
# Maths Calculation Policy

# Moorlands Primary School Calculation Policy

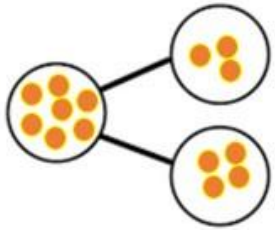
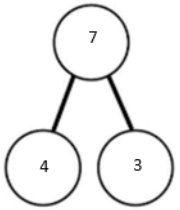
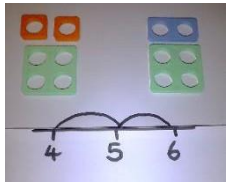
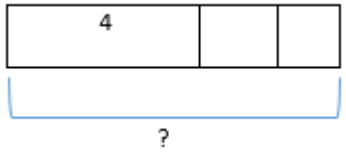
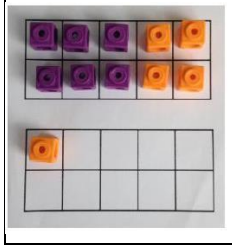
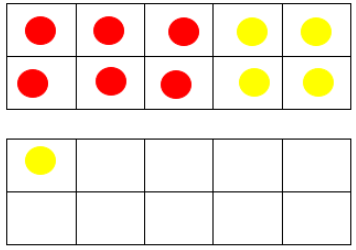
This policy shows the progression children need to move through in order to become efficient mathematicians.
It is not split into year groups or key stages, this policy shows the methods used to develop the required skills in order to, ultimately work abstractly with number. It is important that this guidance is used alongside Year Group Expectations to ensure correct content is taught. Do not move into higher year group expectations but if children are working below expected you can use the principles of previous years to help them gain a greater understanding, through the use of concrete resources and taking the concept back a step.
Children should move from concrete to pictorial to abstract. In KS2 if children are already competent with abstract (you are sure they fully understand and haven't just learnt a process) there is no need to make them go back to concrete, however it is important that they can use the concrete as these will often be needed in more complex problem solving activities. All examples of calculations should be moved onto children finding missing numbers within the calculation.
At Moorlands we recognise the importance of fluency variation, at the end of each section there are examples of varied ways you can ask the same question.

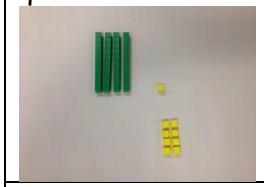
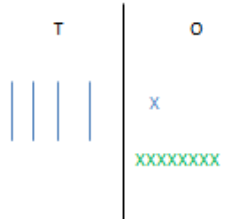
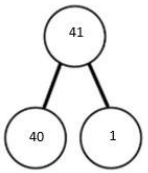
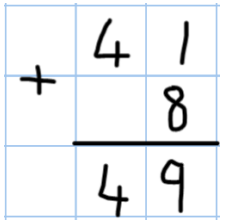
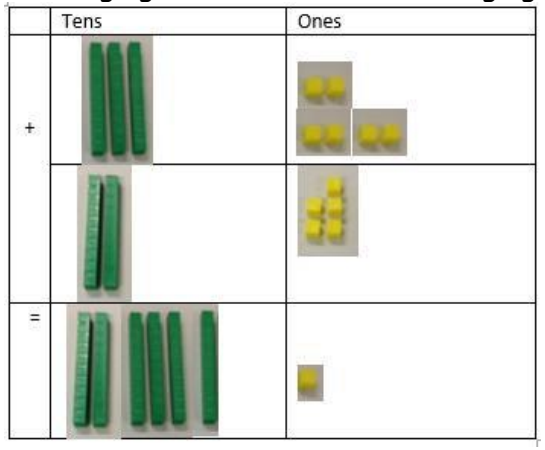
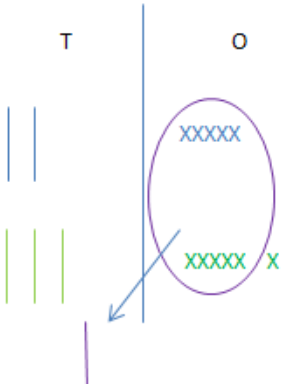
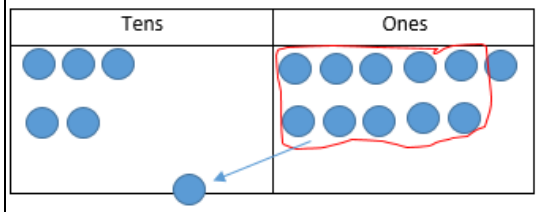
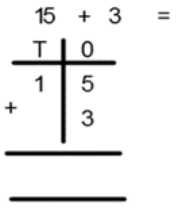
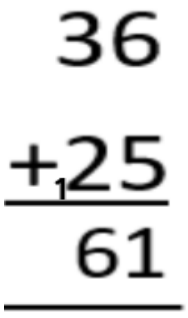
**ANY NEW CONCEPT SHOULD ALWAYS BE INTRODUCED WITH CONCRETE RESOURCES.**

***The written steps on the calculation ALWAYS need to go alongside each step made with the concrete otherwise children will never be able to move away from concrete to abstract alone.***

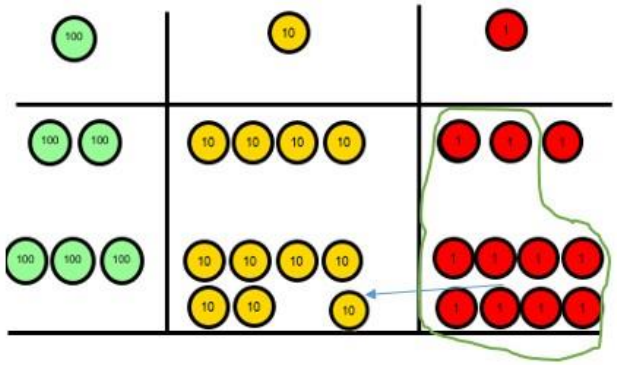
# Addition-

*Key language which should be used: sum, total, parts and wholes, plus, add, altogether, more than, 'is equal to' 'is the same as'*

