

This policy has outlined both the mental and written methods that should be taught from Year 1 to Year 6. It has been written in line with the National Curriculum 2014 and outlines the Programme of Study from KS1 into the end of KS2. The document builds on the interconnections of mathematics and demonstrates progression for addition, subtraction, multiplication and division.

The policy outlines the mental strategies that children should be encouraged to use:

A mental strategy that they can always rely on, such as:

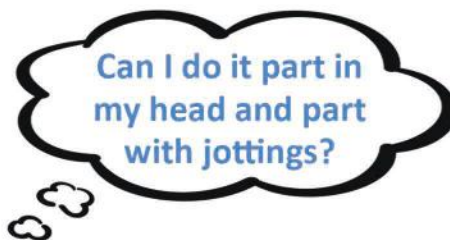
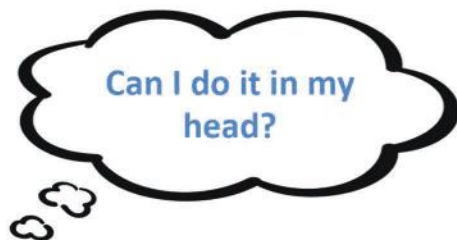
*Counting in tens and ones, forwards and backwards. For example:  $56 - 25$  (count back in 10s 56, 46, 36 and back in ones 36, 35, 34, 33, 32, 31)*

There are several strategies in place to help with working out calculations. Having children select a strategy they feel confident using can greatly help them form their own understanding about the numbers they are being asked to calculate, such as:

*46 - 24 (I can use near doubles to support my calculation. For example  $46 - 23 - 1$ )*

The policy outlines the written methods as suggested on the appendices of the Curriculum 2014 and suggests that children:

*Look at a calculation and are taught and encouraged to use the following thought process when deciding what approach they will take to a calculation. Pupils need to select the most appropriate method for the numbers involved.*



*Estimate, calculate and check to ensure that the answer they generate has some meaning.*

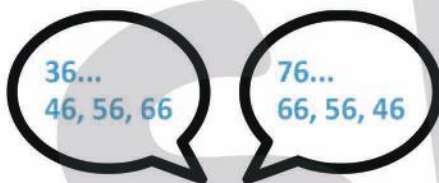
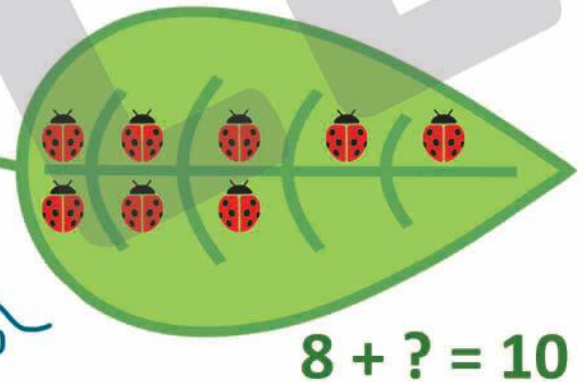
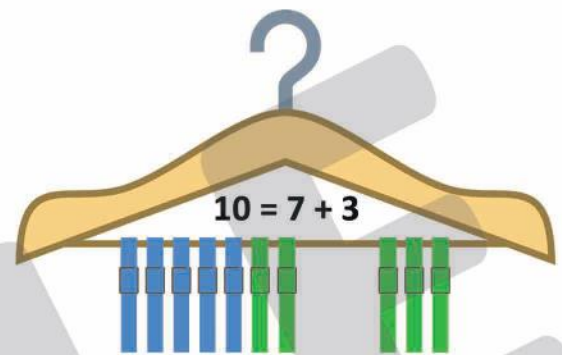
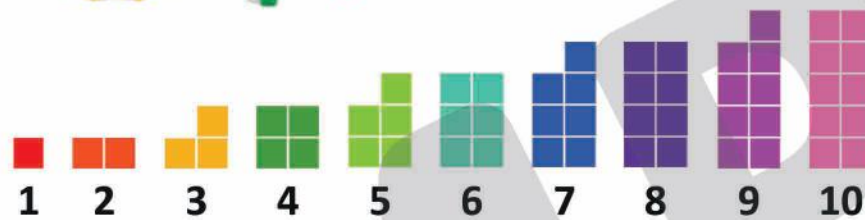
For the purpose of developing understanding there may be occasions when examples that can be completed mentally may be shown as a written method purely to develop understanding of the method. This needs to be made very clear to children and when they are practising the methods, appropriate calculations should be used.

There is also a section on calculating with fractions; the expectations from Year 1 - Year 6 and examples with the models and images that should be used in order to ensure children develop a conceptual understanding when calculating with fractions.

