



# *Calculation Policy / Teaching for Maths Mastery – Multiplication*

*This policy has been largely adapted from the White Rose Maths Hub Calculation Policy with further materials added.*

*It is a working document and will be revised and amended as necessary.*

## **Multiplicative Reasoning**

*Multiplicative reasoning is essentially a recognition and use of grouping in the underlying pattern and structure of our number system.*

*In the national curriculum, various topics need an understanding of multiplicative reasoning, for example, multiplication, division, scaling, area, ratio and proportion.*

*The foundations for thinking multiplicatively are embedded in outcomes in Foundation.*

### **Unitising**

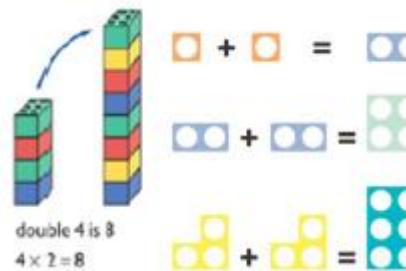

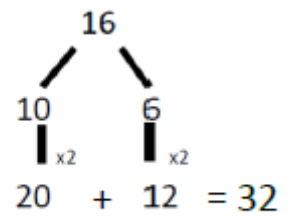

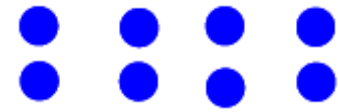
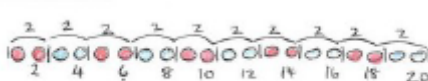
*In order to reason multiplicatively, children need to be able to ‘unitise’ (treat a group as a single entity). I need 30 balloons. If there are 5 balloons in a pack how many packs do I need?*



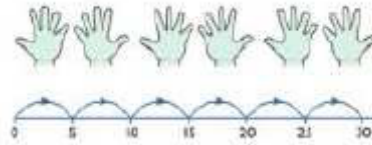
### **What is a unit?**

- *One to one correspondence – where each item (unit) has a value of 1*
- *Many to one correspondence, where one unit has a value of more than one*
- *One to many correspondence where each unit has a value less than one*
- *Each unit has the same value, but that value needs to be defined.*

# F2/ Y1 MULTIPLY IT!

Objectives and strategies	Concrete <i><b>BUILD IT/ USE IT!</b></i>	Pictorial <i><b>DRAW IT!</b></i>	Abstract <i><b>SOLVE IT!</b></i>
<p><i>Doubling</i></p>	<p>Use practical activities to show how to double a number. Use manipulatives including numicon and cubes.</p>  <p>double 4 is 8 <math>4 \times 2 = 8</math></p>	<p>Draw pictures to show how to double a number.</p> <p style="text-align: center;">Double 4 is 8</p> 	<p>Partition a number and then double each part before recombining it back together.</p>  <p style="text-align: center;"><math>20 + 12 = 32</math></p>
<p><i>Counting in multiples</i></p>	<p>Count in multiples supported by concrete objects in equal groups.</p> 	 <p>Children make representations to show 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, 25, 20, 25, 30</p>

Use a number line or pictures to continue support in counting in multiples.




Making equal groups and counting the total.

Use manipulatives to create equal groups.

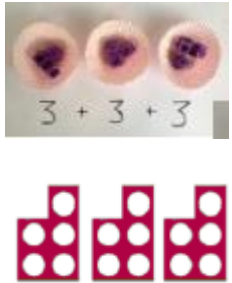
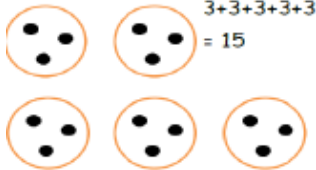
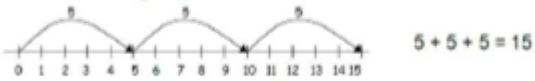


