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Contents

Addition	3
Combining two parts to make a whole	3
Starting with the greatest number and counting on	3
Adding three single digit numbers	4
Adding two 2 digit numbers with no regrouping	4
Adding using the column method with no regrouping	5
Add two 2 digit numbers with regrouping	5
Column method – regrouping	6
Column method – decimals and money	6
Subtraction	7
Taking away units/ones	7
Starting with the greatest number and counting back	8
Find the difference	8
Subtracting two 2 digit numbers	9
Column method without regrouping	9
Subtracting two 2 digit numbers with regrouping	10
Column method with regrouping	10
Column method decimals and money	11
Multiplication	11
Doubling	11
Repeated addition	12
Counting in multiples	12
Arrays showing communicative multiplication	13
Grid method	14
Column method	15
Division	16
Sharing objects into groups	16
Division as grouping	17
Division within arrays	17
Division with a remainder	18
Short division	18
Long division	19

Addition

Combining two parts to make a whole

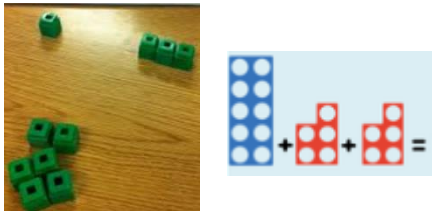
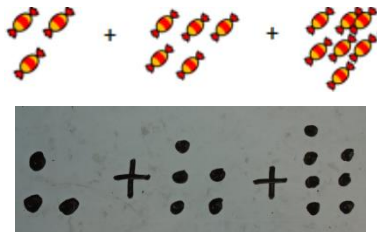
Concrete	Pictorial	Abstract
<p>Use cubes to add two numbers together as a group or in a bar. Then recount all using one-to-one correspondence.</p> <p>Use Numicon to add two numbers together.</p>	<p>Use pictures to add two numbers together as a group or in a bar</p>	<p>$4 + 3 = 7$</p> <p>$10 = 6 + 4$</p>

Starting with the greatest number and counting on

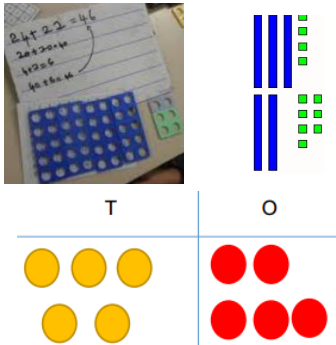
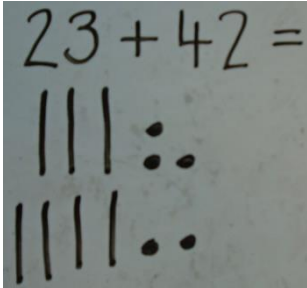
Concrete	Pictorial	Abstract
<p>Start with the greatest number and then count on using Numicon, Base 10/Cuisenaire or bead strings.</p>	<p>Start with the greatest number and count on using jottings. Put 12 in your head and count on 5 using jottings</p> <p>Start at the greatest number and count on to find the answer.</p> <p>$12 + 5 = 17$</p>	<p>$12 + 5 = 17$</p> <p>Start with the greatest numbers and count on the lower number to find the answer. Can use fingers to help.</p>



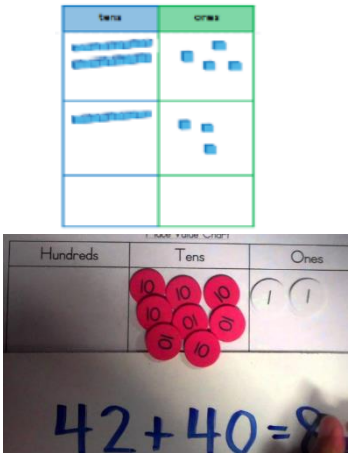
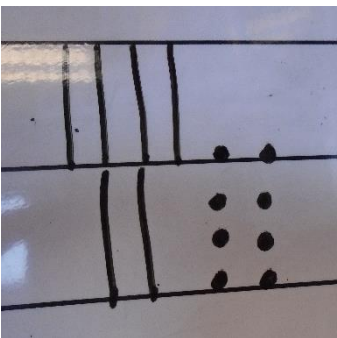
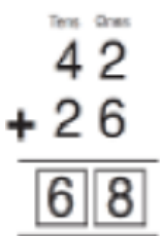
Adding three single digit numbers