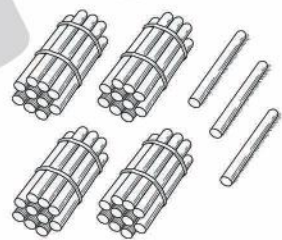


# Key representations to support conceptual understanding of addition and subtraction

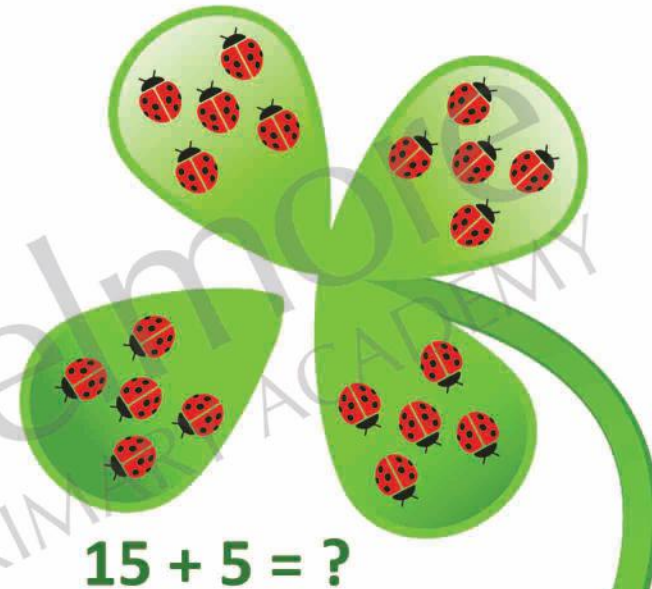
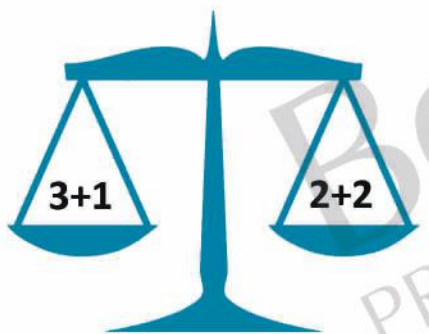
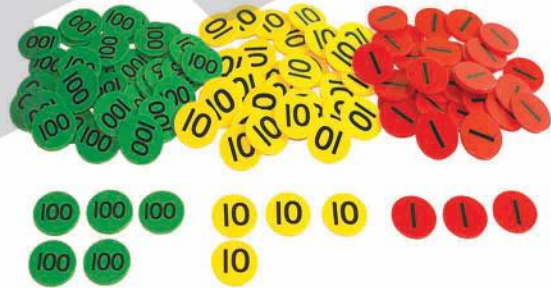
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



The difference between 11 and 14 is 3.  
 $14 - 11 = 3$   
 $11 + 3 = 14$



- $6 + 10 = 16$
- $16 + 10 = 26$
- $26 + 10 = 36$
- $36 + 10 = 46$
- $36 + 20 = 56$
- $96 - 10 = 86$
- $86 - 10 = 76$
- $76 - 10 = 66$
- $66 - 10 = 56$
- $76 - 30 = 46$



**Objectives**

Read, write and interpret

Mathematical statements

Involving addition (+), subtraction (-) and equals (=) signs

Represent and use number bonds and related subtraction facts within 20

Add and subtract one-digit and two-digit numbers to 20, including zero

**Recall of Facts**

$$\square + \square = \square$$

If we know  $4 + 5 = 9$

We also know:

$$5 + 4 = 9$$

$$9 - 5 = 4$$

$$9 - 4 = 5$$

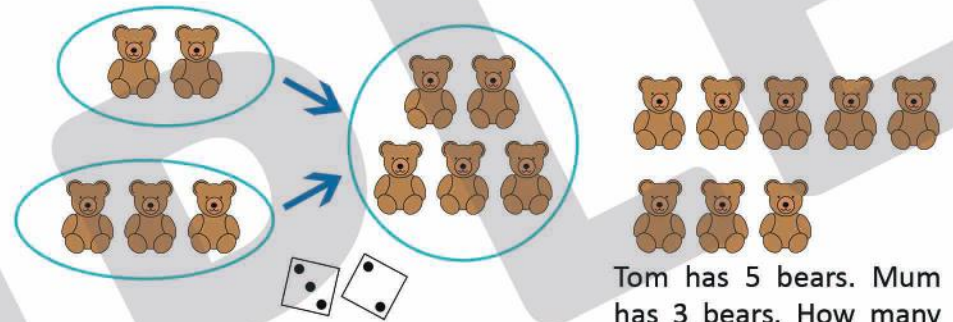
$$14 + 5 = 19$$

$$9 - 14 = 5$$

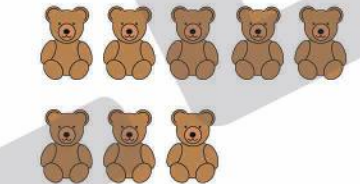
Work with all numbers up to 20

**Mental Jottings with representations**

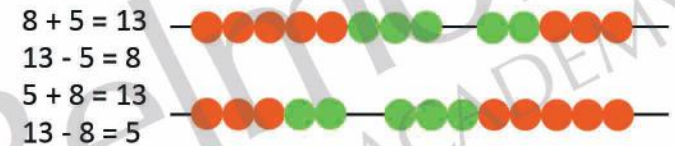
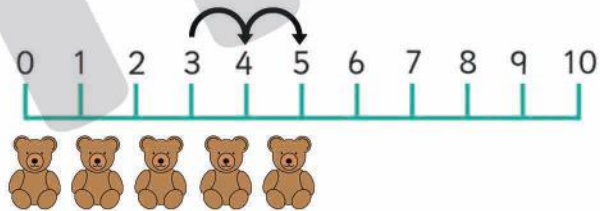
Immerse children in practical opportunities to develop understanding of addition and subtraction. Link practical representations on a number track on a bead string to recording on a number line. By the end of Year 1 children should be able to recall and use facts within and to 20.