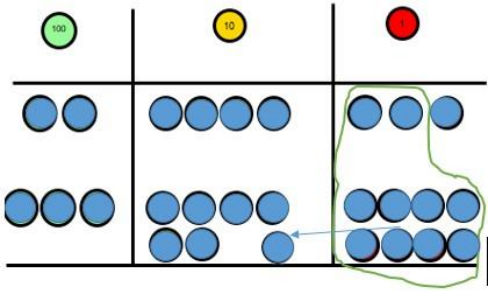
| Concrete | Pictorial | Abstract |
|---|---|---|
| **Combining two parts to make a whole** (use other resources too e.g. eggs, shells, teddy bears etc)<br>   |  | 4 + 3 = 7 (four is a part, 3 is a part and the whole is seven)<br>  |
| **Counting on using number lines** by using cubes or numicon<br>   | A bar model which encourages the children to count on<br>  | The abstract number line:<br>What is 2 more than 4? What is the sum of 4 and 4? What's the total of 4 and 2?<br>4 + 2<br>  |
| **Regrouping to make 10** by using ten frames and counters/cubes or using numicon:<br>6 + 5 becomes 6 + 4 = 10 10 + 1 = 11<br>This then moves on to missing number questions worked out in the same way 5 + _ = 12<br>   | Children to draw the ten frame and counters/cubes<br>  | Children will add by bridging through 10 mentally.<br><br>Children to develop an understanding of<br><br>equality e.g 6 + ☐ = 11 and<br><br>6 + 5 = 5 + ☐ 6 + 5 = ☐ + 4 |

| | | |
|---|---|---|
| **TO + O using base 10**. Continue to develop understanding of partitioning and place value<br>41 + 8<br>**This would move onto exchanging tens for a rod of 10**. Show how to represent on calculation as each step is taken with the concrete. Develop this into missing number questions.<br>  | Children to represent the concrete using a particular symbol e.g. lines for tens and crosses for ones. When exchanging occurs children can group the ten ones or cross them out and exchange for a ten.<br>  | 41 + 8<br>  <br>1 + 8 = 9<br>40 + 9 = 49<br>  |
| **TO + TO using base 10.** Continue to develop understanding of partitioning and place value and use this to support addition. Begin with no exchanging. Then move into exchanging 36 + 25<br>  <br>Here 10 ones have been exchanged for one ten. | This could be done one of two ways:<br>  <br>  |  <br>Formal method:<br>  |

**Use of place value counters to add HTO + TO, HTO + HTO** etc. once the children have had practice with this, they should be able to apply it to larger numbers and the abstract



Chidren to represent the counters e.g. like the image below

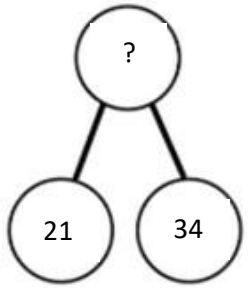


If the children are completing a word problem, draw a bar model to represent what it's asking them to do

| ? | |
|---|---|
| 243 | 368 |

$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline \end{array}$$

# Fluency variation, different ways to ask children to solve 21+34:





Sam saved £21 one week and £34 another. How much did he save in total?

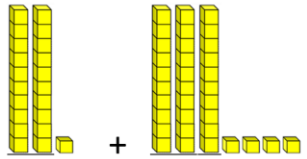
21+34=55. Prove it! (reasoning but the children need to be fluent in representing this)

$$\begin{array}{r} 21 \\ +34 \\ \hline \\ \hline \end{array}$$

**21 + 34 =**

$\square$ = 21 + 34

What's the sum of twenty one and thirty four?

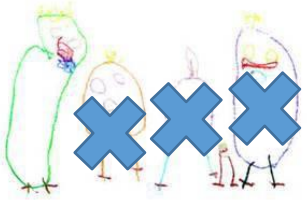
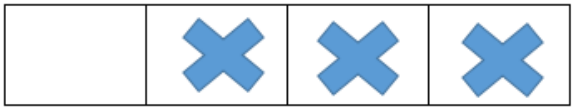
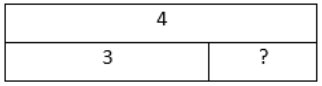
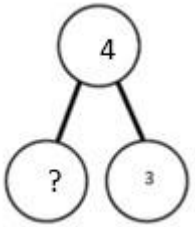
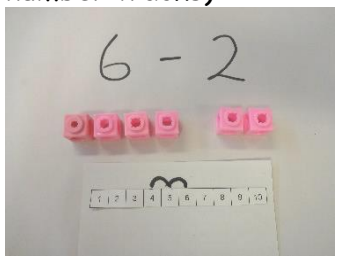
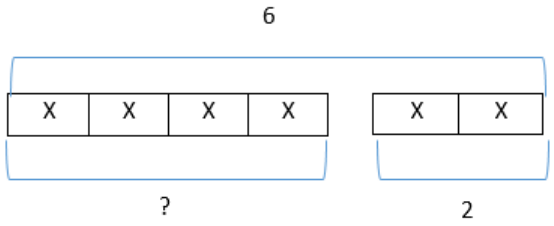
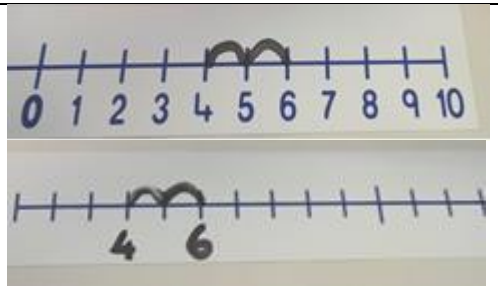


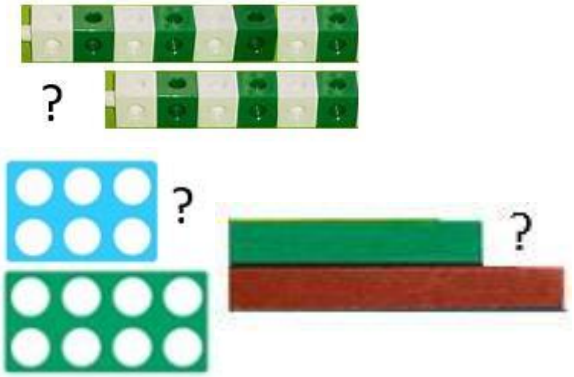
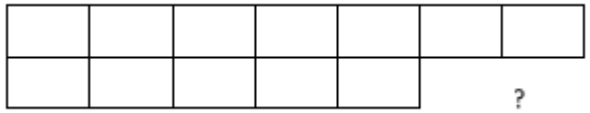
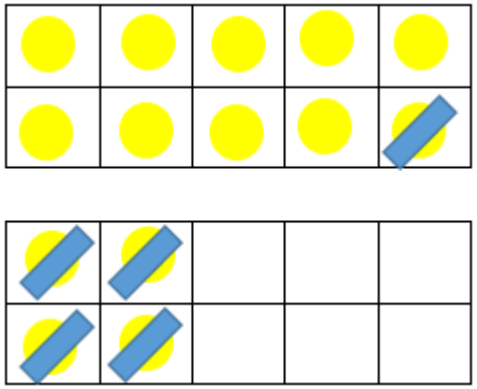
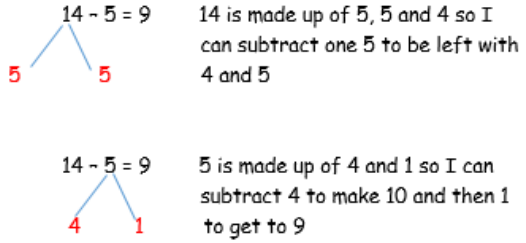
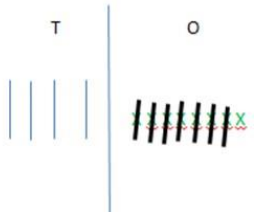
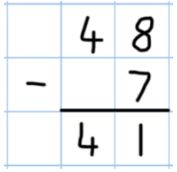
**Always use missing digit problems too:**