Concrete	Pictorial	Abstract
<p>Start with the greatest number, make 10 with the next number (if possible) and then add on the third number. Use objects or Numicon.</p> 	<p>Draw 3 groups of objects and then combine them.</p>  <p>$3 + 5 + 7 =$</p>	<p>$6 + 4 + 2 =$</p> <p>Combine the two numbers to make 10 (where possible) and then add the third number.</p>

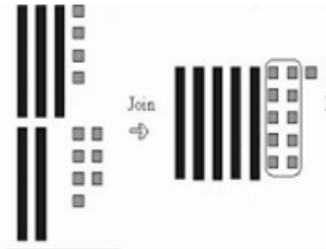
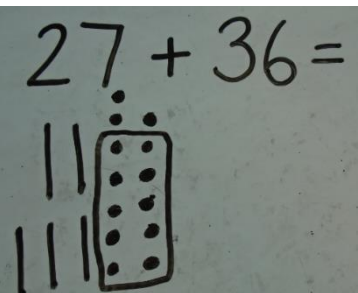
Adding two 2 digit numbers with no regrouping

Concrete	Pictorial	Abstract
<p>Add together the units and then add the tens. Use Numicon or Base 10/Cuisenaire before moving on to using place value counters.</p>  <p>$23 + 32$</p>	<p>Add together the <u>units first</u> and then the tens using jottings of Base 10 or place value counters.</p> 	<p>$23 + 42 =$</p>

Adding using the column method with no regrouping

Concrete	Pictorial	Abstract
<p>Put the Numicon, place value counters or Base 10/Cuisenaire into tens and units. Add the units and then the tens.</p> 	<p>Draw the jottings with the tens in one column and the units in another for Base 10/Cuisenaire and then add the units and then the tens.</p> 	

Add two 2 digit numbers with regrouping

Concrete	Pictorial	Abstract
<p>Exchange 10 units for 1 ten</p> 	<p>Draw the jottings, count the units first and group the 10 and then count the remaining units and then the tens including the group.</p> 	<p>27+36=63</p>

Column method – regrouping

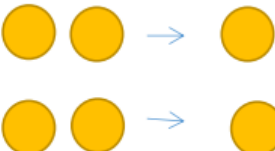

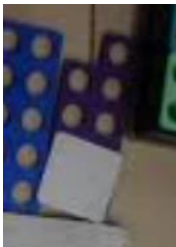


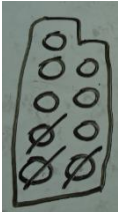
Concrete	Pictorial	Abstract
<p>Make both numbers using a place value grid, cubes, base 10 or Cuisenaire</p> <p>146 + 527</p> <p>Add up the units and exchange 10 ones for one 10.</p> <p>146 + 527</p> <p>Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.</p> <p>This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.</p> <p>As children move on to decimals, money and decimal place value counters can be used to support learning.</p>	<p>Children can draw a pictorial representation of the columns and place value counters to further support their learning and understanding.</p>	<p>Start by partitioning the numbers before moving on to clearly show the exchange below the addition.</p> $\begin{array}{r} 20 + 5 \\ 40 + 8 \\ 60 + 13 = 73 \end{array}$ $\begin{array}{r} 536 \\ + 85 \\ \hline 621 \\ 11 \end{array}$ <p>Any exchanges needs to be shown below the line.</p>

Column method – decimals and money

Concrete	Pictorial	Abstract
<p>Cuisenaire rods, counters, plastic money</p> <p>Decimal place value wall</p>		<p>As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.</p> $\begin{array}{r} 72.8 \\ + 54.6 \\ \hline 127.4 \end{array}$ $\begin{array}{r} £ 23.59 \\ + £ 7.55 \\ \hline £ 31.14 \end{array}$ $\begin{array}{r} 23.361 \\ 9.080 \\ 59.770 \\ + 1.300 \\ \hline 93.511 \\ 212 \end{array}$