2 bears and 3 bears is 5 bears altogether  
 $2 + 3 = 5$



Tom has 5 bears. Mum has 3 bears. How many more does Tom have?



Children need to be secure with **using** and **applying** these skills in unfamiliar contexts before moving into the Year 2 objectives.



**Objectives**

Show that addition of two numbers can be done in any order and subtraction cannot.

Recall and use addition and subtraction facts to 20 fluently and derive and use related facts up to 100.

Add and subtract numbers using concrete objects, pictorial presentations and mentally, including:

- 2 digit number and ones*
- 2 digit number and tens*
- Two 2 digit numbers*
- Add three 1 digit numbers*

Solve problems with addition and subtraction:

*Using concrete objects and pictorial representations, including those involving numbers, quantities and measures*

*Applying their increasing knowledge of mental and written methods*

**Mental Recall/Jottings:**

**Using known facts**

*If I know:*  
 $2 + 3 = 5$

*I also know:*  
 $3 + 2 = 5$   
 $20 + 30 = 50$   
 $30 + 20 = 50$   
 $50 - 30 = 20$   
 $50 - 20 = 30$

**Bridge through 10**

$26 + 7 = 26 + 4 + 3$   
 $26 + 4 = 30$   
 $30 + 3 = 33$

**Counting on/back in 10s**

$26 + 20 =$   
 $67 - 20 =$

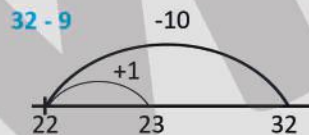
**Partitioning**

$23 + 34 =$   
 $46 - 25 =$

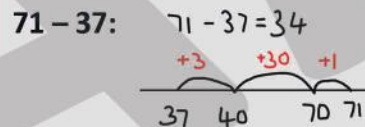
**Bonds to 10**

$2 + 7 + 8 = 8 + 2 + 7$

**Special Strategy - Rounding and Adjusting**



**Finding the difference between two numbers.**



**Partitioning numbers in different ways in preparation for subtracting using decomposition:**

$90 + 2$   
 $80 + 12$  (I have subtracted a ten and added it onto the ones)

Continue to record mental jottings as outlined in Year 2 with increasingly larger numbers.

Use suitable resources as required (See models and images page).

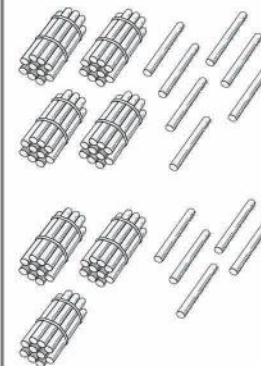
Children that have not achieved the age related expectations for Year 2 should not move onto formal written methods until they are secure

**Written Methods with representations**

Recording addition and subtraction in columns supports place value and prepares for formal written methods.

Tens	Ones
10	1
10	1
10	1
10	1
10	1
	1
	1
	1

$$\begin{array}{r} 20 + 3 \\ + 30 + 4 \\ \hline 50 + 7 \\ = 57 \end{array}$$



$$\begin{array}{r} 40 + 7 \\ 30 + 5 \\ \hline 70 + 12 = 82 \end{array}$$

Tens	Ones
10 10 10 10	1 1
10 10 10	10 1 1

Encourage children to recognise this can be completed mentally:

$42$	$40 + 2$	$30 + 12$	$42 - 15 = 27$
$-15$	$10 + 5$	$10 + 5$	
		<hr style="width: 50%; margin: 0 auto;"/>	
		$20 + 7$	

**Objectives**

Add and subtract numbers mentally

A 3 digit number and 1s

A 3 digit number and 10s

A 3 digit number and 100s

Add and subtract numbers with up to 3 digits using formal written methods of columnar addition and subtraction.

**Mental Recall/Jottings**

**Bridging to 10**

$$\begin{aligned} 425 + 8 &= 425 + 5 + 3 \\ &= 430 + 3 \\ &= 433 \end{aligned}$$

**Rounding and Adjusting**

$$\begin{aligned} 425 + 90 &= 425 + 100 - 10 \\ &= 525 - 10 \\ &= 515 \end{aligned}$$

$$\begin{aligned} 146 - 9 &= 146 - 10 + 1 \\ &= 136 + 1 \\ &= 137 \end{aligned}$$

$$\begin{aligned} 146 - 50 &= 146 - 40 - 10 \\ &= 106 - 10 \\ &= 96 \end{aligned}$$

Counting forwards or backwards in 100s

$$636 - 500 = 136$$

**Mental Jottings with representations**

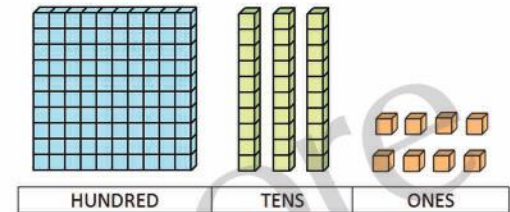
Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent.

