Woodview School

Calculations Policy

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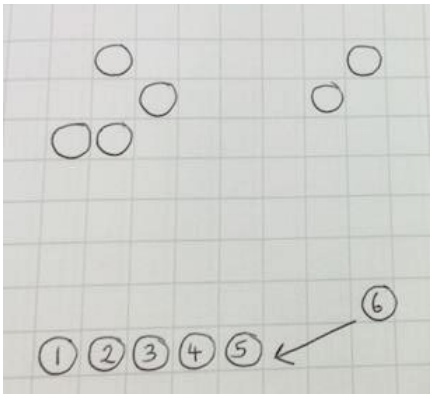
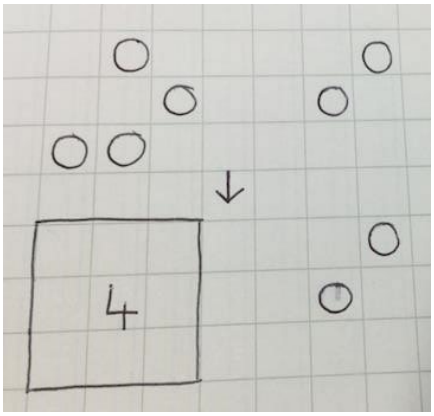
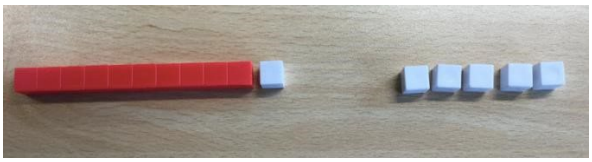
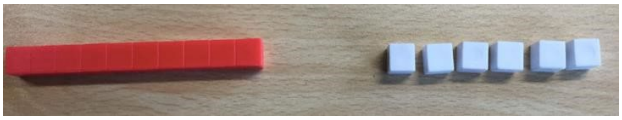
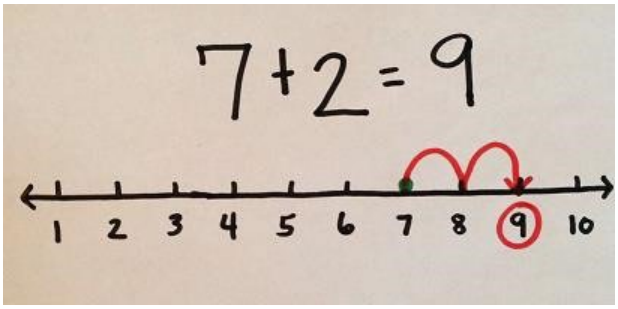
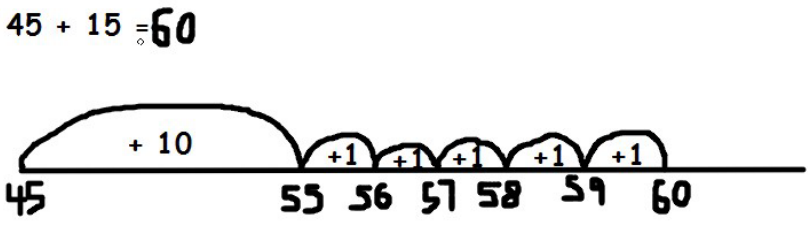
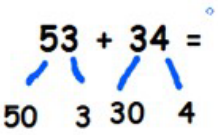
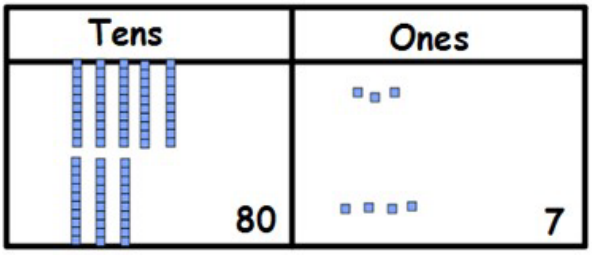
Calculations

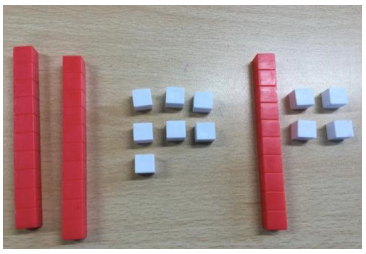
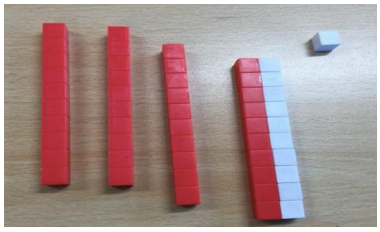
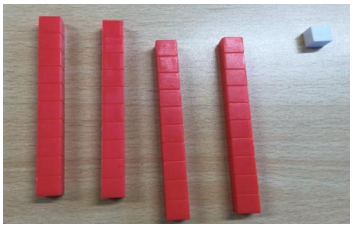
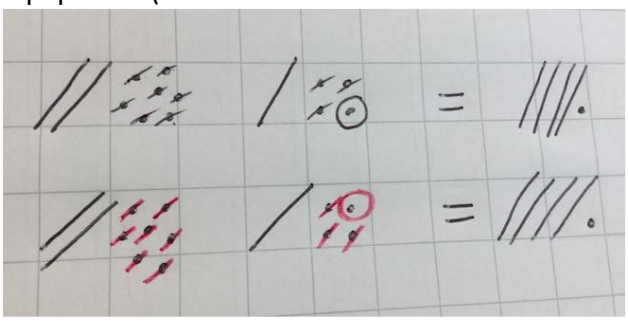
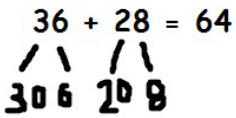
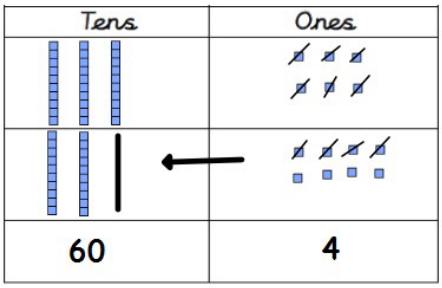
Addition