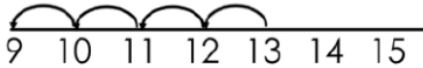
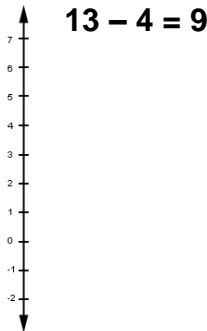
Subtraction

Taking away units/ones


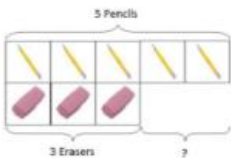


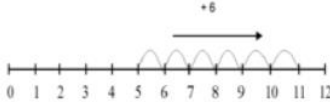
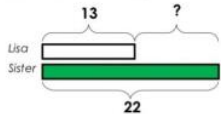
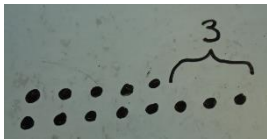
Concrete	Pictorial	Abstract
<p>Use physical objects, counters, cubes etc to show how objects can be taken away.</p> <p>$6 - 2 = 4$</p>   <p>Use Numicon covers to hide the amount to</p> <p>$9 - 4 = 5$</p> 	<p>Cross out drawn objects to show what has been subtracted</p>  <p>$8 - 5 = 3$</p>  <p>$4 - 3 = 1$</p> <p>Draw Numicon and then cross out holes to show what has been subtracted</p> <p>$9 - 3 =$</p> 	<p>$8 - 5 = 3$ $3 = 8 - 5$</p>




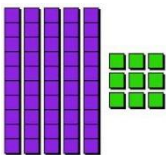
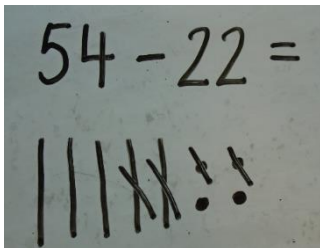
Starting with the greatest number and counting back

Concrete	Pictorial	Abstract
<p>Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.</p>  <p>$13 - 4$</p> <p>Use counters and move them away from the group as you take them away counting backwards as you go.</p> 	<p>Count back on a number line or number track</p>  <p>Start at the bigger number and count back the smaller number showing the jumps on the number line.</p>  <p>$13 - 4 = 9$</p>	<p>Put 13 in your head, count back four. What number are you at? Use fingers to help $13 - 4 = 9$</p>

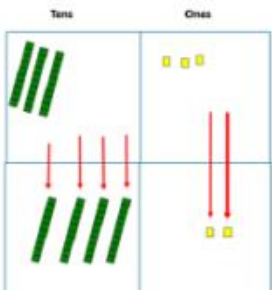
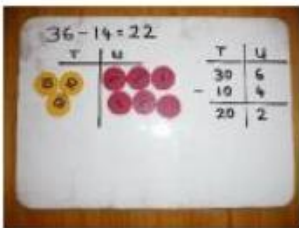
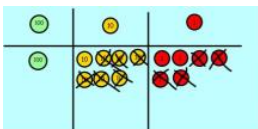
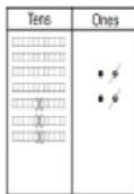
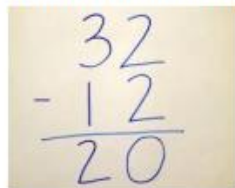
Find the difference

Concrete	Pictorial	Abstract
<p>Compare amounts and objects to find the difference.</p>  <p>Use cubes to build towers or make bars to find the difference</p>  <p>Use basic bar models with items to find the difference</p>  	<p>Count on to find the difference.</p>  <p>Draw bars to find the difference between 2 numbers.</p> <p>Comparison Bar Models</p> <p>Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.</p>  	<p>Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.</p>

Subtracting two 2 digit numbers

Concrete	Pictorial	Abstract
<p>$52 - 21 =$</p>  <p>Start with the greatest numbers and take away the next amount</p> 	<p>$54 - 22 = 32$</p> <p>Draw the Base 10 alongside the written calculation and cross out the amount to subtract</p> 	<p>$36 - 14 =$</p>