| Tens | Ones |
|---|---|
| 10 10 | 1 |
| 10 10 10 | ? |
| ? | 4 |

# Subtraction-

*Key language which should be used: take away, less than, the difference, subtract, minus, fewer, decrease, '7 take away 3, the difference is four'*

| Concrete | Pictorial | Abstract |
|---|---|---|
| **Physically taking away and removing objects from a whole** rather than crossing out- children will physically remove the objects. Move this onto missing numbers<br>4 – 3 = 1<br>  | Children to draw the concrete resources they are using and cross out.<br>  <br>Use of the bar model:<br>  | **4- 3 =**<br>**☐ = 4 – 3**<br>  <br><br>  <br> |
| **Counting back** (using number lines or number tracks)<br>  <br> | Children to represent what they see pictorially e.g.<br>  <br> |  <br> |

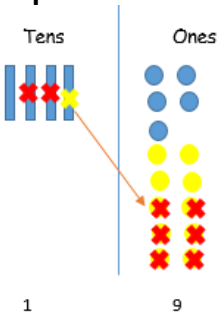
| | | |
|---|---|---|
| **Finding the difference** (using cubes, numicon or Cuisenaire rods, other objects can also be used)<br>  | Children to draw the cubes/other concrete objects which they have used<br><br>XXXXXXXX<br>XXXXXX<br><br>Use of the bar model<br>  | Find the difference between 8 and 6.<br><br>8 – 6, the difference is ?<br><br>Children to also explore why<br>9 - 7 = 8 – 6 (the difference, of each digit, has changed by 1 so the difference is the same) |
| **Making 10** (using numicon or ten frames)<br>14 – 5 becomes 14 – 4 = 10 then take one more away to gain answer of 9.<br>  <br>Carry this out with missing number questions<br>e.g. 16 - _= 7 | Children to present the ten frame pictorially<br>  | 14 – 5 = 9 You also want children to see related facts e.g. 15 – 9 = 5<br><br>Children to represent how they have solved it e.g.<br>  |
| **Column method** (using base 10)<br>48-7<br>  <br>Develop this into missing number questions. |  <br>Develop this into missing number questions. | 48 – 7 =<br>  <br>Develop this into missing number questions. |

**Column method** (using base 10 and having to exchange)

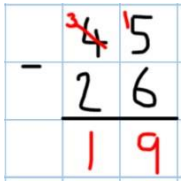
**45-26**

1) Start by partitioning 45
2) Exchange one ten for ten more ones
3) Subtract the ones, then the tens.

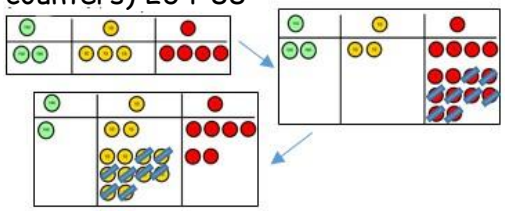
**Represent the base 10 pictorially**




It's crucial that the children understand that when they have exchanged the 10 they still have 45. 45 = 30 + 15

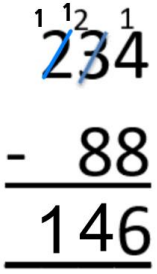



**Column method** (using place value counters) 234-88

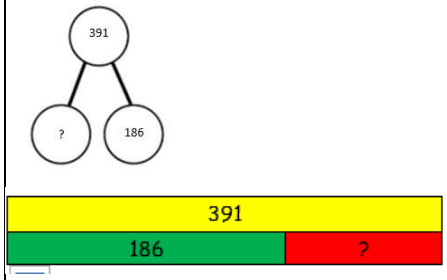


Once the children have had practice with the concrete, they should be able to apply it to any subtraction.

Like the other pictorial representations, children to represent the counters.




# Fluency variation, different ways to ask children to solve 391-186:




Raj spent £391, Timmy spent £186. How much more did Raj spend?

I had 391 metres to run. After 186 I stopped. How many metres do I have left to run?

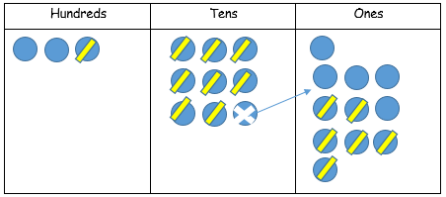
391 – 186

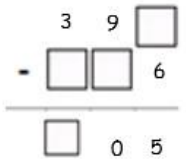
= 391 – 186

391
-186
———

Find the difference ebtween 391 and 186
Subtract 186 from 391.
What is 186 less than 391?

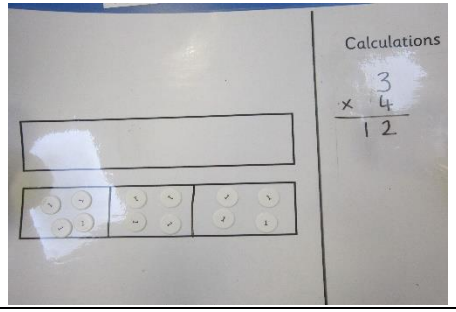
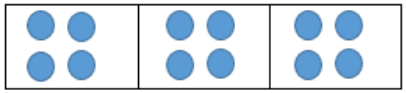
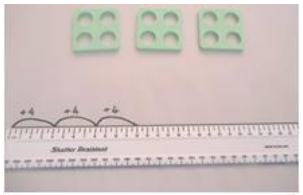
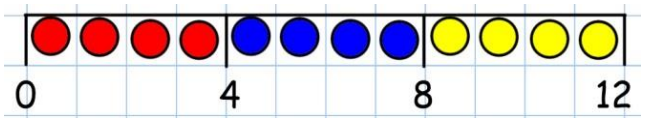
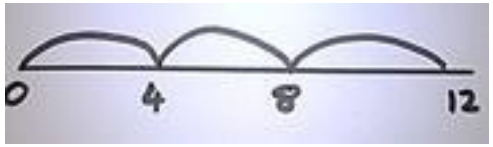
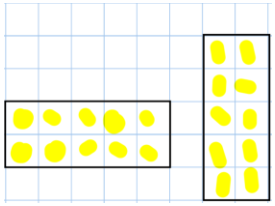
What's the calculation? What's the answer?