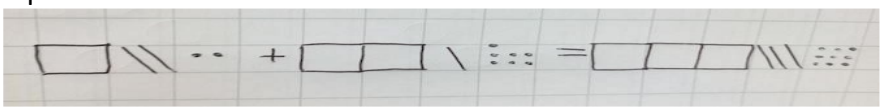
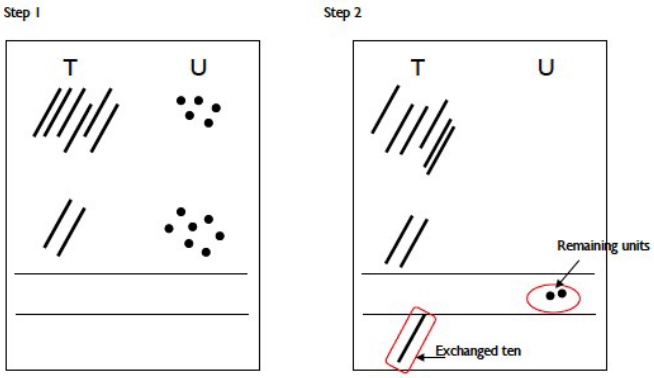
Stage 1 **Counting all method**	Children will begin to develop their ability to add by using practical equipment to count out the correct amount, for each number in the calculation and then combine them to find the total. For example, 4 + 2 
Stage 2 **Counting on method**	Children should still have two groups of objects but one should be covered so that it cannot be counted. They can then start their count at 4 and touch count 5 and 6 in the same way as Stage 1, rather than having to count all of the counters separately as before. 

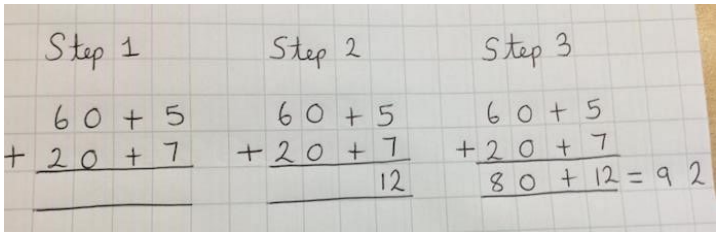
Stage 3 **Counting on/all with Base 10**	Children will continue to use practical equipment, combining groups of objects to find the total by counting all or counting on. They will move on to be able to use Base 10 equipment to make teens numbers using separate tens and units.  For example, when adding 11 and 5, they can make 11 using a ten rod and a unit.  The units can then be combined to aid with seeing the final total.

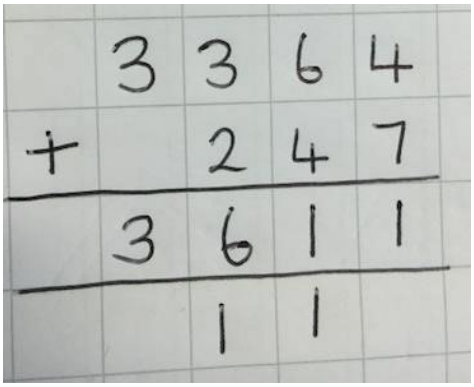
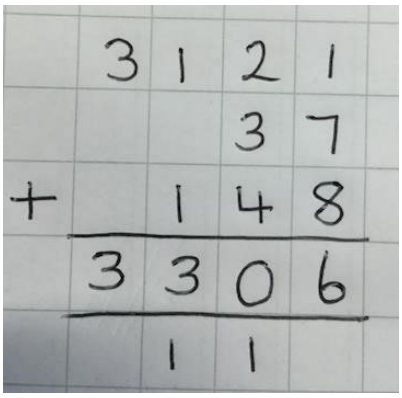
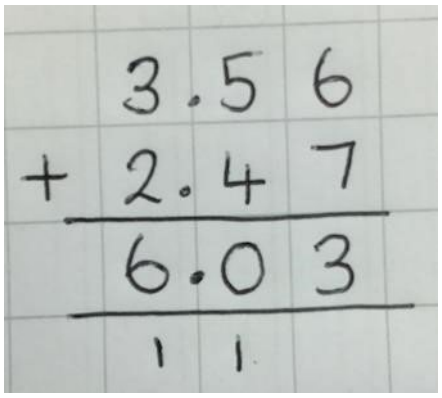
Stage 4 **Counting on a marked number line**	Children find the number on the number line and then count on. Use games (like snakes and ladders)to demonstrate going to the next number to count on. 
Stage 5 **Addition using an empty number line**	Children to progress to jumping on in tens and ones without a marked number line.  From this children will then add larger 2 digit numbers and jump in tens or multiples of ten depending on their development.

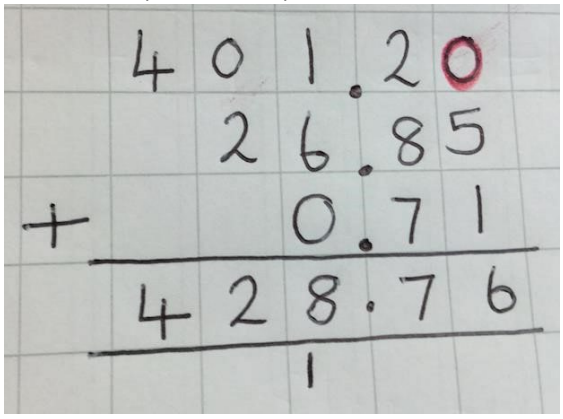
Stage 6 **Counting tens and then units**	Children will continue to use the Base 10 equipment to support their calculations. For example, to calculate 32 + 21, they can make the individual amounts, counting the tens first and then count on the units.  Children can then progress to drawing the tens and ones (partition addition)  

Stage 7 **Counting tens and then units with 'exchanging' – 2 digits**	When the units total more than 10, children should encouraged to exchange 10 units for 1 ten. This is the start of children understanding 'exchanging'. For example when calculating 27 + 14 they would complete the following steps using practical equipment.    Children can also record the calculations using their own drawings of Base 10 equipment (as slanted lines for 10 rods and dots for the unit blocks)  It is important that children circle the remaining tens and units after exchange to identify the amount remaining.  

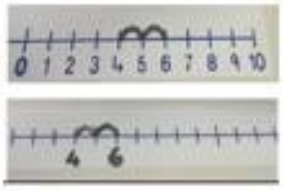
Stage 8 **Counting tens and then units with 'exchanging' – 3 digits**	Working from the written representation of Stage 5 children use this method to add two three-digit numbers, e.g. 122 + 217 using a square as the representation of 100. 
Stage 9 **Expanded method**	Children will build upon their knowledge of using base 10 equipment and continue to use the idea of exchange. They should identify whether there are greater than ten units which can be exchanged for one ten. Children can use a place value grid to begin to set the calculation out vertically and to support their knowledge of exchange between columns. 

