Lyndhurst Junior School Maths Calculation Policy

Lyndhurst Junior School is committed to the lively and engaging delivery of mathematics across the age ranges and curriculum. For children to access the majority of their learning in Maths, a strong and confident grasp of the four number operations is important; for formal and informal written methods and mental strategies. This policy blends current practices with the expectations of the National Curriculum. The ultimate decision to move a child onto a new method of calculation lies with the teacher and rests on the child feeling confident and secure with the method they currently rely upon.

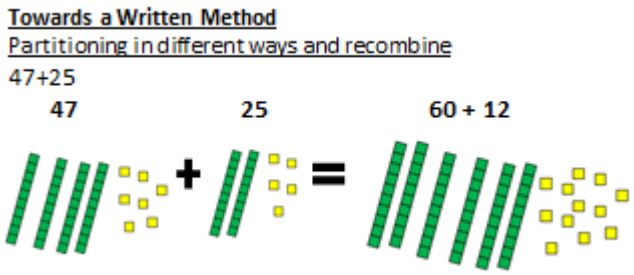
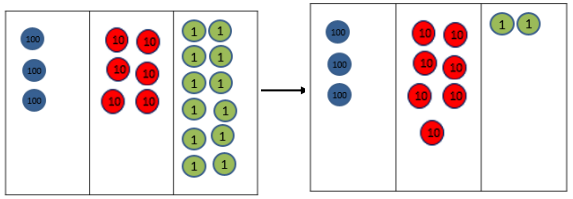
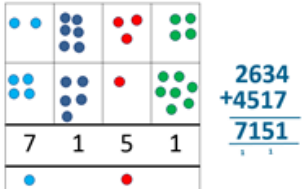
Contents:

Ongoing practice

- Children should estimate before calculating an answer.
- Children should be given the opportunities to determine if a calculation can be done in their head or using a written method.
- Children should check their answer (e.g. by using the inverse operation).
- Children should practice their multiplication facts until they know them off by heart.
- Children should experience contextual and procedural variation in a given method (e.g. solving word problems)
- Teachers should move children on when it is appropriate.
- Teachers should encourage children to use alternative, secure methods to check their answers and draw links.
- Teachers should use a variety of representations to support the learning of written and mental methods of calculation.

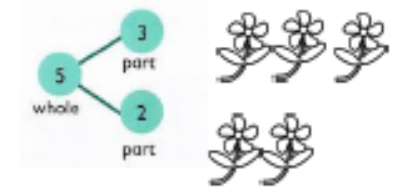
Updated Autumn 2018

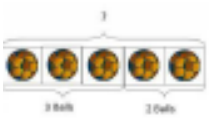
Addition

Year 3	Year 4
Missing number problems using a range of equations as in Year 1 and 2 but with appropriate, larger numbers. 145 + ☐ = 200; 480 = 350 + ☐	Missing number/digit problems: 387 + ☐ = 523; 350 = 148 + ☐
Partition into tens and ones Expanded column addition: 235 + 158 200 30 5 100 50 8 300 90 3 10 Children need to be secure adding multiples of 100 and 10 to any three-digit number including those that are not multiples of 10.	**Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.
Towards a Written Method Introduce expanded column addition modelled with place value counters (Dienes could be used for those who need a less abstract representation)	**Written methods (progressing to 4-digits)** Expanded column addition modelled with place value counters, progressing to calculations with 4-digit numbers.
 Leading to children understanding the exchange between tens and ones. 	 **Compact written method** Extend to numbers with at least four digits.  **Children should be able to make the choice of reverting to expanded methods if experiencing any difficulty.** Extend to up to two places of decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

Year 5	Year 6
Missing number/digit problems: 3587 + ☐ = 5293; 5438 = 3850 + ☐ **Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. Children should practise with increasingly large numbers to aid fluency e.g. 12462 + 2300 = 14762 **Written methods (progressing to more than 4-digits)** As year 4, progressing when understanding of the expanded method is secure, children will move on to the formal columnar method for whole numbers and decimal numbers as an efficient written algorithm. 172.83 + 54.68 227.51 1 1 1 Place value counters can be used alongside the columnar method to develop understanding of addition with decimal numbers.	Missing number/digit problems: 35.7 + ☐ = 56.8; 64.8 = 38.5 + ☐ **Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. **Written methods** As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured. Continue calculating with decimals, including those with different numbers of decimal places **Problem Solving** Teachers should ensure that pupils have the opportunity to apply their knowledge in a variety of contexts and problems (exploring cross curricular links) to deepen their understanding.