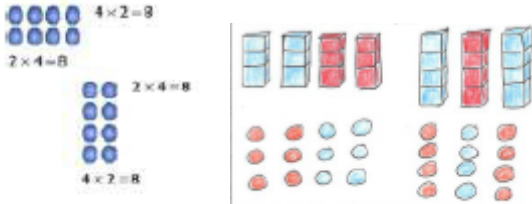




Draw and make representations

Draw  to show  $2 \times 3 = 6$

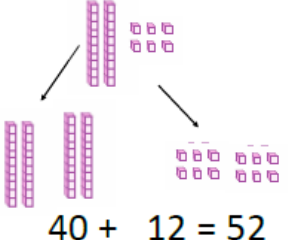
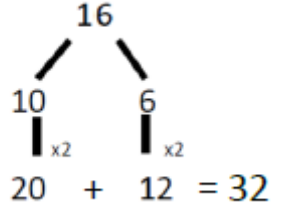
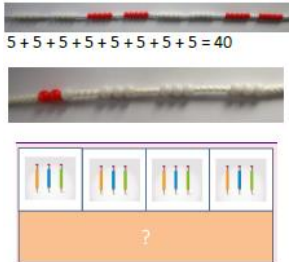
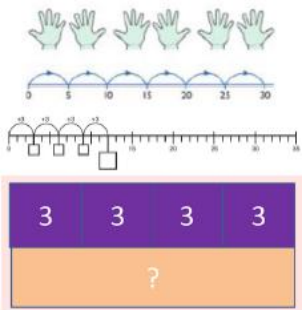
$$4 \times 2 = 8$$

# Y1 MULTIPLY IT!

Objectives and strategies	Concrete <i>BUILD IT/ USE IT!</i>	Pictorial <i>DRAW IT!</i>	Abstract <i>SOLVE IT!</i>
Repeated addition	<p>Use different objects to add equal groups.</p> 	<p>Use pictorial including number lines to solve problems.</p> <p>There are 3 sweets in one bag. How many sweets are in 5 bags altogether?</p>  	<p>Write addition sentences to describe objects.</p> 
Understanding arrays	<p>Create arrays using counters/cubes to show multiplication sentences.</p> 	<p>Draw representations of arrays to show understanding.</p> 	<p><math>3 \times 2 = 6</math></p> <p><math>2 \times 5 = 10</math></p>

	 		
--	---	--	--

# Y2 MULTIPLY IT!

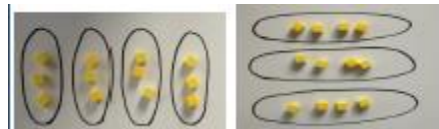
Objectives and strategies	Concrete <b>BUILD IT/ USE IT!</b>	Pictorial <b>DRAW IT!</b>	Abstract <b>SOLVE IT!</b>
Doubling	<p>Model doubling using dienes and place value counters.</p>  <p><math>40 + 12 = 52</math></p>	<p>Draw pictures and representations to show how to double numbers.</p>	<p>Partition a number and then double each part before recombining it back together.</p>  <p><math>20 + 12 = 32</math></p>
<p>Counting in multiples of 2, 3, 4, 5 and 10 from 0.</p> <p>(repeated addition)</p>	<p>Count the groups as children are skip counting, children may use their fingers as they are skip counting.</p> <p>Use bar models.</p>  <p><math>5 + 5 + 5 + 5 + 5 + 5 + 5 = 40</math></p>	<p>Number lines, counting sticks and bar models should be used to show representation of counting in multiples.</p> 	<p>Count in multiples of a number aloud.</p> <p>Write sequences with multiples of numbers.</p> <p>0, 2, 4, 6, 8, 10 0, 3, 6, 9, 12, 15 0, 5, 10, 15, 20, 25, 30</p> <p><math>4 \times 3 = \square</math></p>

Multiplication is commutative

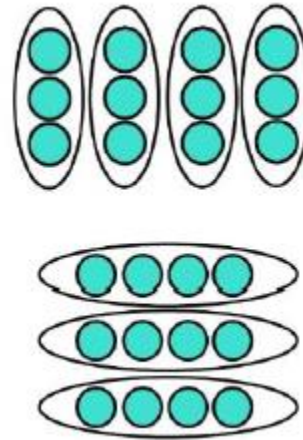
Create arrays using counters, cubes and numicon.



Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of multiplication does not affect the answer.



Use representations of arrays to show different calculations and explore commutativity.



Use an array to write multiplication sentences and reinforce repeated addition.

$$12 = 3 \times 4$$

$$12 = 4 \times 3$$



$$5 + 5 + 5 = 15$$

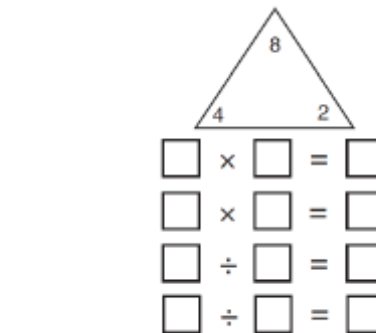
$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

$$3 \times 5 = 15$$

Using the Inverse

This should be taught alongside division, so pupils learn how they work alongside each other.



$$2 \times 4 = 8$$

$$4 \times 2 = 8$$

$$8 \div 2 = 4$$

$$8 \div 4 = 2$$

$$8 = 2 \times 4$$

$$8 = 4 \times 2$$

$$2 = 8 \div 4$$

$$4 = 8 \div 2$$

Show all 8 related fact family sentences.



# Y3 MULTIPLY IT!

**Objectives and strategies**

**Concrete**

**BUILD IT/ USE IT!**

**Pictorial**

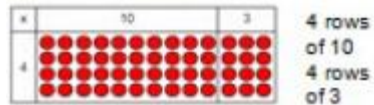
**DRAW IT!**

**Abstract**

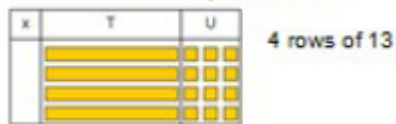
**SOLVE IT!**

**Grid Method**

Show the links with arrays to first introduce the grid method.



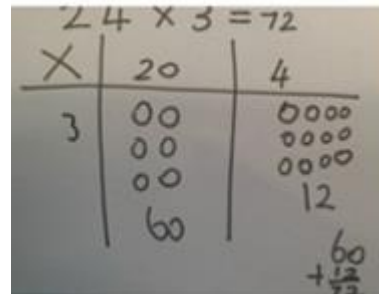
Move onto base ten to move onwards a more compact method.



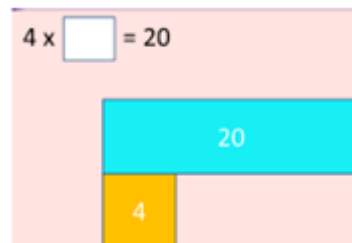
Move onto place value counters to show how we are finding groups of a number.

We are multiplying by 4 so we need 4 rows.

Children can represent their work with place value counters in a way that they understand. They can draw counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.



Bar models are used to explore missing numbers



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

x	30	5
7	210	35

$$210 + 35 = 245$$

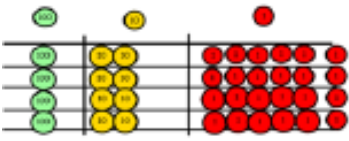
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

	10	8
10	100	80
3	30	24



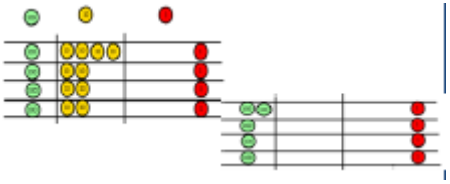
Calculations  
4 x 126

Fill each row with 126



Calculations  
4 x 126

Add up each column, starting with the ones. Making an exchanges needed.