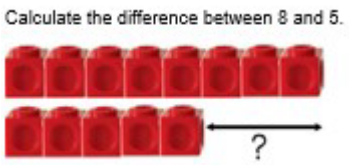
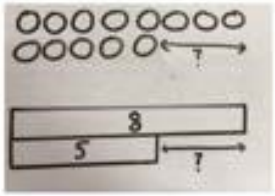
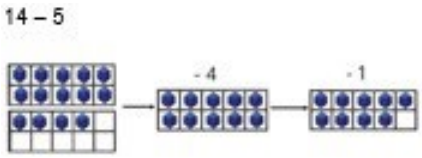
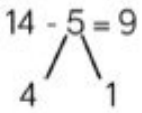
Stage 10 **Partitioned written (expanded) method**	Children should then progress to utilising the practical methods with confidence and fluency and then, when they are ready to, children should utilise just the 'partitioning' written method. 

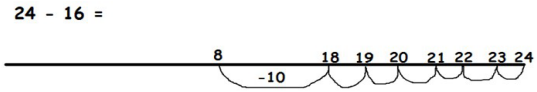
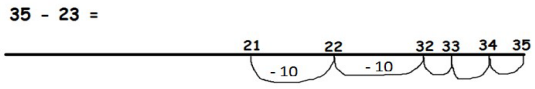
Stage 11 **Compact method**	Children will still use practical apparatus to practise exchanging and will then show this exchange in a compact method.  School policy is that we teach the children to 'carry' under the equal line.
Stage 12 **Compact method – multiple numbers and decimals.**	Children will continue to develop their understanding of exchanging and 'carrying' by adding multiple numbers as well as decimals. Practical apparatus should be used alongside written methods to deepen understanding. Resources could be Base 10 or place value counters that children can still 'exchange'.  

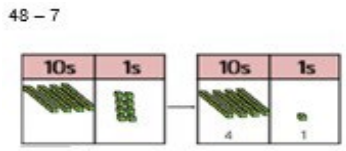
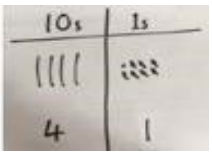
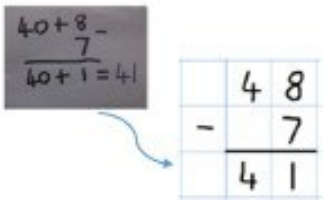
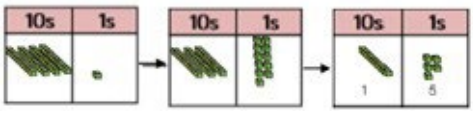
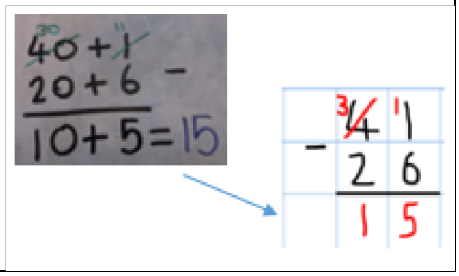
Stage 13 **Compact method – decimals to different d.p.**	Children should extend the carrying method and use it to add whole numbers and decimals with any number of digits. When adding decimals with different numbers of decimal places, children should be taught and encouraged to make them the same through identification that 2 tenths is the same as 20 hundredths, therefore, 0.2 is the same value as 0.20. 

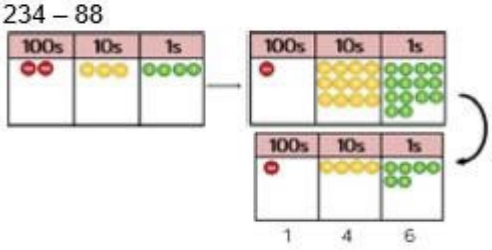
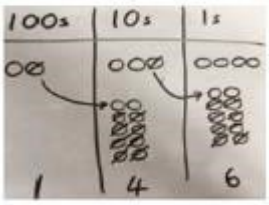
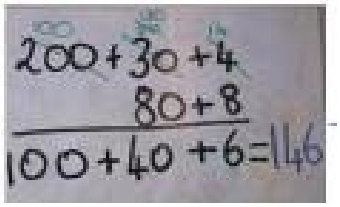
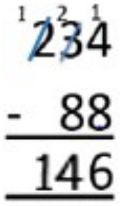
Subtraction

Stage 1 **Removing objects from a set method**	Children will begin to develop their ability to subtract by using practical resources, counting the total, taking away the correct amount for the number in the calculation and counting the remaining objects to find the answer to the calculation. For example, 4 – 3 = 1
Stage 2 **Counting back method**	Children use a number line or number track to represent the calculation and show their jumps. Encourage children to use an empty number line. For example they start at six, jump backwards (in ones) two and understand the number they have landed on is the answer 

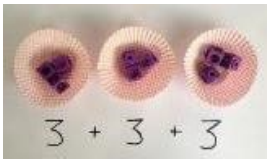
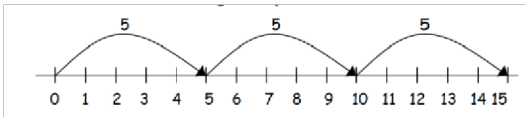
Stage 3 **Find the difference method**	Children will continue to use practical equipment but now use them to find the difference. The real objects or draw a bar model to illustrate what they have to calculate.   8 – 5, the difference is ☐
Stage 4 **Subtraction using 10 frames**	Children to partition the number to subtract ones until they make ten. Then continue to subtract the remaining ones. Children can then record the steps they have taken to subtract.   14 - 4 = 10 10 - 1 = 9

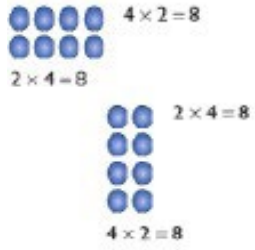
Stage 5 **Subtraction on a empty numberline**	Children to use an empty numberline to take away ones and then tens in a 2 digit number.  