Column method without regrouping

Concrete	Pictorial	Abstract
<p>Use Base 10 to make the bigger number then take the smaller number away.</p>  <p>Show how you partition numbers to subtract. Again make the larger number first.</p> 	<p>Draw the Base 10 or place value counters alongside the written calculation.</p>  <p>Calculations</p> $\begin{array}{r} 176 \\ - 64 \\ \hline 112 \end{array}$ 	<p>$47 - 24 = 23$</p> $\begin{array}{r} 40 + 7 \\ - 20 + 4 \\ \hline 20 + 3 \end{array}$ <p>This will lead to a clear written column subtraction.</p> 

Subtracting two 2 digit numbers with regrouping

Concrete	Pictorial	Abstract
<p>$28 - 19 =$ Exchange one 10 for units and then subtract</p>	<p>Exchange one 10 for units and then subtract</p>	<p>$24 - 17 =$</p>

Column method with regrouping

Concrete	Pictorial	Abstract
<p>Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.</p> <p>Make the larger number with the place value counters</p> <p>Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.</p> <p>Now I can subtract my ones.</p> <p>Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.</p>	<p>Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.</p> <p>When confident, children can find their own way to record the exchange/regrouping.</p> <p>Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.</p>	<p>Children can start their formal written method by partitioning the number into clear place value columns.</p> <p>Moving forward the children use a more compact method.</p>



Column method decimals and money

Concrete	Pictorial	Abstract
<p>Cuisenaire rods, counters, plastic money</p> <p>Decimal place value wall</p>		<p>This will lead to an understanding of subtracting any number including decimals.</p> $\begin{array}{r} 5 \quad 12 \quad 1 \\ 2 \quad \cancel{6} \quad \cancel{3} \quad . \quad 0 \\ - \quad 2 \quad 6 \quad . \quad 5 \\ \hline 2 \quad 3 \quad 6 \quad . \quad 5 \end{array}$

Multiplication

Doubling

Concrete	Pictorial	Abstract
<p>Use practical activities to show how to double a number using cubes, numicon or base 10</p> <p>$5 \times 2 = 10$</p>	<p>Draw pictures to show how to double a number</p> <p>Double 4 is 8</p>	<p>$16 \times 2 = 32$</p> <p>Partition a number and then double each part before recombining it back together.</p>



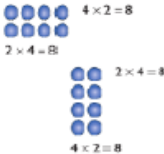
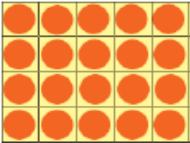

Repeated addition

Concrete	Pictorial	Abstract
<p>Use different objects to add equal groups.</p>	<p>There are 3 plates. Each plate has 2 star biscuits on. How many biscuits?</p> <p>2 add 2 add 2 equals 6</p>	<p>Write addition sentences to describe objects and pictures.</p> <p>$2 + 2 + 2 + 2 + 2 = 10$</p>

Counting in multiples

Concrete	Pictorial	Abstract
<p>Count in multiples supported by concrete objects in equal groups</p>	<p>Use a number line or pictures to continue to support in counting in multiples</p>	<p>Count in multiples of a number aloud.</p> <p>Write sequences with multiples of numbers.</p> <p>2, 4, 6, 8, 10</p> <p>5, 10, 15, 20, 25, 30</p>

Arrays showing communicative multiplication

Concrete	Pictorial	Abstract
<p>Create arrays using counters/cubes to show multiplication sentences</p>  	<p>Draw arrays in different rotations to find commutative multiplication sentences.</p>   <p>Link arrays to area of rectangles.</p>	<p>Use an array to write multiplication sentences and reinforce repeated addition.</p>  <p> $5 + 5 + 5 = 15$ $3 + 3 + 3 + 3 + 3 = 15$ $5 \times 3 = 15$ $3 \times 5 = 15$ </p>



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.

Calculations
 4×126

Fill each row with 126.

Calculations
 4×126

Add up each column, starting with the ones making any exchanges needed.

Then you have your answer

Pictorial

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.