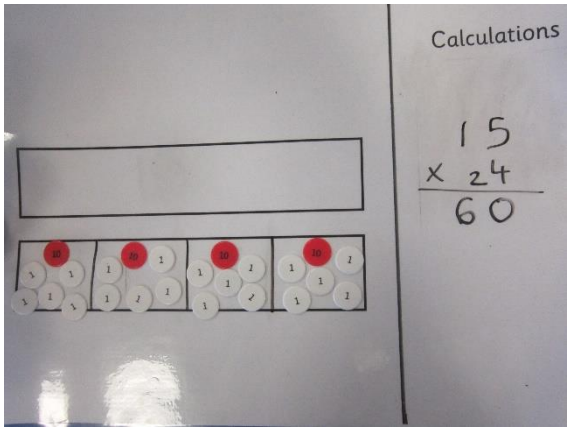
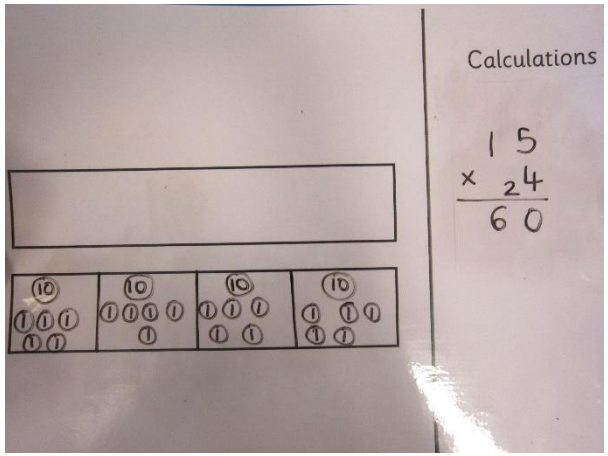
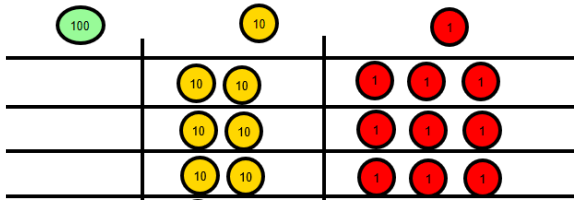
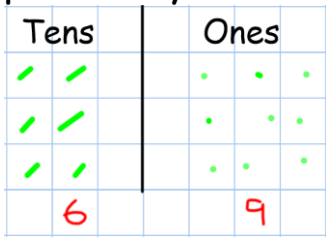


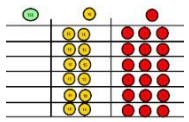
# Multiplication-

*Key language which should be used: double times, multiplied by, the product of, groups of, lots of, 'is equal to' 'is the same as'*

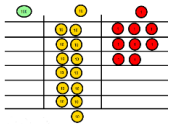
| Concrete | Pictorial | Abstract |
|---|---|---|
| **Repeated grouping/repeated addition**<br>3 x 4 or 3 lots of 4<br>  | Use of a bar model to draw dots<br>  | 3 x 4<br>4 + 4 + 4 |
| **Use number lines to show repeated groups-** 3 x 4<br>  <br>  | Represent this pictorially alongside a number line e.g:<br>  | Abstract number line<br>**3 x 4 = 12**<br>  |
| **Use arrays to illustrate commutativity** (counters and other objects can also be used)<br>**2 x 5 = 5 x 2**<br>  <br>  <br>  | Children to draw the arrays<br>  | Children to be able to use an array to write a range of calculations e.g.<br>2 x 5 = 10<br>5 x 2 = 10<br>2 + 2 + 2 + 2 + 2 = 10<br>5 + 5 =10 |

| | | |
|---|---|---|
| **Partition to multiply** 4 x 15 using place value counters on a bar model.<br>  | Draw place value counters on the bar model.<br>  | Children to be encouraged to show the steps they have taken<br>4 x 15<br>10 5<br>**4 x 5 – 20**<br>**4 x 10 = 40**<br>**40 + 20 = 60**<br><br>**This is a step before formal written method.** |
| **Formal column method** with place value counters or base 10 (at the first stage- no exchanging) 3 x 23<br><br>Make 23, 3 times. See how many ones, then how many tens<br>  | **Children to represent the counters in a pictorial way**<br>  | Children to record what it is they are doing to show understanding<br>3 x 23<br>20 3<br>3 x 3 = 9<br>3 x 20 = 60<br>60 + 9= 69<br><br>23<br>x 3<br>69 |
| **Formal column method** with place value counters (children need this stage, initially, to understand how the column method works) | Children to represent the counters/base 10, pictorially e.g. the image below. | **6 x 23**<br>6 x 3 = 18<br>6 x 20 = 120<br>120 + 18 = 138 |

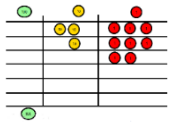
6 x 23



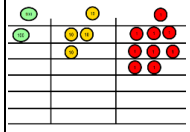
**Step 1**: get 6 lots of 23



**Step 2**: 6 x 3 is 18. Can I make an exchange? Yes! Ten ones for one ten….

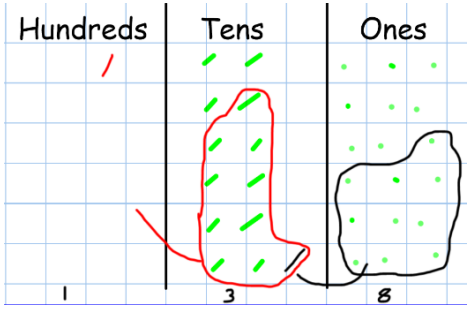


**Step 3**: 6 x 2 tens and my extra ten is 13 tens. Can I make an exchange? Yes! Ten tens for one hundred…



**Step 4**- what do I have I each column?

Here each step that is taken with the concrete needs showing on the written calculation alongside. E.g. as an exchange is made show how that would look on the calculation.



