷ 5 = 4*<br><br>Sharing (partitive)<br>Can you share 12 cubes equally between three boxes?<br><br>  <br><br>*12 ÷ 3 = 4* | Use of concrete resources to support using times table knowledge to divide:<br><br>*24 ÷ 8 = 3*<br><br>  <br><br>Use place value equipment to divide 2-digit numbers, including the concept of a remainder:<br><br>*42 ÷ 3 =*<br><br>  | Use place value counters to illustrate the short division algorithm (2 and 3-digit divided by 1-digit). Explore exchange where necessary:<br><br>  | Continue to use place value counters when necessary to explain the short division algorithm:<br><br>*4894 ÷ 4 =*<br><br>  <br><br> | Use place value counters to introduce long division. Demonstrate alongside written algorithm:<br><br>  |

# Written Calculation Guidance - Division

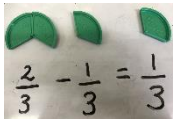
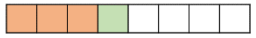
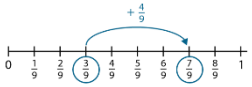
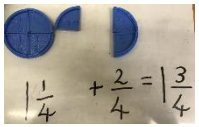
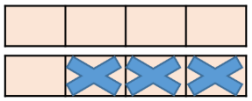
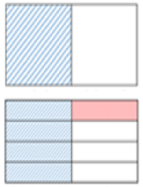
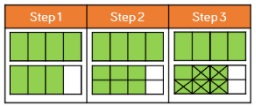
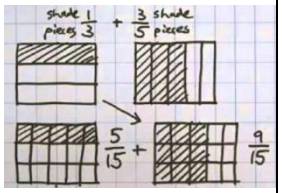
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Halving and sharing in a practical way.** | **Solve one step word problems using arrays and other concrete materials.**<br><br>***TT:- x10, x5, x2*** | **Solve problems using arrays and other concrete materials.**<br><br>**Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs**<br><br>***TT:- x10, x5, x2*** | **Write and calculate mathematical statements for division using the times tables they know.**<br><br>***TT:- x10, x5, x2, x4, x8, x3*** | **Pupils practise to become fluent in the formal written method of short division with exact answers.**<br><br>**TT:- All times tables** | **Divide numbers up to 4-digits by a 1-digit number using a formal written method of short division and interpret remainders.**<br><br>**TT:- All times tables** | **Use long division to divide a 4-digit number by a 2-digit number.**<br><br>**Use short division to divide a 4-digit number by a 2-digit number (where appropriate).**<br><br>**TT:- All times tables** |
| **Pictorial** | Use of visual images to support halving and sharing:<br><br>Have these strawberries been shared equally?<br><br>  <br><br>Are these pupils in fair / equal groups?<br><br>  | Pupils use images to group and share quantities:<br><br>Grouping:<br>*How many groups of 2 can you make?*<br><br>:<br>  <br><br>Sharing:<br>*6 shared between 2 groups is 3.*<br><br>  | Pupils can draw images to support division:<br><br>Grouping (quotative)<br>*How many equal groups of 5 can you make?*<br><br>  <br><br>*10 ÷ 5 = 2*<br><br>Sharing (partitive)<br>*15 cakes shared between 3 plates. How many on each plate?*<br><br>  <br><br>*15 ÷ 3 = 5*<br><br>Use a number line to calculate how many equal groups you can make from a number (repeated subtraction):<br><br>  <br><br>*20 ÷ 4 = 5* | Use images to support division, including with a remainder:<br><br>  <br>*17 ÷ 5 = 3*<br><br>Pupils can draw images to support division:<br><br>*42 ÷ 3 = 14*<br><br>  | Represent place value counters pictorially:<br><br>*615 ÷ 5 = 123*<br><br>  | Pupils can draw place value counters pictorially to support written algorithm. | Display images of place value counters to support understanding: |