# Y4 MULTIPLY IT!

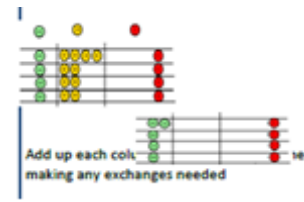
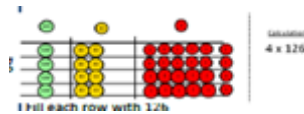
## Objectives and strategies

Grid method recap from year 3 for 2 digits x 1 digit  
Move to multiplying 3 digit numbers by 1 digit. (year 4 expectation)

## Concrete

### BUILD IT/ USE IT!

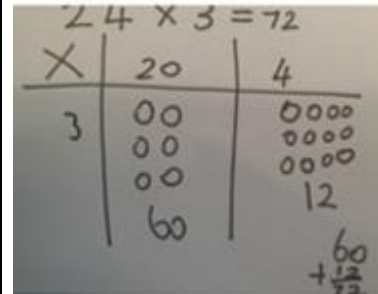
Use place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need rows of 4.



## Pictorial

### DRAW IT!

Children can represent their work with place value counters in a way that they understand. They can draw counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.



## Abstract

### SOLVE IT!

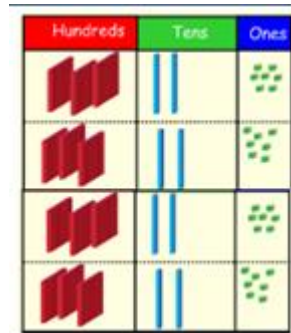
Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

X	30	5
7	210	35

$$210 + 35 = 245$$

Column multiplication for 3 and 4 digits x 1 digit.

It is important at this stage that they always multiply by ones first.



Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping.  $321 \times 2 = 642$

x	300	20	7
4	1200	80	28



$$\begin{array}{r}
 327 \\
 \times 4 \\
 \hline
 28 \\
 80 \\
 1200 \\
 \hline
 1308
 \end{array}$$

$$\begin{array}{r}
 327 \\
 \times \quad 4 \\
 \hline
 1308 \\
 \begin{array}{l}
 \phantom{1} \phantom{3} \phantom{0} \phantom{8} \\
 \phantom{1} \phantom{3} \phantom{0} \phantom{8} \\
 \phantom{1} \phantom{3} \phantom{0} \phantom{8} \\
 \phantom{1} \phantom{3} \phantom{0} \phantom{8}
 \end{array}
 \end{array}$$

This will lead to a compact method.

# Y5/6 MULTIPLY IT!

**Objectives and strategies**

**Concrete**

**BUILD IT/ USE IT!**

**Pictorial**

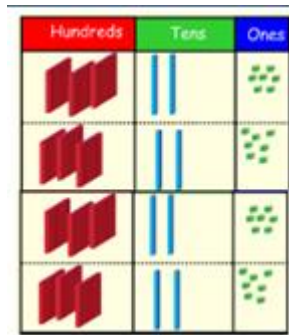
**DRAW IT!**

**Abstract**

**SOLVE IT!**

Column multiplication for 3 and 4 digits x 1 digit.

It is important at this stage that they always multiply by ones first.



Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping.  $321 \times 2 = 642$

x	300	20	7
4	1200	80	28



$$\begin{array}{r}
 327 \\
 \times 4 \\
 \hline
 28 \\
 80 \\
 1200 \\
 \hline
 1308
 \end{array}$$

$$\begin{array}{r}
 327 \\
 \times 4 \\
 \hline
 1308 \\
 \hline
 \end{array}$$

This will lead to a compact method.

Column multiplication

Manipulatives may still be used with the corresponding long multiplication modelled alongside.