Hundreds	Tens	Ones
100	10	1
100	10	1
	10	1
		1
		1
		1

$\begin{array}{r} 236 \\ + 73 \\ \hline 9 \\ 100 \\ 200 \\ \hline 309 \end{array}$	→	$\begin{array}{r} 236 \\ + 73 \\ \hline 309 \end{array}$
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$$187 - 64 = 123$$

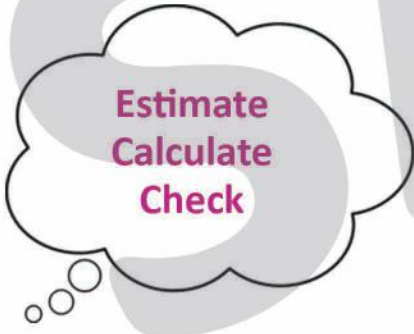
$$\begin{array}{r} 100 + 80 + 7 \\ 60 + 4 \\ \hline 100 + 20 + 3 \end{array}$$



Using my knowledge of partitioning in different ways.  $376 = 360 + 16$

H	T	O
100	10 10	1 1
100	10 10	1 1
100	10 10	1 1
		10

$$\begin{aligned} 376 - 168 \\ 360 + 16 \\ 160 + 8 \\ \hline 200 + 8 \end{aligned}$$





**Objectives**

Continue to secure and extend mental methods from previous year groups.

To select whether a calculation can be done mentally, with a jotting or using a formal written method.

Add and subtract numbers with up to 4 digits using formal written methods of column addition and subtraction where appropriate.

**Mental Recall/Jottings**

Develop confidence at calculating mentally with larger numbers.

**Using the full range of strategies:**

*Counting in 1s/10s*

*Bridging through multiples of 10  
Partitioning*

*Rounding and Adjusting*

*Reordering*

*Near Doubles*

*Bridging through 60 when calculating  
with time*

*Can I do it mentally?*

*Should I use a jotting?*

*Should I use a written method?*

**Written Methods**

Add and subtract numbers up to four digits.

$$\begin{array}{r} 3 \overset{8}{9} \overset{14}{5} \overset{12}{2} \\ - 1475 \\ \hline 2477 \end{array}$$

$$\begin{array}{r} 1765 \\ + 4388 \\ \hline 6153 \\ \hline 11 \end{array}$$

Revert to expanded methods if the children experience any difficulty.

**Use the written method with decimals in the context of money:**

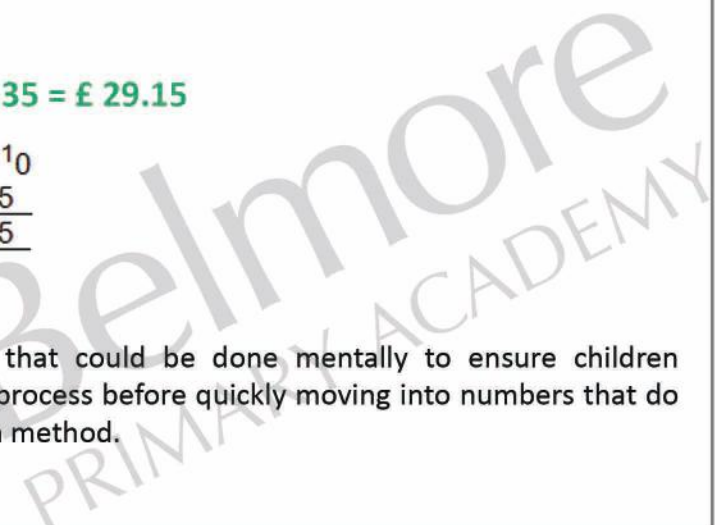
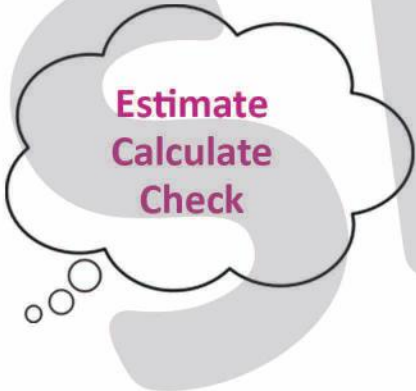
**£ 32.50 + £ 21.75 = £54.25**

$$\begin{array}{r} £32.50 \\ + £21.75 \\ \hline £54.25 \\ \hline 1 \end{array}$$

**£ 42.50 - £ 13.35 = £ 29.15**

$$\begin{array}{r} £ \overset{3}{4} \overset{12}{2} \overset{4}{5} \overset{10}{10} \\ - £ 13.35 \\ \hline £ 29.15 \end{array}$$

Using numbers that could be done mentally to ensure children understand the process before quickly moving into numbers that do require a written method.



**Objectives**

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction).

Add and subtract numbers mentally with increasingly larger numbers.

Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

**Mental Recall/Jottings**

12 462 - 2300

Use knowledge of place value to calculate mentally with increasingly larger numbers.