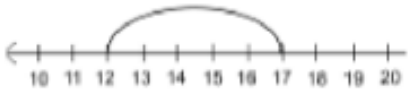
Year 3 may require scaffolded support using models, images and techniques acquired during Key Stage 1:





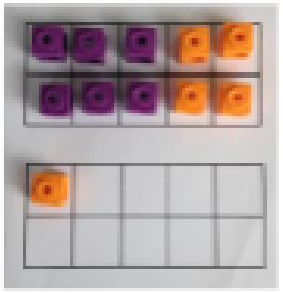
Use pictures to add two numbers together as a group or in a bar.

12 + 5 = 17



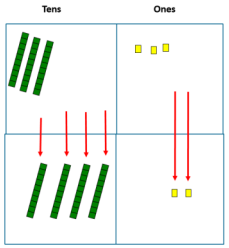
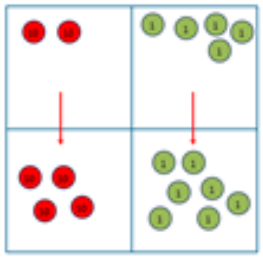
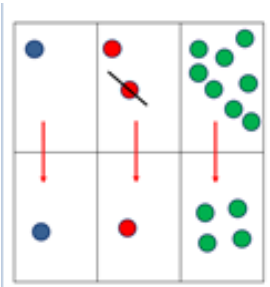
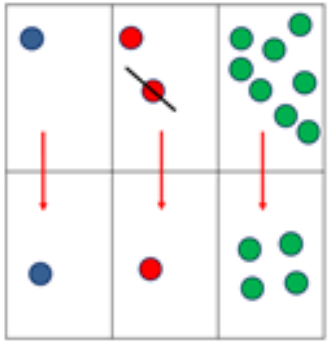
Start at the larger number on the number line and count on in ones or in one jump to find the answer.

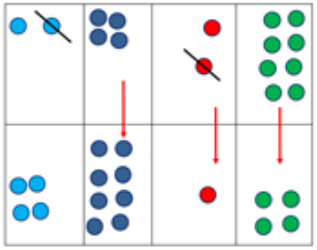
6 + 5 = 11



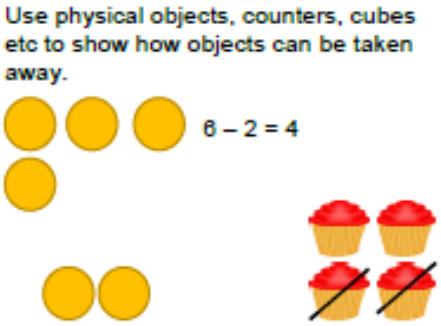
Start with the larger number and add on to make 10.