		10	8
10	100	80	
3	30	24	

		1	8
x		1	3
		5	4
		2	
	1	8	0
	2	3	4

18 x 3 on the first row  
(8 x 3 = 24, carrying the 2 for 20, then 1 x 3)

18 x 10 on the 2nd row. Show multiplying by 10 by putting zero in units first

$$\begin{array}{r}
 1234 \\
 \times 6 \\
 \hline
 7404 \quad (1234 \times 6) \\
 12340 \quad (1234 \times 10) \\
 \hline
 19744
 \end{array}$$

Multiplying decimals up to 2 decimal places by a single digit.

Remind children that the single digit belongs in the ones column. Line up the decimal points in the question and the answer.

$$\begin{array}{r} 3.19 \\ \times 8 \\ \hline 25.52 \end{array}$$

# Y1 DIVIDE IT!

**Objectives and strategies**

**Concrete**

**BUILD IT/ USE IT!**

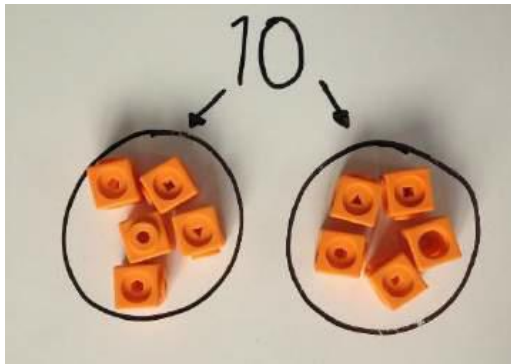
**Pictorial**

**DRAW IT!**

**Abstract**

**SOLVE IT!**

Division as sharing



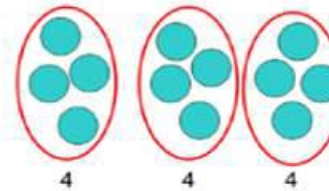
I have 10 cubes, can you share them equally in 2 groups?

Children use pictures or shapes to share quantities.



$$8 \div 2 = 4$$

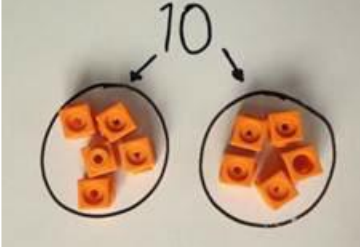

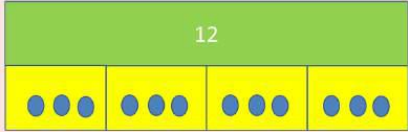
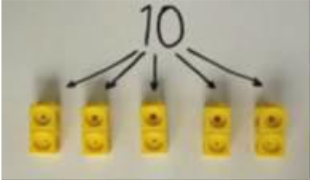
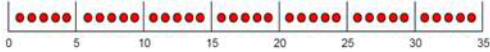
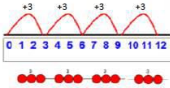
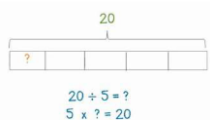
Sharing:



12 shared between 3 is 4


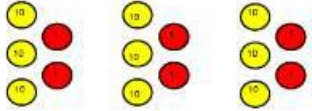

12 shared between 3 is  
4

# Y2 DIVIDE IT!

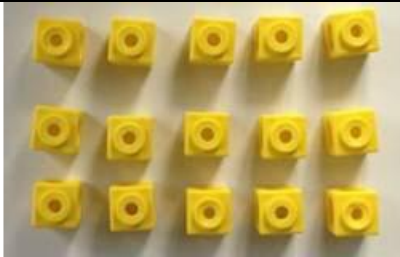
Objectives and strategies	Concrete <i>BUILD IT/ USE IT!</i>	Pictorial <i>DRAW IT!</i>	Abstract <i>SOLVE IT!</i>
<p>Division as sharing</p>	 <p>I have 10 cubes, can you share them equally in 2 groups?</p>	<p>Children use pictures or shapes to share quantities.</p>  <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <math>8 \div 2 = 4</math> </div> <p>Children use bar modelling to show and support understanding.</p>  <p style="text-align: center;"><math>12 \div 4 = 3</math></p>	<p style="text-align: center;"><math>12 \div 3 = 4</math></p>
<p>Division as grouping</p>	<p>Divide quantities into equal groups.</p> <p>Use cubes, counters, objects or place value counters to aid understanding.</p>  	<p>Use number lines for grouping</p>  <p style="text-align: center;"><math>12 \div 3 = 4</math></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 style="text-align: center;"> <math>20 \div 5 = ?</math>  <math>5 \times ? = 20</math> </p>	<p><math>28 \div 7 = 4</math></p> <p>Divide 28 into 7 groups.</p> <p>How many are in each group?</p>



# Y3 DIVIDE IT!

Objectives and strategies	Concrete <i>BUILD IT/ USE IT!</i>	Pictorial <i>DRAW IT!</i>	Abstract <i>SOLVE IT!</i>
Division as grouping	<p>Use cubes, counters, objects or place value counters to aid understanding.</p>  <p>24 divided into groups of 6 = 4</p> $96 \div 3 = 32$ 	<p>Continue to use bar modelling to aid solving division problems.</p>  $20 \div 5 = ?$ $5 \times ? = 20$	<p>How many groups of 6 in 24?</p> $24 \div 6 = 4$

Division with arrays

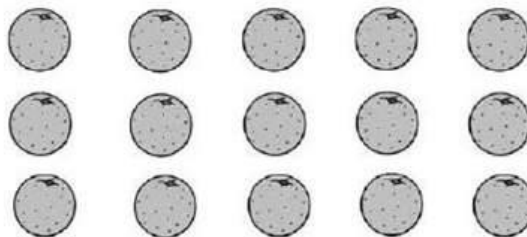


Link division to multiplication by creating an array and thinking about the number sentences that can be created.

Eg  $15 \div 3 = 5$   $5 \times 3 = 15$

$15 \div 5 = 3$   $3 \times 5 = 15$

Draw an array and use lines to split the array into groups to make multiplication and division sentences



Find the inverse of multiplication and division sentences by creating eight linking number sentences.

- $7 \times 4 = 28$
- $4 \times 7 = 28$
- $28 \div 7 = 4$
- $28 \div 4 = 7$
- $28 = 7 \times 4$
- $28 = 4 \times 7$
- $4 = 28 \div 7$

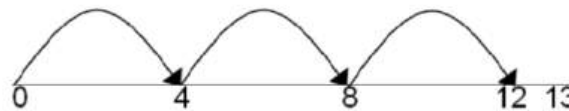
$7 = 28 \div 4$

Division with remainders.

$14 \div 3 =$   
Divide objects between groups and see how much is left over



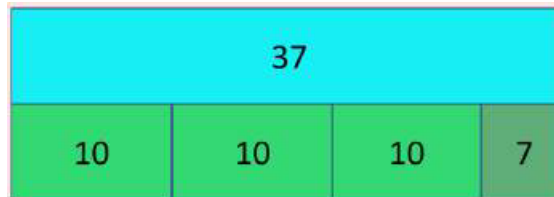
Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.



Draw dots and group them to divide an amount and clearly show a remainder.



Use bar models to show division with remainders.

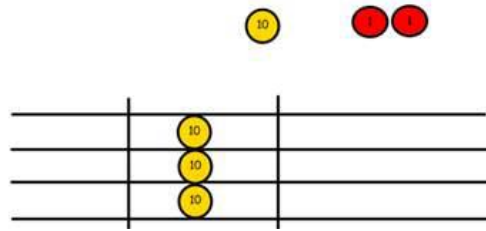


Complete written divisions and show the remainder using r.