# Written Calculation Guidance - Division

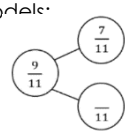
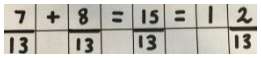
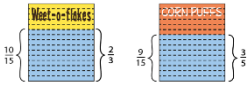
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | **Halving and sharing in a practical way.** | **Solve one step word problems using arrays and other concrete materials.**<br><br>***TT:- x10, x5, x2*** | **Solve problems using arrays and other concrete materials.**<br><br>**Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs**<br><br>***TT:- x10, x5, x2*** | **Write and calculate mathematical statements for division using the times tables they know.**<br><br>***TT:- x10, x5, x2, x4, x8, x3*** | **Pupils practise to become fluent in the formal written method of short division with exact answers.**<br><br>**TT:- All times tables** | **Divide numbers up to 4-digits by a 1-digit number using a formal written method of short division and interpret remainders.**<br><br>**TT:- All times tables** | **Use long division to divide a 4-digit number by a 2-digit number.**<br><br>**Use short division to divide a 4-digit number by a 2-digit number (where appropriate).**<br><br>**TT:- All times tables** |
| **Abstract** | Pupils are not required to record written number sentences. Understanding can be assessed through verbal and practical work.<br><br>Pupils can place numbers onto a structure provided by the teacher (e.g. part-whole model):<br><br>*Sharing 6 into 3 equal groups*<br><br>  | Pupils record their understanding in sentences, not through formal division:<br><br>  <br><br>*I can make 5 equal groups of 2.*<br>*I can make 2 equal groups of 5.*<br>*I can make 1 equal group of 10.*<br><br>Stem sentences can be provided to support with this. | Pupils use the division and equals symbols to record findings:<br><br>  | Pupils to use their knowledge of times tables facts to calculate division facts mentally and record in a number sentence:<br><br>**67 ÷ 5 = 13 r 2** | Complete calculations using the short division algorithm:<br><br>  <br><br>2d by 1d<br>3d by 1d<br>2d by 1d (exchange)<br>3d by 1d (exchange)<br>2d by 1d (remainder)<br>3d by 1d (remained)<br>2d by 1d (remainder with exchange)<br>3d by 1d (remainder with exchange)<br><br>3d - 1d<br>3d - 2d<br>3d - 3d<br>3d - 1d (exchange)<br>3d - 2d (exchange)<br>3d - 3d (exchange) | Complete abstract calculations using the short division algorithm:<br><br>  <br><br>Pupils express remainders in different ways according to the context (whole numbers, or fractions):<br><br>  <br>  | Use the 'drop down' algorithm for long division, interpreting remainders as whole numbers, fra rounding:<br>  <br>  <br><br>Use short division to divide by a 2-digit number when appropriate:<br>  |

| Written Calculation Guidance – Addition and Subtraction with Fractions | | | | | | | |
|---|---|---|---|---|---|---|---|
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
| NC Objectives | | | | Add and subtract fractions with the same denominator (within one whole) | Add and subtract fractions with the same denominator (across one whole) | Add and subtract fractions with the same denominator and denominators that are multiples of the same number (including mixed numbers) | Add and subtract fractions with different denominators and mixed numbers using the concept of equivalent fractions. |

# Written Calculation Guidance – Addition and Subtraction with Fractions

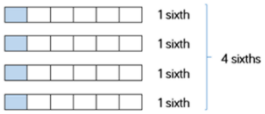
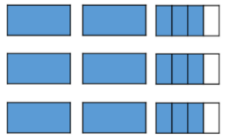
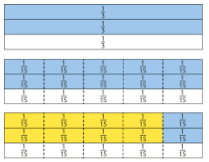
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| NC Objectives | | | | **Add and subtract fractions with the same denominator (within one whole)** | **Add and subtract fractions with the same denominator (across one whole)** | **Add and subtract fractions with the same denominator and denominators that are multiples of the same number (including mixed numbers)** | **Add and subtract fractions with different denominators and mixed numbers using the concept of equivalent fractions.** |
| Concrete and Pictorial Representations | | | | Use of concrete materials e.g. fraction bars, fraction circles, paper strips:<br>  <br>Use of bar models and other visual diagrams:<br>$\frac{3}{8}+\frac{1}{8}=\frac{4}{8}$<br>  <br>$\frac{5}{7}-\frac{\square}{7}=\frac{\square}{7}$<br>  <br>Use the language of 'first, then and now' for subtraction:<br>  <br>Illustrate using a number line:<br>  | Use of concrete materials e.g. fraction bars, fraction circles, paper strips:<br>  <br>Use of bar models and other visual aids:<br>$\frac{3}{5}+\frac{4}{5}=$<br>  <br>$\frac{7}{9}-\frac{3}{9}$<br>  <br>$2-\frac{3}{4}=\frac{8}{4}-\frac{3}{4}=\frac{5}{4}=1\frac{1}{4}$<br>  | Pupils to use pictorial representations to support understanding:<br>$\frac{1}{2}+\frac{1}{8}=\frac{4}{8}+\frac{1}{8}=\frac{5}{8}$<br>  <br>$1\frac{3}{4}-\frac{5}{8}=1\frac{1}{8}$<br>  | Pupils continue to use pictorial representations to support understanding:<br>$\frac{2}{3}+\frac{3}{5}=1\frac{4}{15}$<br>  |