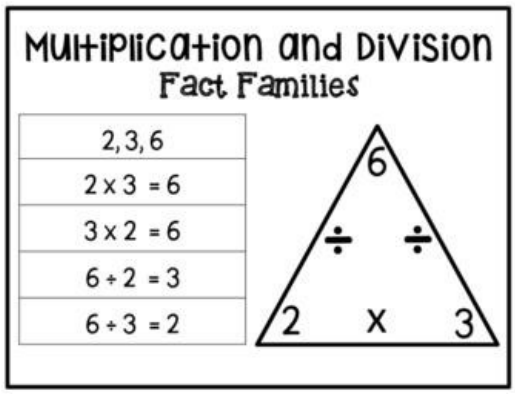
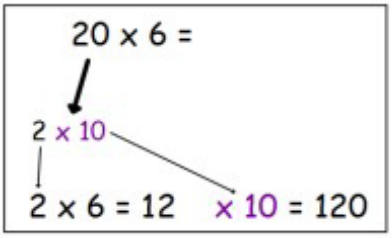
Stage 6 **Subtraction using base ten without exchanging**	Children to use base 10 to represent the subtraction calculation both using concrete resources and pictorial representations (drawing lines to represent the tens and dots to represent the ones).   Children should then be encouraged to record their calculation in the formal method. 
Stage 7 **Subtraction using base ten (with exchanging) and column method**	Children begin to understand that when solving a subtracion calculation practically and there are 'not enough' ones to take away we can exchange a ten rod for ten ones. For example: 41 – 26  40 + 1 30 + 11 Children should be encouraged to do this practically to give them a secure understanding that 40 + 1 is the same as 30 + 11. Children can then move onto representing it pictorially, remembering to show the exchange.  When children are secure in their understanding they can then be introduced to first recording in the expanded method and then then formal method. 

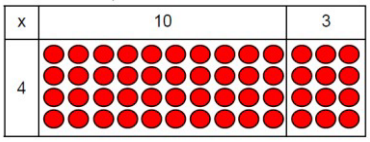
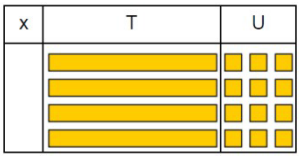
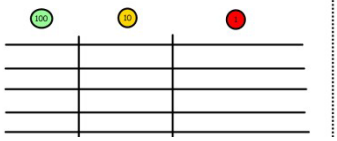
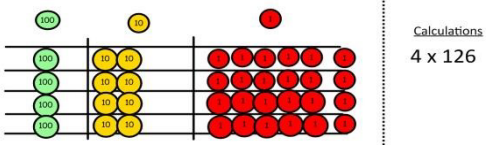
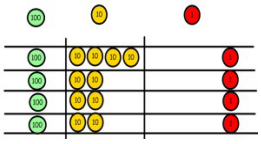
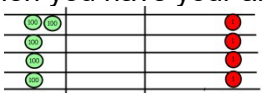
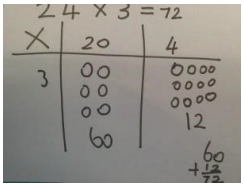
Stage 8 **Column method using place value counters**	Children will build upon their previous knowledge exchanging with base ten and move onto exchanging with place value counters.  Children should then be encouraged to record their calculation pictorially. 
	Children should then be encouraged to record the calculation using the expanded method. It is essential children are secure in their understanding of place value to enable them to move onto this. 
Stage 9 **Compact method**	Once children are confident and secure using this method they can then begin to record sing the formal method. It is essential children are still encouraged to use concrete apparatus alongside this to support their understanding. 

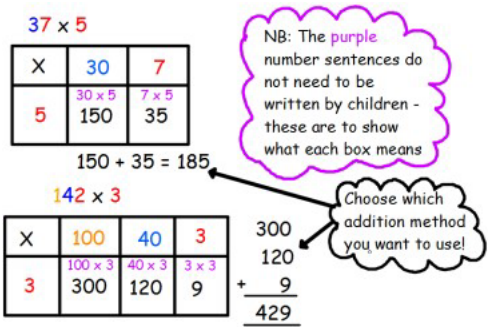
Multiplication

Multiplication	Multiplication links to division and these links must be made explicit to the children so much of the time multiplication must be taught alongside division if children are to have a clear understanding.
Stage 1 **Making equal groups and counting the total.**	Pictures/Objects How many socks in three pairs?  Symbolic 3 pairs, 2 socks in each pair:  Role play activities using plastic food/sweets etc Concrete objects – making groups of Division as sharing – has it been shared fairly?
Stage 2 **Repeated addition**	Alongside the knowledge that multiplication is repeated addition, introducing the knowledge that division can be seen as repeated subtraction. We are aiming to subtract in appropriate groups until all objects have been grouped equally or with any remainders.   **Repeated addition on a number line:**  5 + 5 + 5 =

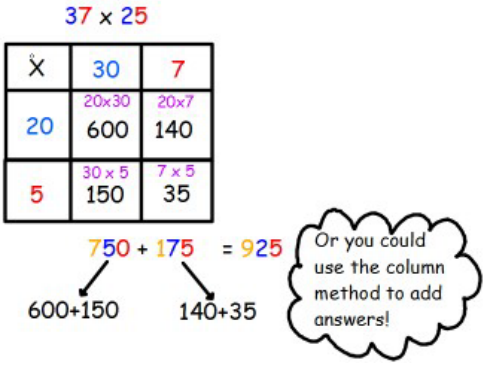
Stage 3 **Arrays (making equal groups)**	Using the mathematical vocabulary of arrays. Creating groups of objects ordered into rows is known as an array. Making the objects much easier to count and organise.   Understand that multiplication is commutative by drawing arrays of different orientations Link to repeated addition to reinforce the language  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

Stage 4 Inverse operation	Once again, this is linked to the knowledge and skills of multipliaction and times tables. As children begin to understand that multipliaction calculations are repeated lots of a number, they should be making links to the inverse operation also. Use of part – whole models, number bugs, bar modelling and fact families should all help to create the inverse links of calculations. 
Stage 5 **Multiply/divide by 10 and multiples of 10**	

Stage 6 **Grid method** **(Concrete)**	Show the link with arrays to first introduce the grid method.  4 rows of 10 4 rows of 3 Move on to using Base 10 to move towards a more compact method.  4 rows of 13 Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.  Fill each row with 126.  Add up each column, starting with the ones making any exchanges needed.  Then you have your answer. 
Stage 7 Grid method	Children can move onto a pictorial representation:  Use the grid method to multiply 2 digit by 1 digit