Abstract

Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

x	30	5
7	210	35

$$210 + 35 = 245$$

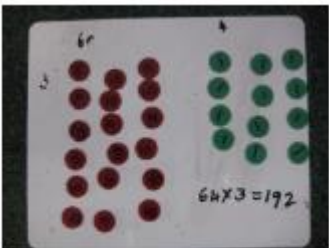
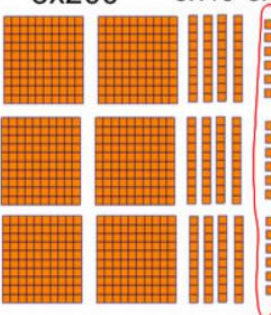
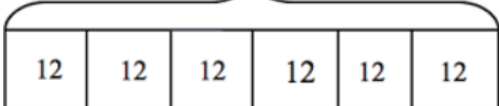
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

	10	8
10	100	80
3	30	24

x	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16



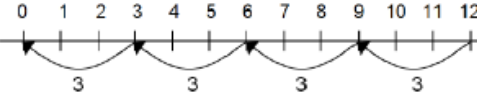



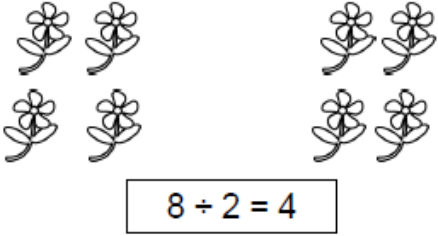
Column method

Concrete	Pictorial	Abstract
<p>Children can continue to be supported by place value counters or base 10 at this stage. It is important that they always multiply the units first and note down their answer followed by the tens</p> 	<p>Bar modelling, number lines and base 10 can support learners when solving problems with multiplication alongside the formal written methods</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>3x200 3x40 3x6</p>  </div> <div style="text-align: center;"> <p>Expanded</p> $\begin{array}{r} 246 \\ \times 3 \\ \hline 18 \\ 120 \\ 600 \\ \hline 738 \end{array}$ </div> <div style="text-align: center;"> <p>Standard</p> $\begin{array}{r} 246 \\ \times 3 \\ \hline 738 \end{array}$ </div> </div> <div style="text-align: center; margin-top: 20px;"> <p>?</p>  </div>	<p>Start with long multiplication reminding children about lining their numbers up clearly in columns. If it helps, the children can write out what they are solving next to their answer.</p> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 32 \\ \times 24 \\ \hline 8 \quad (4 \times 2) \\ 120 \quad (4 \times 30) \\ 40 \quad (20 \times 2) \\ 600 \quad (20 \times 30) \\ \hline 768 \end{array}$ </div> <p>This then moves to the more compact method.</p> <div style="text-align: center; margin-top: 20px;"> $\begin{array}{r} 327 \\ \times 53 \\ \hline 981 \leftarrow 327 \times 3 \\ 16350 \leftarrow 327 \times 50 \\ \hline 17331 \end{array}$ </div>

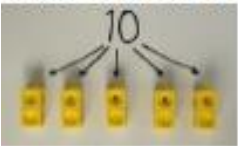
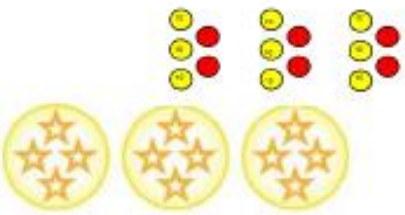
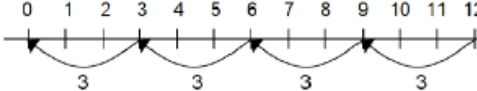
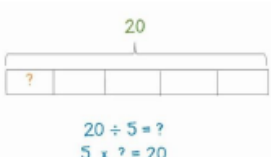


Division


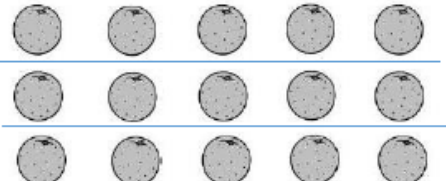
Sharing objects into groups

Concrete	Pictorial	Abstract
<p>I have 10 cubes, can you share them equally into groups of two?</p> <p>Use a number line to show jumps in groups. The number of jumps equals the number of groups.</p>  <p>Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.</p>  <p>$20 \div 5 = ?$ $5 \times ? = 20$</p>  	<p>Children use pictures or shapes to share quantities.</p> 	<p>Share 9 buns between three people.</p> <p>$9 \div 3 = 3$</p>