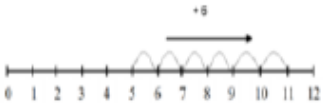
Subtraction

Year 3	Year 4
Missing number problems e.g. □ = 43 – 27; 145 – □ = 138; 274 – 30 = □; 245 – □ = 195; 532 – 200 = □; 364 – 153 = □ **Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model and part-whole model should continue to be used to help with problem solving (see Y1 and Y2). Children should make choices about whether to use complementary addition or counting back, depending on the numbers involved. **Written methods (progressing to 3-digits)** Introduce expanded column subtraction with no decomposition, modelled with Dienes.  70 5 - 40 2 30 3 For some children this will lead to exchanging (regrouping), modelled using place value counters (or Dienes).  70 12 - 40 7 20 5 A number line and expanded column method may be compared next to each other. Some children may begin to use a formal columnar algorithm, initially introduced alongside the expanded method. The formal method should be seen as a more streamlined version of the expanded method, not a new method.	Missing number/digit problems: 456 + □ = 710; 1□7 + 6□ = 200; 60 + 99 + □ = 340; 200 – 90 – 80 = □; 225 - □ = 150; □ – 25 = 67; 3450 – 1000 = □; □ - 2000 = 900 **Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model and part-whole model should continue to be used to help with problem solving. **Written methods (progressing to 4-digits)** Expanded column subtraction with decomposition, modelled with place value counters, progressing to calculations with 4-digit numbers.  200 30 12 - 100 10 4 100 10 8 If understanding of the expanded method is secure, children will move on to the formal method of decomposition, which again can be initially modelled with place value counters.  2 1 232 - 114 118

Year 5	Year 6
Missing number/digit problems: 6.45 = 6 + 0.4 + □; 119 - □ = 86; 1 000 000 - □ = 999 000; 600 000 + □ + 1000 = 671 000; 12 462 – 2 300 = □ **Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. **Written methods (progressing to more than 4-digits)** When understanding of the expanded method is secure, children will move on to the formal method of decomposition, which can be initially modelled with place value counters.  5 1 2 1 6232 - 4814 1418 Progress to calculating with decimals, including those with different numbers of decimal places.	Missing number/digit problems: □ and # each stand for a different number. # = 34. # + # = □ + □ + #. What is the value of □? What if # = 28? What if # = 21 10 000 000 = 9 000 100 + □ 7 – 2 x 3 = □; (7 – 2) x 3 = □; (□ - 2) x 3 = 15 **Mental methods** should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. **Written methods** As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with decomposition to be secured. Teachers may also choose to introduce children to other efficient written layouts which help develop conceptual understanding. For example: 326 -148 -2 -20 200 178 Continue calculating with decimals, including those with different numbers of decimal places.

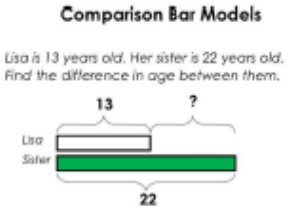
Year 3 may require scaffolded support using models, images and techniques acquired during Key Stage 1:



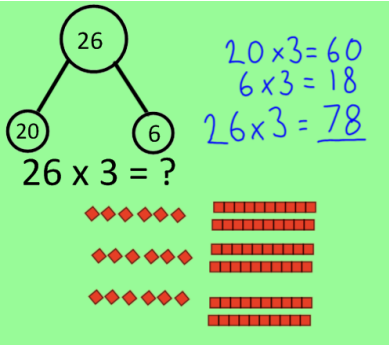
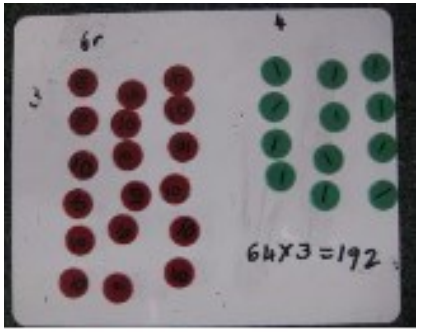


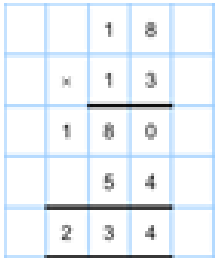
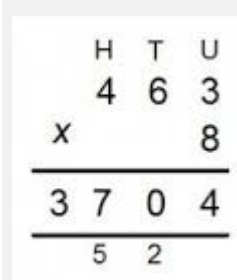
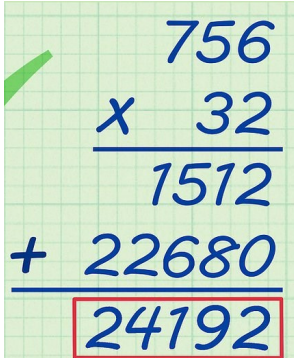
Count on to find the difference.