# Written Calculation Guidance – Addition and Subtraction with Fractions

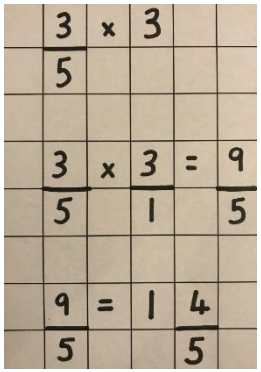
| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| **NC Objectives** | | | | **Add and subtract fractions with the same denominator (within one whole)** | **Add and subtract fractions with the same denominator (across one whole)** | **Add and subtract fractions with the same denominator and denominators that are multiples of the same number (including mixed numbers)** | **Add and subtract fractions with different denominators and mixed numbers using the concept of equivalent fractions.** |
| **Abstract** | | | | Pupils to form calculations as number sentences, drawing a horizontal line to separate the numerator and denominator:<br>$\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$<br>$\frac{7}{12} - \frac{2}{12} = \frac{5}{12}$<br>Represent on part-whole models:<br>  | Pupils to form calculations as number sentences, drawing a horizontal line to separate the numerator and denominator. Write answers as improper and mixed fractions:<br>  <br>$2 - \frac{3}{4} = \frac{8}{4} - \frac{3}{4} = \frac{5}{4} = 1\frac{1}{4}$ | Pupils to form calculations as number sentences, drawing a horizontal line to separate the numerator and denominator. Write answers as improper and mixed fractions:<br>  <br>$1\frac{3}{4} - \frac{5}{8} = 1\frac{1}{8}$ | Adding and subtracting fractions where denominators are not multiples of the same number:<br>$\frac{7}{9} - \frac{1}{2} = \frac{14}{18} - \frac{9}{18} = \frac{5}{18}$<br>$\frac{3}{4} + \frac{2}{5} = \frac{15}{20} + \frac{8}{20} = \frac{23}{20} = 1\frac{3}{20}$<br>Adding mixed numbers when the added fractions equal less than one (add the whole numbers then the fractions):<br>$1\frac{1}{2} + 2\frac{1}{6} = 1\frac{3}{6} + 2\frac{1}{6} = 3\frac{4}{6} = 3\frac{2}{3}$<br>Adding mixed numbers when the added fractions equal more than one (convert to an improper fraction before adding):<br>$1\frac{1}{2} + 2\frac{1}{6} = \frac{3}{2} + \frac{13}{6} =$<br>$\frac{9}{6} + \frac{13}{6} = \frac{22}{6} = 3\frac{4}{6} =$<br>$3\frac{2}{3}$<br>Subtracting mixed numbers (change to an improper fraction):<br>$3\frac{2}{5} - 1\frac{7}{10} = \frac{17}{5} - \frac{17}{10} =$<br>$\frac{34}{10} - \frac{17}{10} = \frac{17}{10} = 1\frac{7}{10}$ |

| Written Calculation Guidance – Multiplication and Division with Fractions | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **EYFS** | **YEAR 1** | **YEAR 2** | **YEAR 3** | **YEAR 4** | **YEAR 5** | **YEAR 6** |
| **NC Objectives** | | | | | | **Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams** | **Multiply simple pairs of proper fractions, writing the answer in its simplest form.**<br><br>**Divide proper fractions by whole numbers.** |

# Written Calculation Guidance – Multiplication and Division with Fractions

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| NC Objectives | | | | | | **Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams** | **Multiply simple pairs of proper fractions, writing the answer in its simplest form.**<br><br>**Divide proper fractions by whole numbers.** |
| Concrete and Pictorial Representations | | | | | | Pupils link multiplying fractions to repeated addition. Use concrete and pictorial resources to represent this:<br><br>$\frac{1}{6} \times 4 = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$<br><br>  <br><br>When there is a mixed number, multiply the whole numbers together and then multiply the fraction by the whole number:<br><br>$2\frac{3}{4} \times 3$<br><br>  | **Multiplication**<br><br>Visual representations to show that when multiplying two fractions together, the product is smaller than the fractions multiplied. The multiplication symbol means 'of':<br><br>$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$<br><br>$\frac{2}{3}$ of $\frac{4}{5} = \frac{8}{15}$<br><br>  <br><br>**Division**<br><br>Visual representations to show that dividing a fraction by a whole number makes it smaller:<br><br>$\frac{1}{4} \div 2 = \frac{1}{8}$<br><br>  |

# Written Calculation Guidance – Multiplication and Division with Fractions

| | EYFS | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 |
|---|---|---|---|---|---|---|---|
| NC Objectives | | | | | | **Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams** | **Multiply simple pairs of proper fractions, writing the answer in its simplest form.**<br><br>**Divide proper fractions by whole numbers.** |
| Abstract | | | | | | When presenting in an abstract method, remind pupils that any integer (n) can be written as the fraction $\frac{n}{1}$<br><br>(This helps to build a base for future learning in Year 6 when pupils will multiply a fraction by a fraction).<br><br>Pupils should learn to write the final answer as either an improper or a mixed fraction:<br><br>  <br> | **Multiplication**<br><br>When a fraction is multiplied by a fraction, it makes it smaller. To multiply two fractions, multiply the numerators together and multiply the denominators together. Simplify if possible:<br><br>$\frac{3}{4} \times \frac{1}{3} = \frac{3}{12} = \frac{1}{4}$<br><br>**Division**<br>When a fraction is divided by a whole number, it makes it smaller. To divide a fraction by a whole number, convert it to an equivalent multiplication:<br><br>$\frac{1}{4} \div 2 = \frac{1}{8}$ ➔<br><br>$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$<br><br>A more efficient method can be used to divide a fraction by a whole number when the whole number is a factor of the numerator:<br><br>$\frac{6}{7} \div 3 = \frac{2}{7}$ |