Employ a range of special strategies to develop confidence in calculating mentally. For example:

$$\begin{aligned} 2364 + 1999 &= \\ 2364 + 2000 &= 4364 \\ 4364 - 1 &= 4363 \end{aligned}$$

$$\begin{aligned} 13484 + 2400 &= \\ 13000 + 2000 &= 15000 \\ 484 + 400 &= 884 \\ 15000 + 884 &= 15884 \end{aligned}$$

$$4 = 2001 - 1997$$



$$\begin{aligned} 13486 - 5000 &= \\ 13486 - 3000 &= 10486 \\ 10486 - 2000 &= 8486 \end{aligned}$$

**Written Methods**

789 + 642 becomes

Estimate:

$$800 + 640 = 1440$$

$$\begin{array}{r} 789 \\ + 642 \\ \hline 1431 \\ \small{1 \quad 1} \end{array}$$

874 - 523 becomes

$$900 - 500 = 400$$

$$\begin{array}{r} 874 \\ - 523 \\ \hline 351 \end{array}$$

932 - 457 becomes

$$900 - 500 = 400$$

$$\begin{array}{r} 932 \\ - 457 \\ \hline 475 \\ \small{1 \quad 12 \quad 1} \end{array}$$

**Check:**

Is your estimate close to the answer you have calculated?

25.356 + 346.28 becomes:

Estimate:

$$25 + 350 = 375$$

$$\begin{array}{r} 25.356 \\ + 346.28 \\ \hline 371.636 \\ \small{1 \quad 1} \end{array}$$

9.076 - 3.142 becomes:

Estimate:

$$9 - 3 = 6$$

$$\begin{array}{r} 9.076 \\ - 3.142 \\ \hline 5.934 \\ \small{8 \quad 1} \end{array}$$

Estimate  
Calculate  
Check



### Objectives

Perform mental calculations, including with mixed operations and large numbers.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

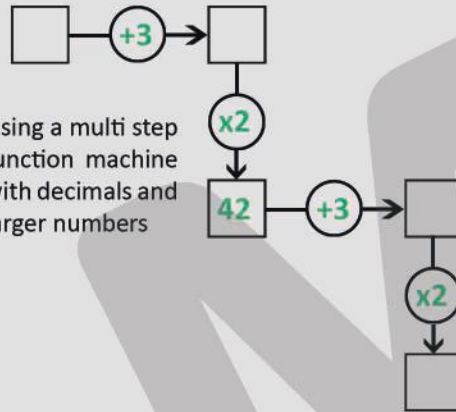
Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

### Mental Recall/Jottings

Ensure children use a wide range of mental strategies when calculating including decimals and increasingly larger numbers.

*What is 2 minus 0.005?*

*What is 5.7 added to 8.3?*



Using a multi step function machine with decimals and larger numbers

$57 + \square = 125$

$911 - 47 = \square$

$149 + 137 + 158 = \square$

$(\square + \square) \times \square = 10$

### Written Methods

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	tenths	hundredths	thousandths
M	HTh	TTh	Th	H	T	O	t	h	th

$12\ 462 + 8\ 456$

Estimate:

$21\ 000 = 12\ 500 + 8\ 500$

$$\begin{array}{r} 12\ 462 \\ + 8\ 456 \\ \hline 20\ 918 \\ \hline 11 \end{array}$$

$3\ 906 = 12\ 462 - 8\ 556$

Estimate:

$4\ 000 = 12\ 500 - 8\ 500$

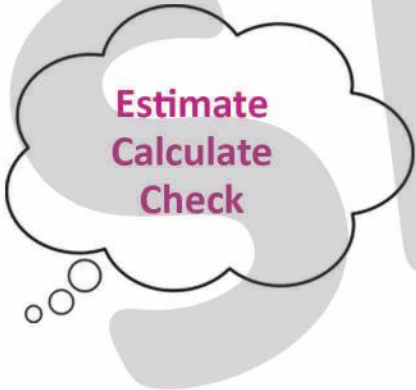
$$\begin{array}{r} \overset{11}{1} \overset{1}{2} \overset{5}{4} \overset{1}{6} \overset{1}{2} \\ - \quad \quad \quad 8\ 5\ 5\ 6 \\ \hline 3\ 9\ 0\ 6 \end{array}$$

Add and subtract numbers with a different number of decimal places.

$12.4 - 3.56 =$

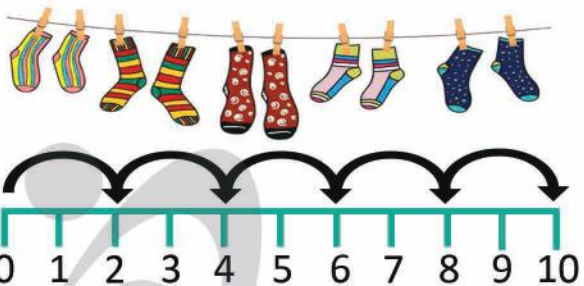
Estimate:  $12 - 4 = 8$  (my answer should be between 8 and 9)

$$\begin{array}{r} \overset{1}{1} \overset{13}{2} . \overset{1}{4} \overset{1}{0} \\ - \quad \quad \quad 3 . 5\ 6 \\ \hline 8 . 8\ 4 \end{array}$$