Draw bars to find the difference between the 2 numbers.



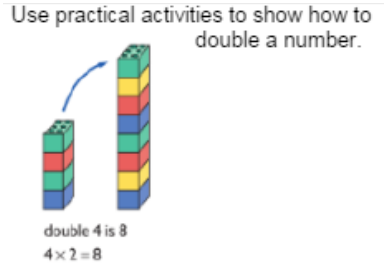
Multiplication

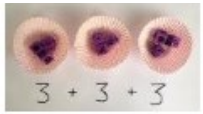
Year 3	Year 4
Missing number problems: 2 x ☐ = 24; ☐ x 6 = 180 **Mental methods** Doubling 2 digit numbers using partitioning. Demonstrating multiplication on a number line or using jottings. **Written methods (progressing to 2d x 1d)** Developing written methods using understanding of visual images. Develop onto an informal written method/expanded method incorporating a part-whole representation.  Give children opportunities for children to explore this and deepen understanding using Dienes apparatus.	Continue with a range of equations as in Year 3 but with appropriate numbers. Also include equations with missing digits. Missing number problems: ☐2 x 5 = 160 **Mental methods** Counting in multiples of 6, 7, 9, 25 and 1000, and steps of 1/100. Solving practical problems where children need to scale up. Relate to known number facts (e.g. how tall would a 25cm sunflower be if it grew 6 times taller?). **Written methods (progressing to 3d x 1d)** Children to embed and deepen their understanding of the column method (expanded algorithm) to multiply up 3d x 1d. Ensure this is still linked back to their understanding of arrays and place value counters and these can still be used to elicit understanding. 

Year 5	Year 6
Continue with a range of equations as in Year 4 but with appropriate numbers. Also include equations with missing digits. ☐1 x 6 = 486 **Mental methods** X by 10, 100, 1000 using a variety of resources to support such as a place value grid. Use practical resources and jottings to explore equivalent statements (e.g. 4 x 35 = 2 x 2 x 35). Recall of prime numbers up 19 and identify prime numbers up to 100 (with reasoning). Solving practical problems where children need to scale up. Relate to known number facts. Identify factor pairs for numbers. **Written methods (progressing to 4d x 2d)** Long multiplication using place value counters. Children to explore how the grid method supports an understanding of long multiplication (for 2d x 2d) i.e. teaching both methods and eliciting the fluency involved in the expanded and, ultimately, contracted algorithm:  10 x 18 3 x 18	Continue with a range of equations as in Year 5 but with appropriate numbers. Also include equations with missing digits. ☐.1 x 6 = 48.6 **Mental methods** Identifying common factors and multiples of given numbers. Solving practical problems where children need to scale up. Relate to known number facts. **Written methods** Continue to refine and deepen understanding of written methods including fluency for using long multiplication.  

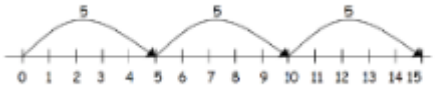
Year 3 may require scaffolded support using models, images and techniques acquired during Key Stage 1:

Count in multiples supported by concrete objects in equal groups.



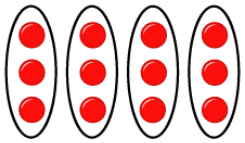
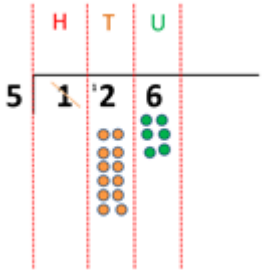


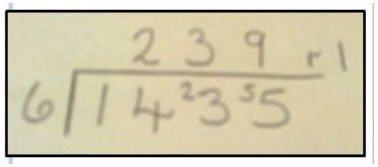
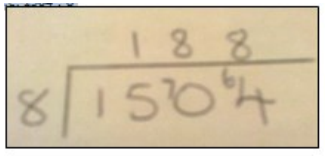
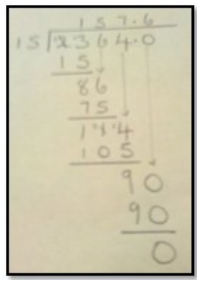
Use different objects to add equal groups.