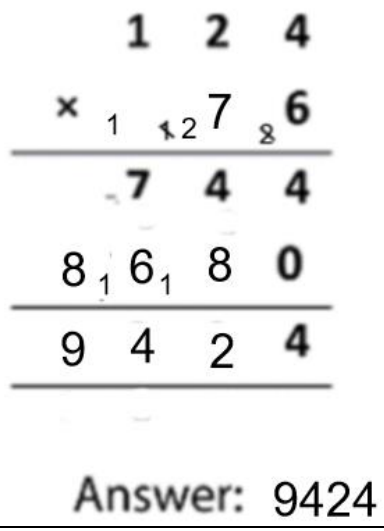

The aim is to get to the formal method but the children need to understand how it works.

$$\begin{array}{r} 23 \\ \times\ 6 \\ \hline 138 \\ \hline \end{array}$$

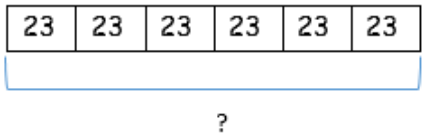
When children start to multiply 3d x 3d and 4d x 2d etc, they should be confident with the abstract:

To get 744 children have solved 6 x 124
To get 8680 they have solved 70 x 124

When exchanging in the first calculation, the exchanged number goes above the line.
When children start to multiply the tens or hundreds, they must cross out the exchanging from the previous calculation and write in the new exchanging.




# Fluency variation, different ways to ask children to solve 6 x 23:




With the counters, prove that 6 x 23 = 138

Why is 6 x 23 = 32 x 6?

Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week?

Tom saved 23p three days a week. How much did he save in 2 weeks?

Find the product of 6 and 23

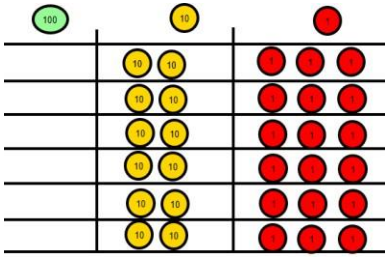
6 x 23 =

= 6 x 23

6 × 23

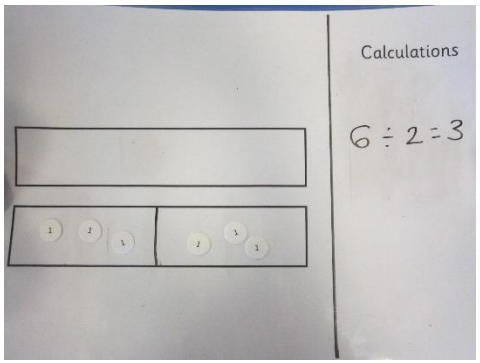
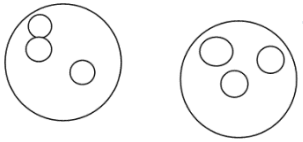
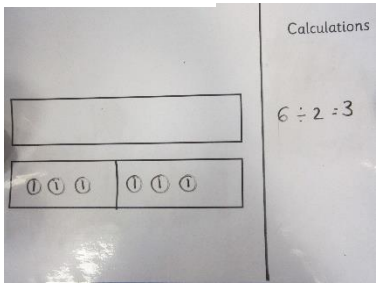
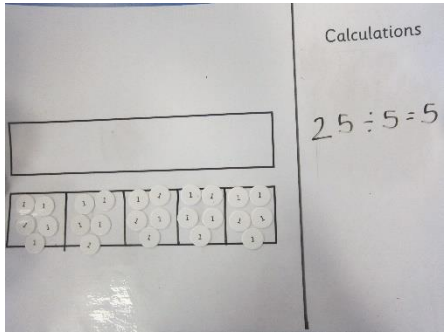
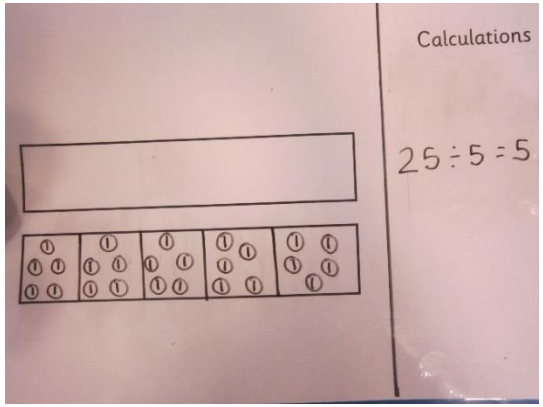
23 × 6

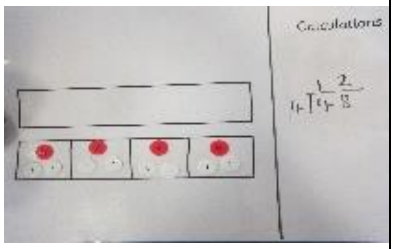
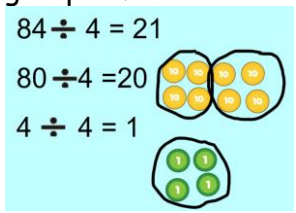
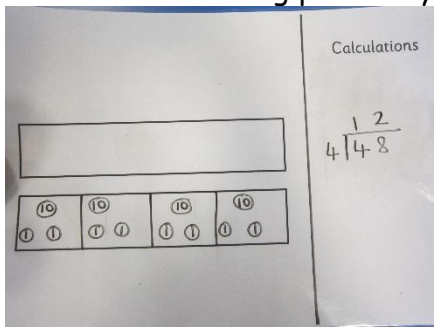
What's the calculation? What's the answer?