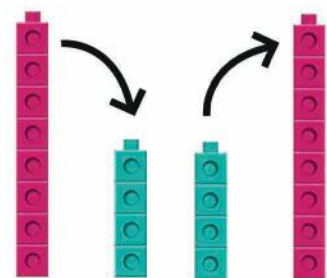




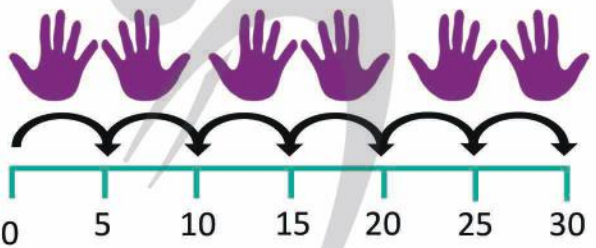
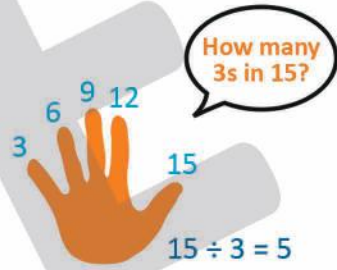
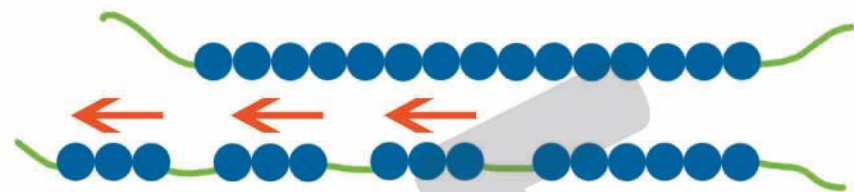
# Key representations to support conceptual understanding of multiplication and division



$2 + 2 + 2 + 2 + 2 = 10$   
 $2 \times 5 = 10$   
 2 multiply by 5  
 5 pairs  
 5 hops of 2



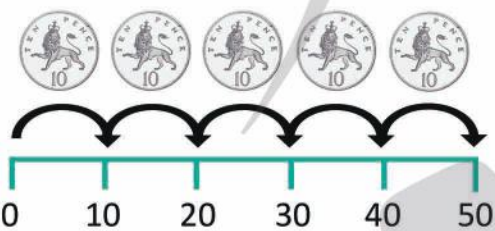
Half of 8 is 4  
 $4 \times 2 = 8$



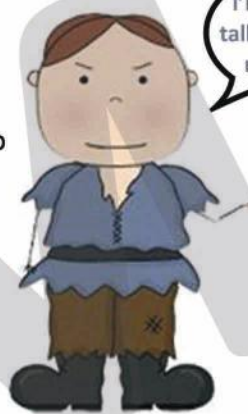
$5 + 5 + 5 + 5 + 5 + 5 = 30$   
 $5 \times 6 = 30$   
 5 multiply by 6  
 6 groups of 5  
 6 hops of 5



5 hops in 15. How big is each hop?  
 $15 \div 5 = 3$   
 15 shared between 5

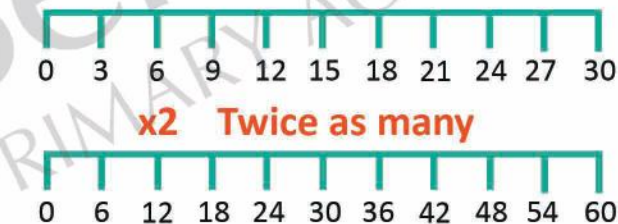
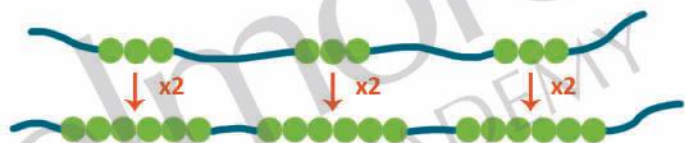
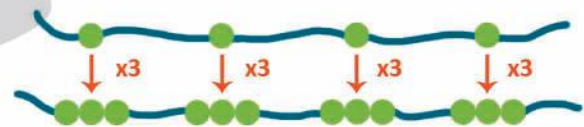
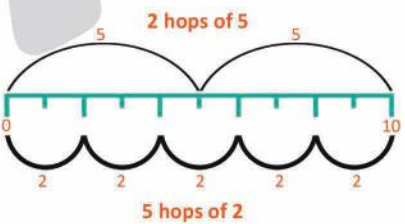
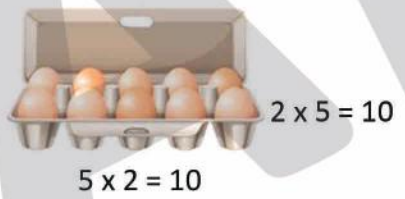
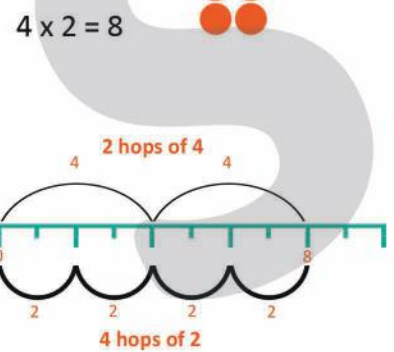
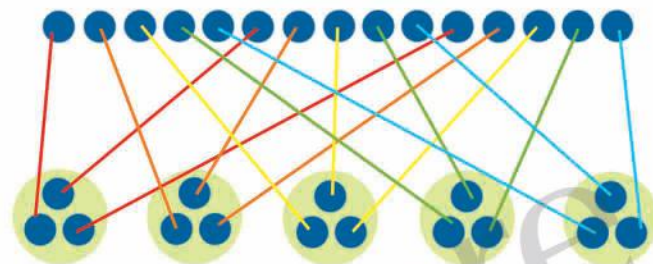