5 + 5 + 5 = 15

Division

Year 3	Year 4
÷ = signs and missing numbers Continue using a range of equations as in year 2 but with appropriate numbers. 15 ÷ 3 = ☐; ☐ ÷ 4 = 3 **Grouping and link with multiplication** How many 3's are in 12? 12 ÷ 3 can be modelled using real life contexts such as 12 sweets between 3 friends or using representations such as  12 ÷ 3 = 4 **Becoming more efficient using a written methods** Children need to be able to represent the dividend and group according to the divisor: 484 ÷ 4 = 121  **Remainders** 49 ÷ 4 = 12 r1 Sharing – 49 shared between 4. How many left over? Grouping – How many 4s make 49. How many are left over? Place value counters and Dienes can be used to support children apply their knowledge of grouping. 60 ÷ 10 = How many groups of 10 in 60?, 600 ÷ 100 = How many groups of 100 in 600?	**÷ = signs and missing numbers** Continue using a range of equations as in year 3 but with appropriate numbers. 27 ÷ 3 = ☐; ☐ ÷ 8 = 4 **Mental calculation:** Through Big Maths, children can derive answers from multiplication facts e.g. 240 ÷ 3 = 80 because 8 x 3 = 24 and 80 x 3 = 240 Link halving to dividing by 2, 4, 8 etc. **Formal Written Methods** Formal short division should only be introduced once children have a good understanding of division, its links with multiplication and strong mental strategies involving groups of numbers.  Short division to be modelled for understanding using place value counters as shown above. Calculations with 2 and 3-digit dividends.

Year 5	Year 6
÷ = signs and missing numbers Continue using a range of equations as in year 4 but with appropriate numbers. 54 ÷ 6 = ☐; ☐ ÷ 7 = 8 **Mental calculation:** Through Big Maths, children can derive answers from multiplication facts, including those with decimal numbers e.g. 2.4 ÷ 3 = 0.8 because 8 x 3 = 24 and 0.8 x 3 = 2.4 **Formal Written Methods** Continued as shown in Year 4, leading to the efficient use of a formal method. The language of grouping to be used. Place value counters may be still be appropriate as a scaffold. e.g. 1435 ÷ 6  Children begin to practically develop their understanding of how express the remainder as a decimal or a fraction. Ensure practical understanding allows children to work through this (e.g. what could I do with this remaining 1? How could I share this between 6 as well?)	**÷ = signs and missing numbers** Continue using a range of equations but with appropriate numbers. 5.4 ÷ 6 = ☐; ☐ ÷ 7 = 0.8 **Sharing and Grouping and using a number line** Children will continue to explore division as sharing and grouping, and to represent calculations using jottings and multiples of a number (coin multiplication). Quotients should be expressed as decimals and fractions. **Formal Written Methods – long and short division** E.g. 1504 ÷ 8 and 2364 ÷ 15  

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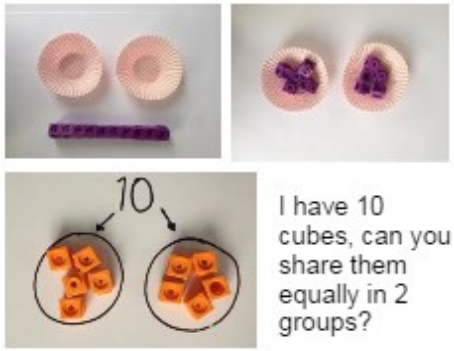
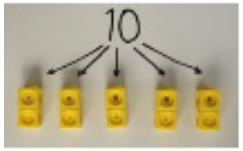


Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.



Use a number line to show jumps in groups. The number of jumps equals the number of groups.