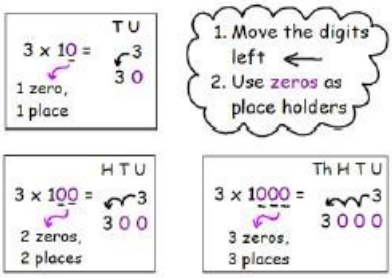
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

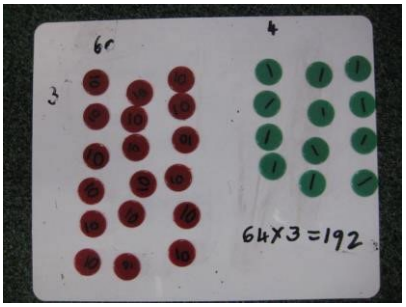


Stage 8

Multiplying by 10,100 and 1000 (and multiples of)

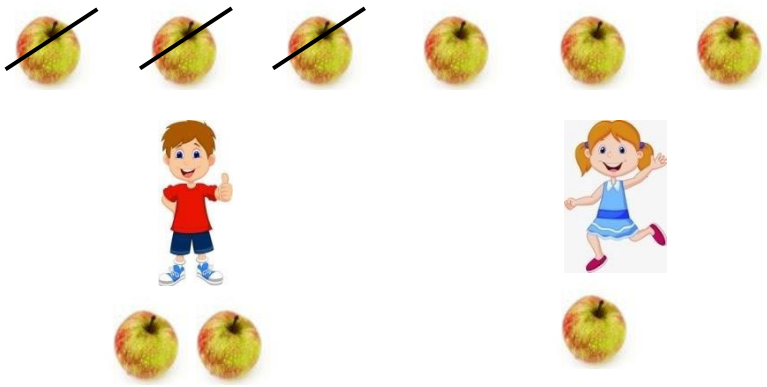
(This will need to be done during stage 7 before moving on to multiplying 3 digit numbers)

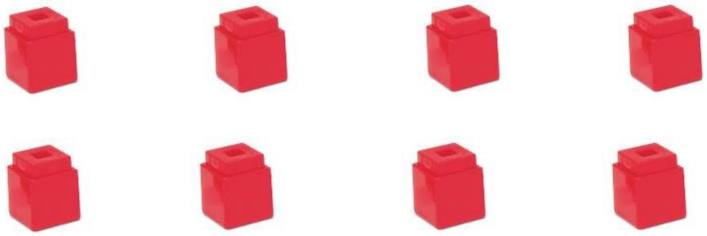


Stage 9 **Column Method (Concrete)**	Children can continue to be supported by place value counters at the stage of multiplication. 
	It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.
Stage 10 **Column Method (Expanded)**	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768

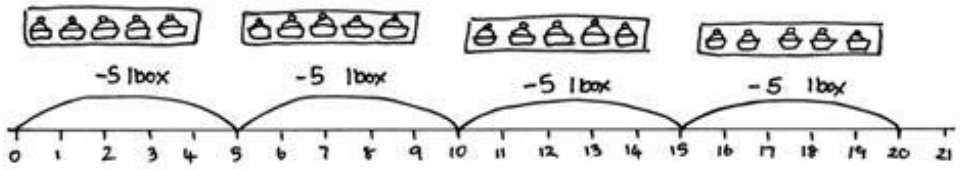
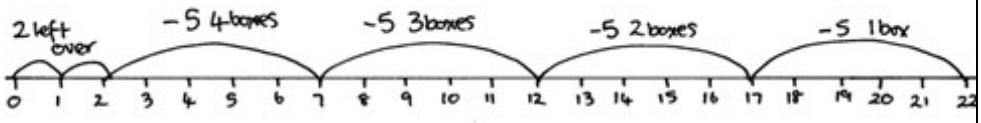
Stage 11 **Column Method** **(Compact)**	Encourage the children to estimate answers before $\begin{array}{r} 24 \\ \times\ 16 \\ \hline 144 \\ 240 \\ \hline 384 \\ \hline \end{array}$ they calculate Moving on to 3 digit multiplied by 2 digit $\begin{array}{r} 124 \\ \times\ 26 \\ \hline 744 \\ 2480 \\ \hline 3224 \\ \hline \end{array}$
Stage 12 Multiply one-digit numbers with up to two decimal places by whole numbers	4.7 x 8 = 37 (estimate 5 x 8 = 40) $\begin{array}{r} 4.7 \\ \times\ 8 \\ \hline 37.6 \\ \hline \end{array}$ Or 47 x 8, then divide the solution by 10.
NOTE: Some of the stages will need to be repeated as the numbers get larger to ensure understanding at all levels.	