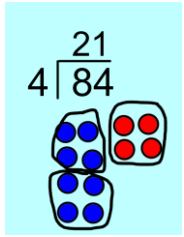
# Division-

*Key language which should be used: share, group, divide, divided by, half, 'is equal to' 'is the same as'*

| Concrete | Pictorial | Abstract |
|---|---|---|
| **6 shared between 2** show on bar model using concrete resources<br>  |  Children will begin draw circles on bar model<br>  | 6 ÷ 2 = 3<br><br>What's the calculation?<br><br>3 \| 3 |
| **Understand division as repeated grouping** "Sam wants to pack cakes into boxes of 5. How many boxes will he need for 25 cakes?"<br>  <br>Here we are counting in 5s up to 25 to see how many lots of 5. | Children will draw counters on the bar.<br>  | Children move towards putting numbers on the bar model and using times table knowledge.<br><br>25<br>5 \| 5 \| 5 \| 5 \| 5<br><br>When children have a secure knowledge of their times tables they will be able to answer these style of questions mentally without the need to show on a bar. |

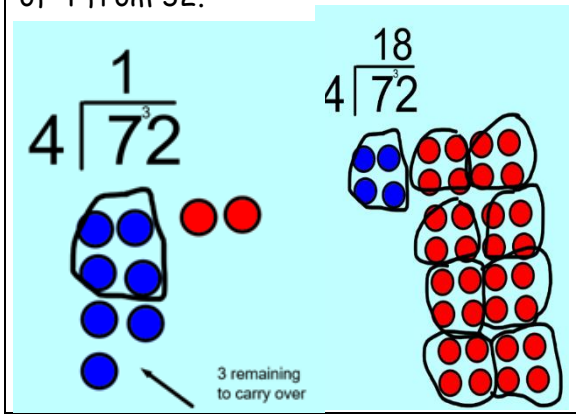
| | | |
|---|---|---|
| **2d divided by 1d using place value counters** (no remainders) SHARING done on a bar model. 48 ÷ **4** = **12**<br>Start with the tens and show calc alongside using bus stop method.<br>  <br>This moves on to partitioning to divide, use the grouping method, how many groups of 4 can I make. Use knowledge of x tables for mutiples of ten e.g. 2 groups of 4 in 8 so 20 in 80.<br>  | Children to represent the place value counters and sharing pictorially on bar model.<br>  <br>Partitioning method to be used and drawing own counters as seen in concrete image to the left. | Children will use their times table knowledge where appropriate or will show on bus stop method through abstract calculation.<br>$3\overline{)96}$ = 32<br>Partitioning method used but children will use knowledge of their times tables to find answers before recombining. |

Next stage would be using bus stop but with grouping counters under the bus stop. Use language of how many groups of 4 can I get from 8 tens? Group the tens into 4s and record number of groups above on bus stop. Repeat for ones.




**2d ÷ 1d with remainders**

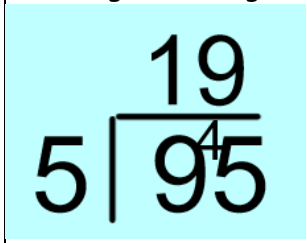
Remainders can also be shown grouping under the bus stop. What cannot fit into a group of 4 needs carrying over and written on the bus stop so now can exchange those 3 tens for 30 ones. Becomes how many groups of 4 from 32.

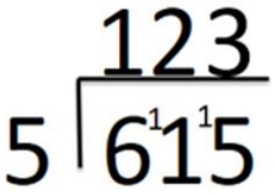



Children can then draw the groups that can be made pictorially under the bus stop.

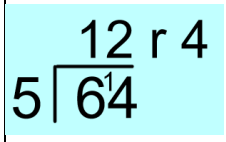
This method can then be repeated with 3 and 4 digit numbers. It can also be done with decimal places if you have a remainder.

After lots of practical experience, children will naturally move away from the need to draw groupings as they understand the method and will complete the bus stop method abstractly using times table knowledge. Showing carried over digits.

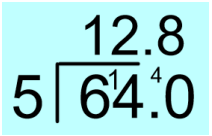



Converting remainders into decimals using bus stop method.
All whole numbers could be written with decimal and zeros e.g. 36 can be written as 36.000. If a remainder is left at the end of a calculation, add the decimal with zero and carry over the remainder to create a decimal answer.

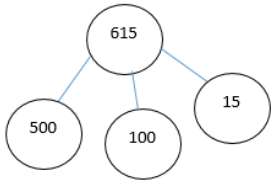



becomes



# Fluency variation, different ways to ask children to solve 615 ÷ 5:

Using the part whole model below, how can you divide 615 by 5 without using the 'bus stop' method?




I have £615 and share it equally between 5 bank accounts. How much will be in each account?

615 pupils need to be put into 5 groups. How many will be in each group?

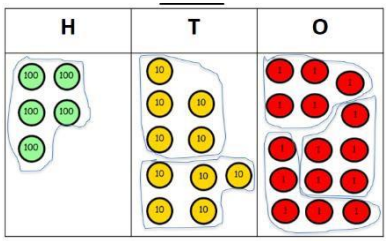
$5\overline{)615}$

615 ÷ 5 =

= 615 ÷ 5

How many 5's go into 615?

What's the calculation? What's the answer?

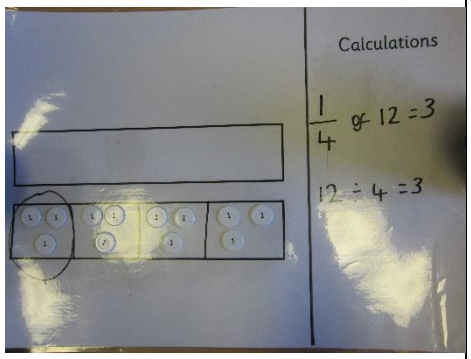
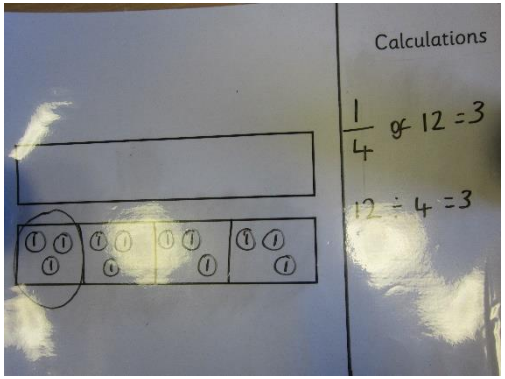
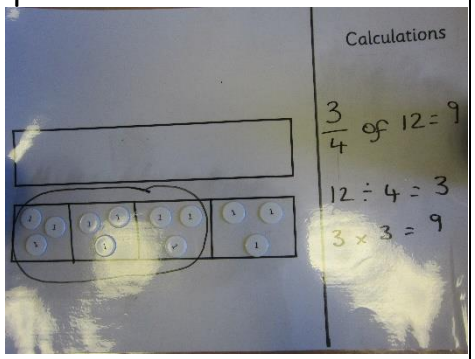
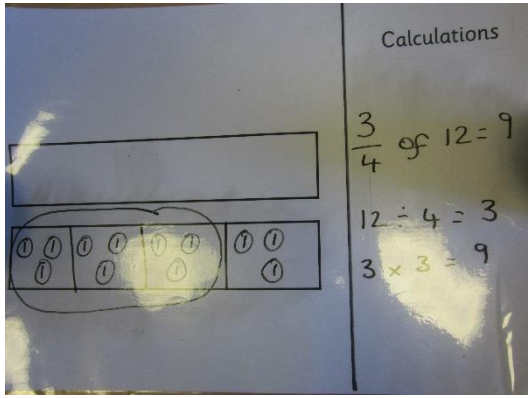