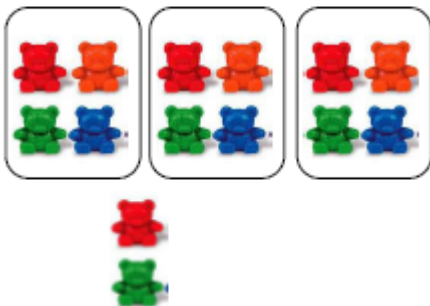


Division as grouping

Concrete	Pictorial	Abstract
<p>Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.</p>  <p>$96 \div 3 = 32$</p> 	<p>Use a number line to show jumps in groups. The number of jumps equals the number of groups.</p>  <p>Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.</p> 	<p>$28 \div 7 = 4$</p> <p>Divide 28 into 7 groups. How many are in each group?</p>

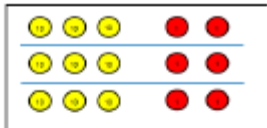

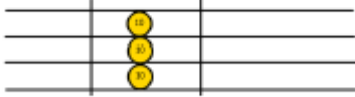
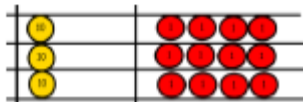
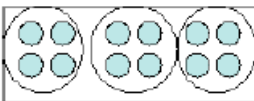
Division within arrays

Concrete	Pictorial	Abstract
 <p>Link division to multiplication by creating an array and thinking about the number sentences that can be created.</p> <p>Eg $15 \div 3 = 5$ $5 \times 3 = 15$ $15 \div 5 = 3$ $3 \times 5 = 15$</p>	 <p>Draw an array and use lines to split the array into groups to make multiplication and division sentences.</p>	<p>Find the inverse of multiplication and division sentences by creating four linking number sentences.</p> <p>$7 \times 4 = 28$ $4 \times 7 = 28$ $28 \div 7 = 4$ $28 \div 4 = 7$</p>

Division with a remainder

Concrete	Pictorial	Abstract
<p>$14 \div 3 =$ Divide objects between groups and see how much is left over</p> 	<p>Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.</p>  <p>Draw dots and group them to divide an amount and clearly show a remainder.</p> 	<p>Complete written divisions and show the remainder using r.</p> $29 \div 8 = 3 \text{ REMAINDER } 5$ <p>↑ ↑ ↑ ↑ dividend divisor quotient remainder</p>

Short division

Concrete	Pictorial	Abstract
<p>Tens Units 3 2</p>  <p>Use place value counters to divide using the bus stop method alongside</p>  <p>$42 \div 3 =$ Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.</p>  <p>We exchange this ten for ten ones and then share the ones equally among the groups.</p>  <p>We look how much in 1 group so the answer is 14.</p>	<p>Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.</p>  <p>Encourage them to move towards counting in multiples to divide more efficiently.</p>	<p>Begin with divisions that divide equally with no remainder.</p> $\begin{array}{r} 218 \\ 3 \overline{) 654} \end{array}$ <p>Move onto divisions with a remainder.</p> $\begin{array}{r} 86 \text{ r } 2 \\ 3 \overline{) 258} \end{array}$ <p>If appropriate children should write remainders as a fraction eg $86 \frac{2}{5}$</p> <p>Finally move into decimal places to divide the total accurately.</p> $\begin{array}{r} 14.6 \\ 35 \overline{) 511.0} \end{array}$



Long division

Concrete	Pictorial	Abstract
<p>Model</p> <p>2544 ÷ 12 How many groups of 12 thousands do we have? None</p> <p>Exchange 2 thousand for 20 hundreds.</p> <p>Model</p> <p>How many groups of 12 are in 25 hundreds? 2 groups. Circle them. We have grouped 24 hundreds so can take them off and we are left with one.</p> <p>Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2</p> <p>Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2</p>	<p>Instead of using physical counters, students can draw the counters and circle the groups on a whiteboard or in their books.</p> <p>Use this method to explain what is happening and as soon as they have understood what move on to the abstract method as this can be a time consuming process.</p>	<p>0 3 1 8 r 5</p> <p>Write the answer as a fraction if appropriate.</p> <p>Finally move into dividing decimals.</p>