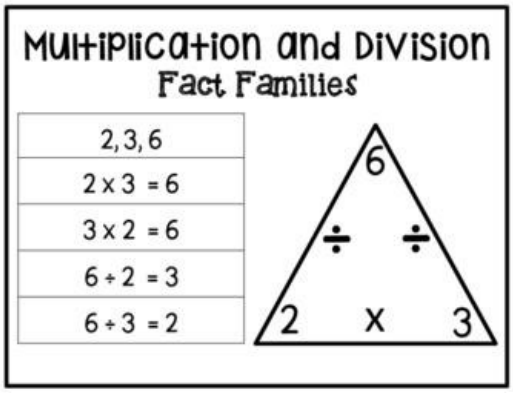
Division

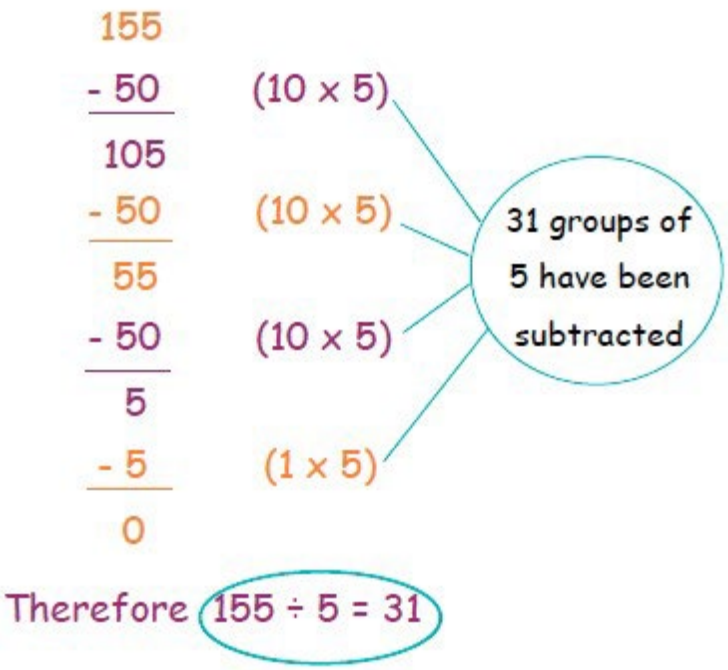
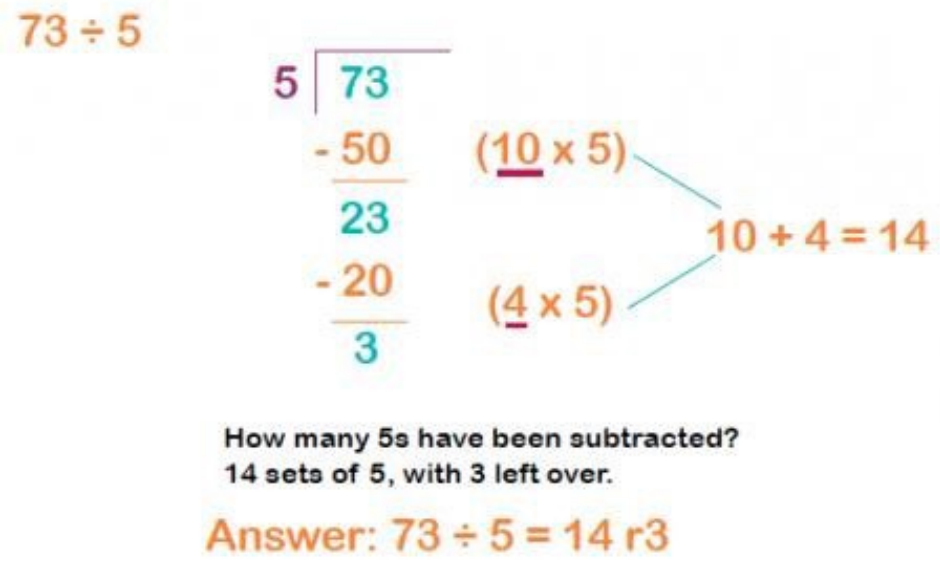
Division	Early division is about sharing objects into equal groups and counting how many are in each group "Grouping" and "sharing" are different aspects of division: I have 6 apples to share between 2 people. How many will each person have?  **This is a "sharing" task. Sharing the apples between 2 by using the "one for you, one for me" approach until all of the apples have been shared. How many does each person have?** **I have 6 apples to pack. Each pack can hold two apples. How many packs do I need?**  This is a "grouping" task as you are putting the apples into groups of 2 and then counting how many groups there are.
Stage 1 Division as sharing.	Start with division as sharing, using concrete objects: If I have 8 cubes and I can share them among 4 people, how many cubes will each person have?  "One for them, one for them, one for them and one for them."

	 Where possible, calculations should be in a “real life” context or at least a possible classroom-based context. Allowing children to see the importance of division and the reasoning behind it.
Stage 2 Division as grouping. Use of arrays.	Division as grouping Numbers to 50 divided by one digit number. Represent repeated subtraction (grouping) as division use practical and informal written methods and related vocabulary to division, including calculations with remainders If I have 12 lollipops and want to put 4 lollipops in each bag, how many bags will I need? 12÷ 4=3  1 bag  2 bags  3 bags Using the mathematical vocabulary of arrays. Creating groups of objects ordered into rows is known as an array. Making the objects much easier to count and organise.

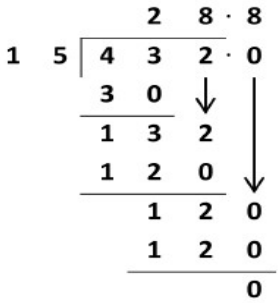
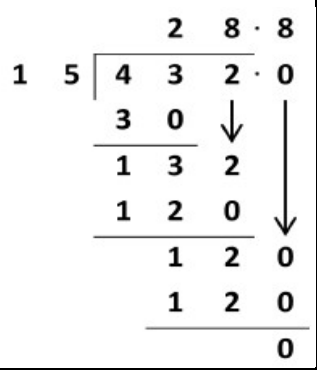
Stage 3	Alongside the knowledge that multiplication is repeated addition, introducing the knowledge that division can be

Use of division on a number line. Introducing repeated subtraction.	seen as repeated subtraction. We are aiming to subtract in appropriate groups until all objects have been grouped equally or with any remainders. *I have 20 cakes, I can fit 5 cakes in a box. How many boxes will I need?*  20 cakes divided into boxes of 5, I need 4 boxes. There are 4 groups of 5 in 20. $20 \div 5 = 4$ boxes *What if I had 22 cakes to box up?*  $22 \div 5 = 4$ boxes, with 2 cakes left over.

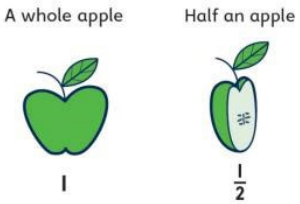
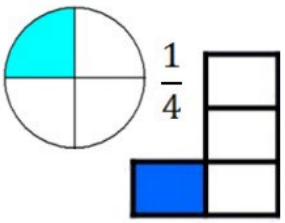
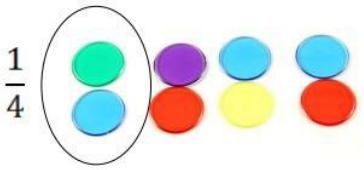
Stage 4 Inverse Operations	Once again, this is linked to the knowledge and skills of multipliaction and times tables. As children begin to understand that multipliaction calculations are repeated lots of a number, they should be making links to the inverse operation also. Use of part – whole models, number bugs, bar modelling and fact families should all help to create the inverse links of calculations. 
Stage 5	This stage of division, often referred to as “chunking”, is based on subtracting multiples of the divsior, or “chunks”.