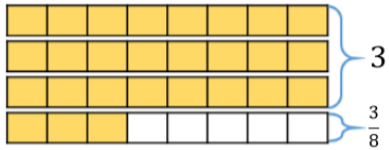
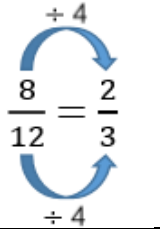
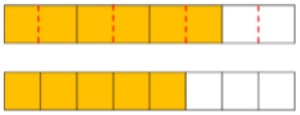
# Long Division

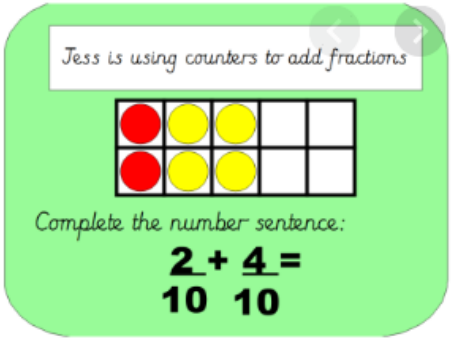
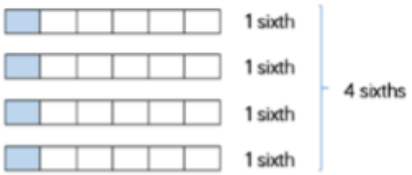
| Concrete | Pictorial | Abstract |
|---|---|---|
| The same method above can be used for long division if needed for LA children. Going through each grouping stage e.g 2544 ÷ 12<br><br>Stage 1 - How many groups of 12 thousands do we have? None<br>Exchange 2 thousand for 20 hundreds<br><br>Stage 2 – How many groups of 12 are in 25 hundreds? Circle them to find 2 groups.<br>We have grouped 24 hundreds so can take them off and we are left with one. Show on the written calculation.<br><br>Stage 3 – Exchange the one hundred for ten tens so now we have 14 tens. Bring the 4 down on calculation to show 14. How may groups of 12 are in 14? 1 remainder 2. Show on calculation.<br><br>Stage 4 – Exchange the 2 tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2 Finish the calculation. | Children to represent the counters, pictorially and record the subtractions beneath. | Step one- exchange 2 thousand for 20 hundreds so we now have 25 hundreds.<br><br>Step two- How many groups of 12 can I make with 25 hundreds? The 24 shows the hundreds we have grouped. The one is how many hundreds we have left.<br><br>Exchange the one hundred for 10 tens. How many groups of 12 can I make with 14 tens?<br>The 14 shows how many tens I have, the 12 is how many I grouped and the 2 is how many tens I have left.<br><br>Exchange the 2 tens for 20 ones. The 24 is how many ones I have grouped and the 0 is what I have left. |

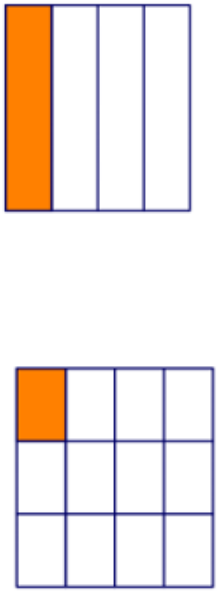
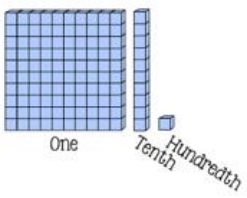
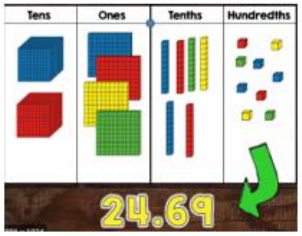
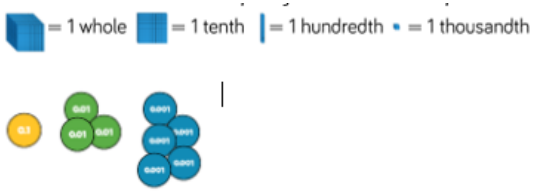
# Fractions, Decimals and Percentages

It is a non-negotiable at Moorlands that bar modelling be used as an introduction to fractions and carried on being used until children are fully secure with the abstract method.

| Concrete | Pictorial | Abstract |
|---|---|---|
| Finding a fraction of an amount e.g. $\frac{1}{4}$ of 12.<br>  | Children will draw counters on the bar.<br>  | Eventually children will recognise that $\frac{1}{4}$ is dividing by 4 and use their x table knowledge.<br>$\frac{1}{4}$ of 12 = 12 ÷ 4 = 3 |
| Children will move onto finding more than one part. The bar model will help to focus them on how many parts to look at.<br>  | Children will draw counters on the bar.<br>  | Children will divide by the fraction amount then x by how many parts.<br>(This is quite a complex abstract method so should be used only when full understanding is evident). |

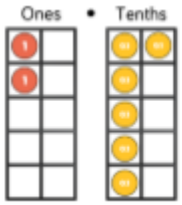
| Learning objective | Concrete or Pictorial | Abstract |
|---|---|---|
| Changing fractions from improper to mixed number and vice versa | $\frac{27}{8}$  $3\frac{3}{8}$ | $\frac{27}{8}$ = 27 ÷ 8 = 3 r 3 = $3\frac{3}{8}$<br>$3\frac{3}{8}$ = 3 x 8 + 3 = $\frac{27}{8}$ |
| Use of factors to simplify fractions | A use of a multiplication grid for children to find these if they are not confident with their times table knowledge. |  |
| Comparing and ordering fractions with multiples of the same denominator | Use bar models to compare $\frac{5}{8}$ and $\frac{3}{4}$  | *Finding a common denominator (in this case 8) and using the method of equivalent fractions.*<br>$\frac{3}{4}$ = $\frac{6}{8}$ *because 4 x 2 = 8 so repeated with the numerator, 3 x 2 = 6* |
| Comparing and ordering with different denominators | $\frac{3}{4}$ and $\frac{2}{3}$  | Dora is comparing $\frac{5}{6}$ and $\frac{3}{4}$ by finding the lowest common multiple of the denominators.<br>Multiples of 6: 6, 12, 18, 24<br>Multiples of 4: 4, 8, 12, 16,<br>12 is the LCM of 4 and 6<br>$\frac{5}{6} = \frac{10}{12}$ $\frac{3}{4} = \frac{9}{12}$<br>$\frac{10}{12} > \frac{9}{12}$  |