$10p + 10p + 10p + 10p + 10p = 50p$   
 $10p \times 5 = 50p$   
 5 hops of 10



I'm 3 times as tall as you. I'm 3 metres tall.

I'm only 1 metre tall.



**Objectives**

Count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens

Double numbers to 20

**Examples**

Use of visual models to support counting in 2, 5, 10

Ensure children begin to see the patterns of counting in 2, 5, 10

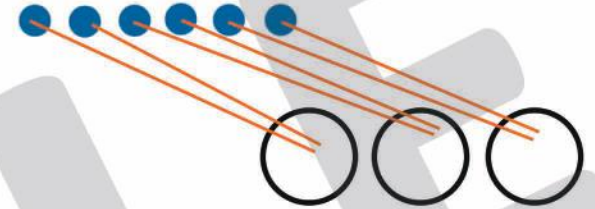
Double/halve numbers up to:

$$10 + 10 = 10 \times 2$$

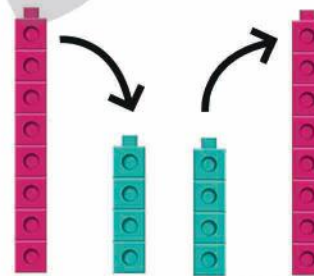
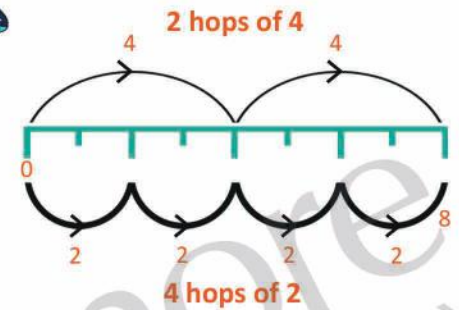
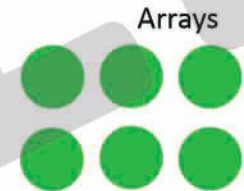
$$20 - 10 = 20 \div 2$$

**Models and Images**

Grouping and sharing



How many legs will 3 teddies have?



Half of 8 is 4  
 $4 \times 2 = 8$





**Objectives**

Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward (copied from Number and Place Value)

Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers

Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot

Written:  
Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication ( $\times$ ), division ( $\div$ ) and equals (=) signs

**Examples**

$2 \times 5 = 10$

$5 \times 2 = 10$

$10 \div 2 = 5$

$10 \div 5 = 2$

Use knowledge of doubling:

$2 \times 10 = 20$

$10 \times 2 = 20$

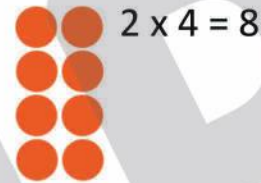
$20 \div 2 = 10$

$20 \div 10 = 2$

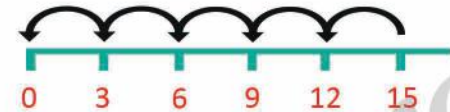
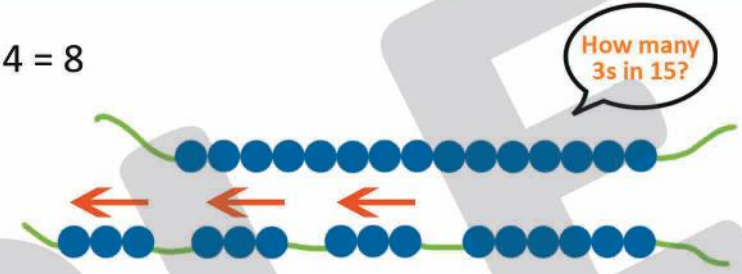
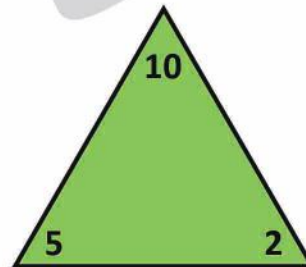
**Models and Images**