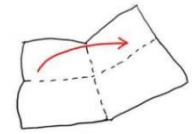
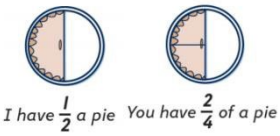
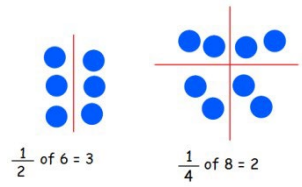
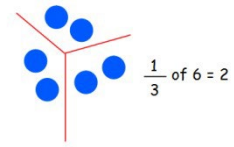
"Chunking" Using known multiples and fact families.	Initially children subtract several chunks.  For this calculation 155 is being divided by 5 so children should subtract "chunks" in multiples of 5 that they are comfortable with. Then moving onto the use of remainders when no more subtractions can be made.  This method allows children to be successful with larger division questions if they have limited times table knowledge.

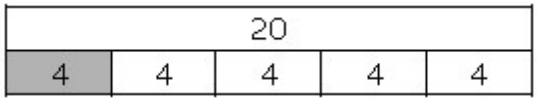
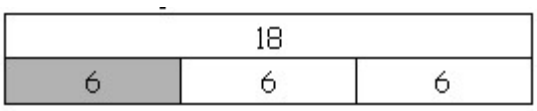
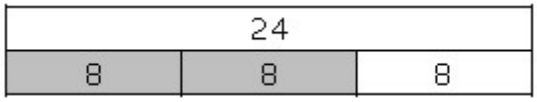
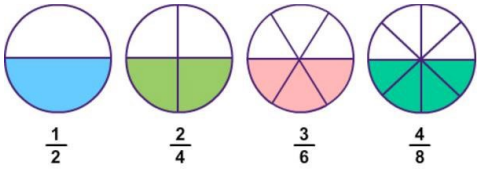
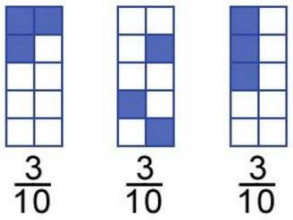
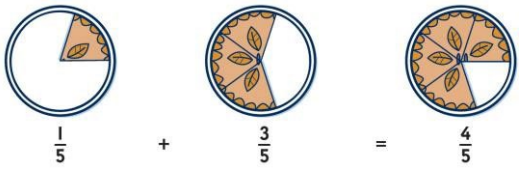
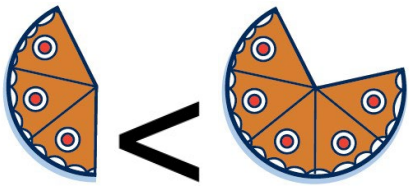
Stage 6 Chunking method Using largest possible multiples	**Chunking method (using largest possible multiples)** As children gain confidence they can refine this method and reduce recording by using the **largest possible multiples.** Children need to be confident with multiplication facts and understanding of place value. For 81 ÷ 3 =**27** 3 81 − 60 (**20** x 3) = 21 − 21 (**7** x 3) = 0 The first "chunk" is a multiple of 3 that is outside of times table knowledge, however relying on ability to create links from prior knowledge. Then the remaining amount can be removed as one "chunk" as it is a direct multiple of 3. For 196 ÷ 6 =**32 remainder 4** 6 196 − 180 (**30** x 6) = 16 − 12(**2** x 6) = **4**(Less than the divisor)
Stage 7 Short division	Short division by a single digit. Short division can be introduced to children who are confident with multiplication and division facts. They must also be able to subtract multiple of 10 mentally. It is essential they have a secure, sound knowledge of partition and place value also.
Stage 8 Short division (remainders as decimals)	43.68 □ 7 = 6.24 (estimate: 42 □ 7 = 6) 6.24 7 ⟌ 43.^{1}6^{2}8

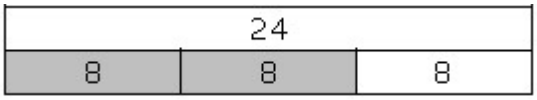
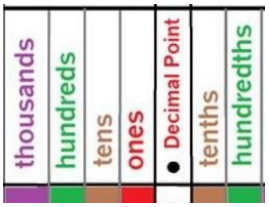
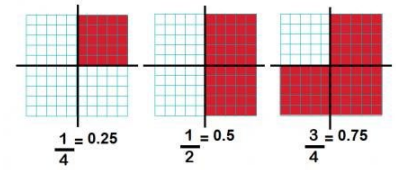
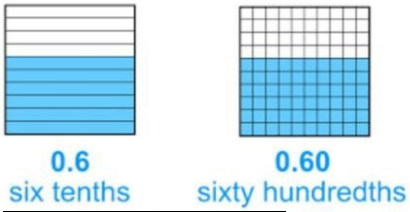
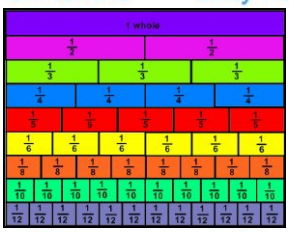
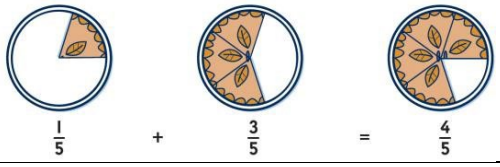
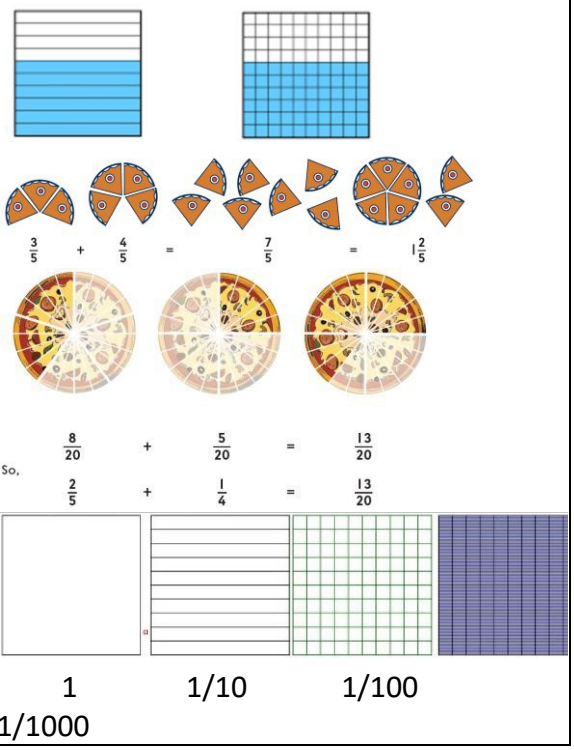
Stage 9 Long division	 