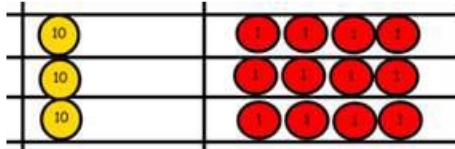
$28 \div 3 = 9 \text{ r}1$

# Y4 – Y6 DIVIDE IT!

<i>Objectives and strategies</i>	<i>Concrete</i>  <b style="color: red;">BUILD IT/ USE IT!</b>	<i>Pictorial</i>  <b style="color: red;">DRAW IT!</b>	<i>Abstract</i>  <b style="color: red;">SOLVE IT!</b>				
<p>Divide at least 3 digit numbers by 1 digit.</p> <p style="text-align: center;">Short Division</p>	<p><math>96 \div 3</math></p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 0 10px;">Tens</td> <td style="padding: 0 10px;">Units</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">2</td> </tr> </table> <div style="text-align: center; margin: 10px 0;"> </div> <p>Use place value counters to divide using the bus stop method alongside</p> <div style="display: flex; align-items: center; justify-content: center; margin: 10px 0;"> <div style="margin-left: 20px; border-left: 1px dashed black; padding-left: 5px;"> <p style="font-size: small;">Calculations</p> <p><math>42 \div 3</math></p> </div> </div> <div style="text-align: center; margin: 10px 0;"> </div> <p><math>42 \div 3 =</math></p> <p>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>	Tens	Units	3	2	<p>Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.</p> <div style="text-align: center; margin: 10px 0;"> </div> <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> <div style="text-align: center; margin: 10px 0;"> </div> <p>Move onto divisions with a remainder.</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>Finally move into decimal places to divide the total accurately.</p> <div style="text-align: center; margin: 10px 0;"> </div>
Tens	Units						
3	2						



We exchange this ten for ten ones and then share the ones equally among the groups.



We look how much in 1 group so the answer is 14.

$$\begin{array}{r}
 0663r5 \\
 8 \overline{) 5350^2 9} \\
 \hline
 \end{array}$$

# Y6 DIVIDE IT!

*Objectives and strategies*

*Concrete*

***BUILD IT/ USE IT!***

*Pictorial*

***DRAW IT!***

*Abstract*

***SOLVE IT!***

Long Division

Step 1—a remainder in the ones

$$\begin{array}{r} \text{h t o} \\ 041 \text{ R}1 \\ \hline 4 \overline{) 165} \end{array}$$

4 does not go into 1 (hundred). So combine the 1 hundred with the 6 tens (160).

4 goes into 16 four times.

4 goes into 5 once, leaving a remainder of 1.

$$\begin{array}{r} \text{th h t o} \\ 0400 \text{ R}7 \\ \hline 8 \overline{) 3207} \end{array}$$

8 does not go into 3 of the thousands. So combine the 3 thousands with the 2 hundreds (3,200).

8 goes into 32 four times ( $3,200 \div 8 = 400$ )

8 goes into 0 zero times (tens).

8 goes into 7 zero times, and leaves a remainder of 7.

$$\begin{array}{r}
 \text{h t o} \\
 061 \\
 \hline
 4 \overline{) 247} \\
 \underline{-4} \\
 3
 \end{array}$$

When dividing the ones, 4 goes into 7 one time. Multiply  $1 \times 4 = 4$ , write that four under the 7, and subtract. This finds us the remainder of 3.

Check:  $4 \times 61 + 3 = 247$

$$\begin{array}{r}
 \text{th h t o} \\
 0402 \\
 \hline
 4 \overline{) 1609} \\
 \underline{-8} \\
 1
 \end{array}$$

When dividing the ones, 4 goes into 9 two times. Multiply  $2 \times 4 = 8$ , write that eight under the 9, and subtract. This finds us the remainder of 1.