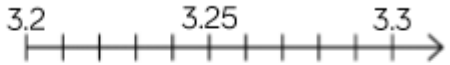
| | | |
|---|---|---|
| Adding and subtracting fractions with the same denominator |  | $\frac{2}{10} + \frac{4}{10} =$ |
| Adding and subtracting fractions with different denominators |  | Find a common denominator using the method above and change the fractions accordingly. Then add or subtract them. If the answer is an improper fraction, use the method shown above to convert it into a mixed number. |
| Multiplying fractions by whole numbers | $\frac{1}{6} \times 4$  | Denominator stays the same and you multiply the numerator by the whole number. If the answer is an improper fraction, then use the method shown above to convert it to a mixed number. |

| | | |
|---|---|---|
| Multiplying pairs of fractions | What is $\frac{1}{3} \times \frac{1}{4}$?<br>This is $\frac{1}{4}$ of a rectangle.<br>What does $\frac{1}{3} \times \frac{1}{4}$ mean?<br>Remember $\frac{1}{3} \times \frac{1}{4}$ means:<br>$\frac{1}{3}$ lots of $\frac{1}{4}$<br>or $\frac{1}{3}$ of $\frac{1}{4}$<br>What is $\frac{1}{3} \times \frac{1}{4}$?<br>This is $\frac{1}{3}$ of our $\frac{1}{4}$ of a rectangle.<br>What fraction are we left with?<br>It is $\frac{1}{12}$ of the total rectangle.  | $$\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4}$$ |
| Dividing proper fractions by whole numbers | What is $\frac{1}{3} \div 2$ ?<br>This is $\frac{1}{3}$ of a pizza.<br>What does $\frac{1}{3} \div 2$ mean?<br>It means divide the $\frac{1}{3}$ into 2 equal pieces.<br>This is $\frac{1}{3} \div 2$<br>What fraction is this part?<br>It is $\frac{1}{6}$ of the whole pizza.  | $$\frac{1}{3} \div 2 = \frac{1}{2} \text{ of } \frac{1}{3} = \frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3} = \mathbf{\frac{1}{6}}$$ |
| Recognising tenths, hundredths and thousandths | Use base ten and place value counters.     |   |

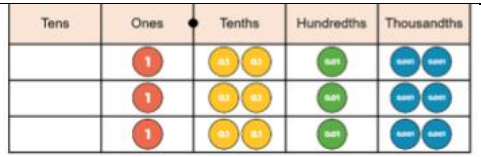
| | |
|---|---|
| Representing decimal numbers | |
| Rounding decimals | |
| Multiplying and dividing a number with up to 3 decimal places | |

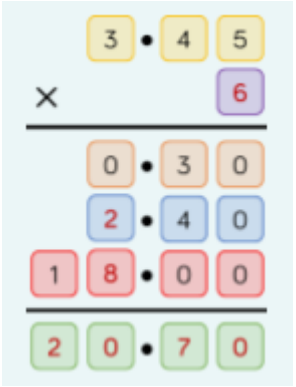
| Concrete | Decimal | Decimal – expanded form | Fraction | Fraction – expanded form | In words |
|---|---|---|---|---|---|
|  | 3.24 | 3 + 0.2 + 0.04 | $3\frac{24}{100}$ | $3+\frac{2}{10}+\frac{4}{100}$ | Three ones, two tenths and four hundredths. |
| | 3.01 | | $3\frac{1}{100}$ | | |
| | | | | $3+\frac{4}{10}+\frac{2}{100}$ | |
| | | | | | Two ones, three tenths and two hundredths. |



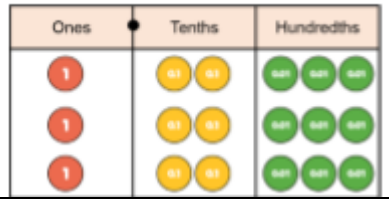




1.212 by 3




3.69 by 3

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<td>Understanding percentages as fractions</td>
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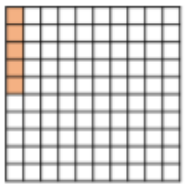
<table>
<tr><th>Pictorial</th><th>Parts per hundred</th><th>Percentage</th></tr>
<tr><td></td><td>There are 51 parts per hundred.</td><td></td></tr>
<tr><td></td><td></td><td>75%</td></tr>
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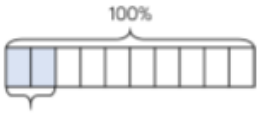

</td>
</tr>
<tr>
<td>Understanding equivalent fractions, decimals and percentages</td>
<td>
<table>
<tr><th>Pictorial</th><th>Percentage</th><th>Fraction</th><th>Decimal</th></tr>
<tr><td></td><td>41 parts per hundred<br>41%</td><td>41 out of 100<br>$\frac{41}{100}$</td><td>41 hundredths<br>0.41</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>7 parts per hundred<br>7%</td><td></td><td></td></tr>
</table>
</td>
<td>
<table>
<tr><th>Decimal</th><th>Fraction</th><th>Percentage</th></tr>
<tr><td>0.35</td><td>$\frac{35}{100}$</td><td>35%</td></tr>
<tr><td>0.27</td><td></td><td></td></tr>
<tr><td>0.6</td><td></td><td></td></tr>
<tr><td>0.06</td><td></td><td></td></tr>
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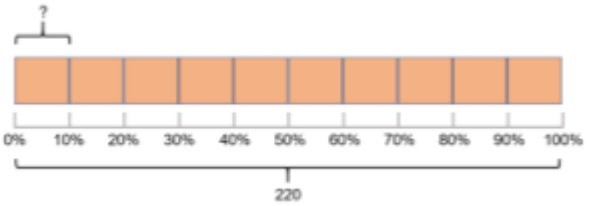
</tr>
<tr>
<td>Finding percentages of amounts</td>
<td>30% of 220<br>


</td>
<td>10% of 220 = 22 , so 30% of 220 = 3 x 22 = 66</td>
</tr>
<tr>
<td colspan="3">For further fraction, decimal and percentages work in KS2, if children are finding the abstract difficult refer to these stages of showing fractions concrete and pictorial using a bar model.</td>
</tr>
</table>