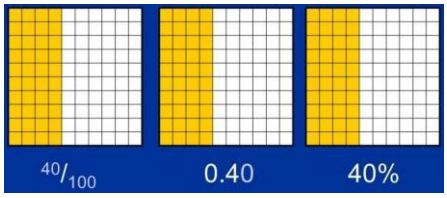
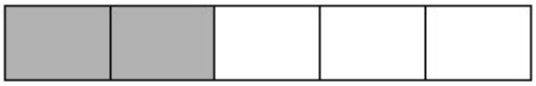
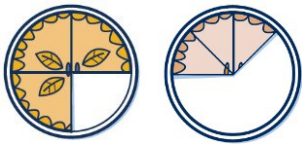
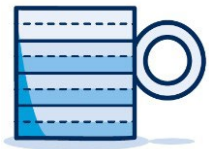
Fractions

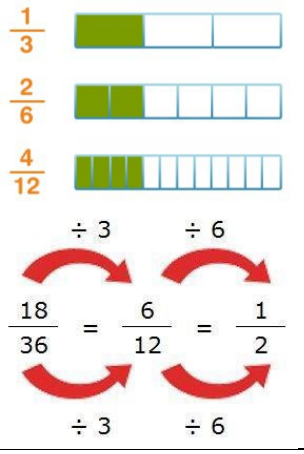
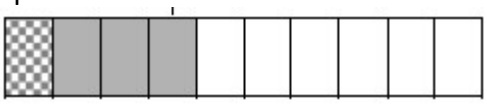
Stage 1	Children will experience sharing and halving in play and problem solving with concrete objects. **Halving objects** or sets of objects in a problem-solving context.	
Stage 2	Finding fractions of a number is linked to strategies used when sharing and grouping in division. Children use concrete objects and pictures to answer questions such as 'What is ½ of 12?' Children recognise ½ and ¼. They can find these fractions of a shape, object or number. Link to time (half past).	   

Stage 3	Children recognise 1 /3, 1 /4, 2 /4 and 3 /4. They can find these fractions of length, shape and quantity such as What is ¼ of 16? Children can record statements such as ½ of 6 = 3. They make links between this and division. Children understand the equivalence of 2 /4 and 1 /2. Children count in fractions (½, 1, 1½) and visualise them on a number line. Link to 2 times table and time (quarter past).	   

Stage 4	Children will continue to find and write fractions of a quantity or number of objects. These will be linked to their known multiplication and division facts e.g. What is  1 /5 of 20?  What is 1 /3 of 18? They will also start to calculate quantities that include non-unit fractions (fractions where the numerator is greater than 1) e.g. 2  /3 of 24= Children will add and subtract fractions with the same denominator within one whole e.g. 5 /7 + 1 /7 = 6 /7 Children understand what a tenth (1 /10) is and can count up and back down in them. Children can recognise and show some equivalent fractions. e.g. 1 /3=2 /6 1 /2 = 2 /4 Continue to use fractions on a number line. Compare and order **unit fractions with the same denominator** Link to 3, 4, 5, 8 & 10 times table.	   

Stage 5	Continue to add and subtract fractions with the same denominator e.g. 5 /7 + 1 /7 = 6 /7 (not within one whole) Recognise and write decimal equivalence of tenths, hundredths, ¼, ½ and ¾ e.g. 1 /10 = 0.1 2 /10 = 0.2 Children understand what a hundredth (1 /100) is and count in **hundredths**, making links with place value and division as well as length and money. Children continue to calculate quantities that include non-unit fractions (fractions where the numerator is greater than 1) e.g. 2 /3 of  24=16 Continue to use fractions on a number line Simplify using factors and multiples Link to 6, 7, 9, 11 and 12 times table.	    
Stage 6	Children can recognise and show the equivalence of any fraction. Children add and subtract fractions with the same denominator e.g. 4 /10 + 2 /10 = 6 /10. As well as adding and subtracting fractions where the denominators are multiples of the same number, so a lowest common denominator needs to be found e.g. 2 /3 + 1 /6 4 /6 + 1 /6 =5 /6 Children multiply proper fractions by a whole number e.g. 2 /3 x 5 = 10/3 10/3 = 3 1 /3 As well as multiplying mixed number fractions by whole numbers e.g. 1 3 /8 x 3 = This could be achieved by turning the mixed number fraction to an improper fraction and then multiplying e.g. 11/8 x 3 = 33/8 = 4 1 /8 or multiply the whole number by three and the fraction by three and adding them	

	together e.g. 1 3 /8 x 3 1 x 3 = 3 3 /8 x 3 = 9 /8 3 + 9 /8 = 3 9 /8 = 4 1 /8 Recognise and use thousandths (1 /1000) and relate to 1 /10, 1 /100 and decimal equivalents. Count in **thousandths** making links with place value, division, decimals and measurement. Compare and order fractions, where **the denominators are multiples of the same number** Introduce percentages and know the percentage and decimal equivalents of ½ , 1 /4, 1 /5, 2 /5, 4 /5 and fractions with a denominator of a multiple of 10 or 25.	
Stage 7	Children simplify fractions using common fractions and use common multiples to express fractions in the same denomination. Add and subtract fractions with different denominators, so a lowest common denominator needs to be found e.g. 1 /3 + 1 /5 = 5 /15 + 3 /15 = 8 /15 As well as mixed numbers e.g. 2 ¾ + 3 ½ = 6 ¼ Multiply pairs of proper fractions e.g. 1 /2 x 2 /5 = 1 /5 This could be solved by using the following  visuals 2 /5 is shown below Each fifth is then split in half to show it has been multiplied by ½. The dotted section shows half of 2 /5 which is 2 /10 of the whole and can be simplified as  1 /5 Divide fractions by whole numbers e.g. 2 /5 ÷ 4 = 1 /10	$\frac{1}{2} \div 3 = \frac{1}{6}$   75% or 3/8?  1/2 of ¾

	This could be solved by recognising that it means the same as 2 /5 x ¼ = 2/20 2 /20 can be simplified as 1 /10 or changing 2 /5 to the equivalent fraction 4 /10 as here the numerator is a multiple of 4. 4 /10 ÷ 4 = 1 /10 The block below has 4 /10 shaded.	
	When divided by 4 you have 1 /10 as the dotted part shows.  Compare and order fractions, including fractions greater than 1.	