Check:  $4 \times 402 + 1 = 1,609$

# Y6 DIVIDE IT!

*Objectives and strategies*

*Concrete*

**BUILD IT/ USE IT!**

*Pictorial*

**DRAW IT!**

*Abstract*

**SOLVE IT!**

Long Division

Step 2— a remainder in the tens

1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
$\begin{array}{r} \text{t o} \\ 2 \\ \hline 2 \overline{) 58} \end{array}$ <p>Two goes into 5 two times, or 5 tens <math>\div 2 = 2</math> whole tens -- but there is a remainder!</p>	$\begin{array}{r} \text{t o} \\ 2 \\ \hline 2 \overline{) 58} \\ -4 \\ \hline 1 \end{array}$ <p>To find it, multiply <math>2 \times 2 = 4</math>, write that 4 under the five, and subtract to find the remainder of 1 ten.</p>	$\begin{array}{r} \text{t o} \\ 29 \\ \hline 2 \overline{) 58} \\ -4 \downarrow \\ \hline 18 \end{array}$ <p>Next, drop down the 8 of the ones next to the leftover 1 ten. You combine the remainder ten with 8 ones, and get 18.</p>

1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
$\begin{array}{r} \text{t o} \\ 29 \\ \hline 2 \overline{) 58} \\ -4 \\ \hline 18 \end{array}$ <p>Divide 2 into 18. Place 9 into the quotient.</p>	$\begin{array}{r} \text{t o} \\ 29 \\ \hline 2 \overline{) 58} \\ -4 \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$ <p>Multiply <math>9 \times 2 = 18</math>, write that 18 under the 18, and subtract.</p>	$\begin{array}{r} \text{t o} \\ 29 \\ \hline 2 \overline{) 58} \\ -4 \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$ <p>The division is over since there are no more digits in the dividend. The quotient is 29.</p>

# Y6 DIVIDE IT!

*Objectives and strategies*

*Concrete*

**BUILD IT/ USE IT!**

*Pictorial*

**DRAW IT!**

*Abstract*

**SOLVE IT!**

Long Division

Step 2— a remainder in any of the place values

1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
$\begin{array}{r} \text{h t o} \\ 1 \\ 2 \overline{)278} \end{array}$	$\begin{array}{r} \text{h t o} \\ 1 \\ 2 \overline{)278} \\ -2 \\ \hline 0 \end{array}$	$\begin{array}{r} \text{h t o} \\ 18 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \end{array}$
Two goes into 2 one time, or 2 hundreds $\div 2 = 1$ hundred.	Multiply $1 \times 2 = 2$ , write that 2 under the two, and subtract to find the remainder of zero.	Next, drop down the 7 of the tens next to the zero.
Divide.	Multiply & subtract.	Drop down the next digit.
$\begin{array}{r} \text{h t o} \\ 13 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \end{array}$	$\begin{array}{r} \text{h t o} \\ 13 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \\ -6 \\ \hline 1 \end{array}$	$\begin{array}{r} \text{h t o} \\ 139 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \\ -6 \\ \hline 18 \end{array}$
Divide 2 into 7. Place 3 into the quotient.	Multiply $3 \times 2 = 6$ , write that 6 under the 7, and subtract to find the remainder of 1 ten.	Next, drop down the 8 of the ones next to the 1 leftover ten.
1. Divide.	2. Multiply & subtract.	3. Drop down the next digit.
$\begin{array}{r} \text{h t o} \\ 139 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \\ -6 \\ \hline 18 \end{array}$	$\begin{array}{r} \text{h t o} \\ 139 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \\ -6 \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$	$\begin{array}{r} \text{h t o} \\ 139 \\ 2 \overline{)278} \\ -2 \\ \hline 07 \\ -6 \\ \hline 18 \\ -18 \\ \hline 0 \end{array}$
Divide 2 into 18. Place 9 into the quotient.	Multiply $9 \times 2 = 18$ , write that 18 under the 18, and subtract to find the remainder of zero.	There are no more digits to drop down. The quotient is 139.