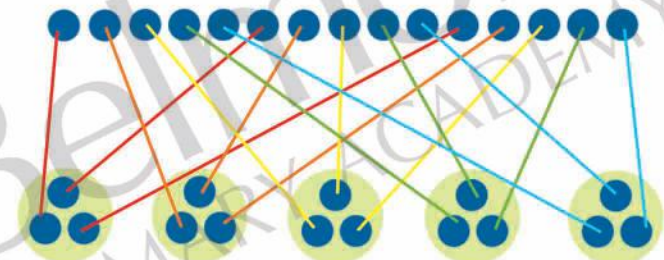
$4 \times 2 = 8$



$4 \times 2 = 8$



5 hops in 15. How big is each hop?  
 $15 \div 5 = 3$   
15 shared between 5



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

Objectives

Count from 0 in multiples of 4, 8, 50 and 100 (copied from Number and Place Value)

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables

Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods (appears also in Written Methods)

Mental Recall Examples

If the children know 2/5/10 facts they now need to learn:

3 x 3	4 x 4	6 x 8
4 x 3	6 x 4	7 x 8
6 x 3	7 x 4	8 x 8
7 x 3	8 x 4	9 x 8
8 x 3	9 x 4	11 x 8
9 x 3	11 x 4	12 x 8
11 x 3	12 x 4	
12 x 3		

With corresponding division facts. Recall facts along with counting in steps sizes.



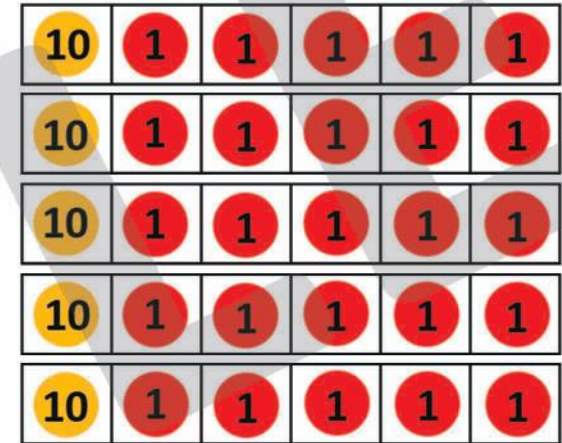
$4 \times 3 = 3 \times 4$   
 $12 \div 3 = 4$   
 $12 \div 4 = 3$

To make 6 fairy cakes you need...  
How much will you need for 12?

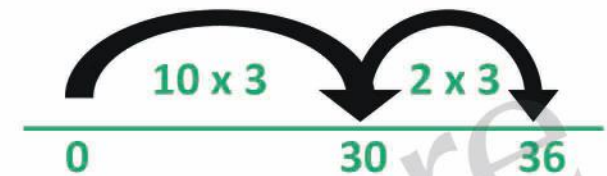
Progressing from Mental to Written Methods with representations

$$\begin{array}{r|l} \times & 10 & 5 \\ 5 & 50 & 25 \end{array}$$

$$\begin{array}{r} 15 \\ \times 5 \\ \hline 25 \\ + 50 \\ \hline 75 \end{array}$$



$36 \div 3 =$



$45 \div 3 = 15$

$$3 \overline{)45}$$



Short multiplication and division rely on mental methods – children should be given short multiplication and division involving 2/3/4/5/6/10 times tables



**Objectives**

Count in multiples of 6, 7, 9, 25 and 1000 (copied from Number and Place Value)

Recall multiplication and division facts for multiplication tables up to  $12 \times 12$

Use place value, known and derived facts to multiply and divide mentally, including:

*Multiplying by 0 and 1*

*Dividing by 1*

*Multiplying together three numbers*

Recognise and use factor pairs and commutativity in mental calculations (appears also in Properties of Numbers)

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout

**Mental Methods**

If the children know 2/5/10 facts they now need to learn:

- $6 \times 6$      $7 \times 7$      $9 \times 9$      $11 \times 11$
- $7 \times 6$      $9 \times 7$      $11 \times 9$      $12 \times 11$
- $9 \times 6$      $11 \times 7$      $12 \times 9$      $12 \times 12$
- $11 \times 6$      $12 \times 7$
- $12 \times 6$

Explore what happens when we divide by 1 and 0

To solve  $24 \times 3$

Use knowledge of factor pairs  
Because:

$24 = 8 \times 3 \rightarrow 24 \times 3 =$

or

$24 = 6 \times 4 \rightarrow 24 \times 4 =$

$6 \times 4 \times 3$

In measuring and scaling contexts, (for example, four times as high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?

12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children)

**Written Methods with representations**

Building on from Year 3, the grid method provides a link to the methods from the appendix of the National Curriculum:

$357 \times 6$   
Partition  
 $357 = 300 + 50 + 7$

<b>X</b>	<b>300</b>	<b>50</b>	<b>7</b>	
<b>6</b>	1800	300	42	<b>1800 + 300 + 42</b>

$357 \times 6 = 1800 + 300 + 42 = 2142$

**Short multiplication**

$24 \times 6$  becomes

$$\begin{array}{r} 24 \\ \times 6 \\ \hline 144 \\ 2 \end{array}$$

Answer: 144

$342 \times 7$  becomes

$$\begin{array}{r} 342 \\ \times 7 \\ \hline 2394 \\ 21 \end{array}$$

Answer: 2394

**Objectives**

Count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000

Multiply and divide numbers mentally drawing upon known facts

Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

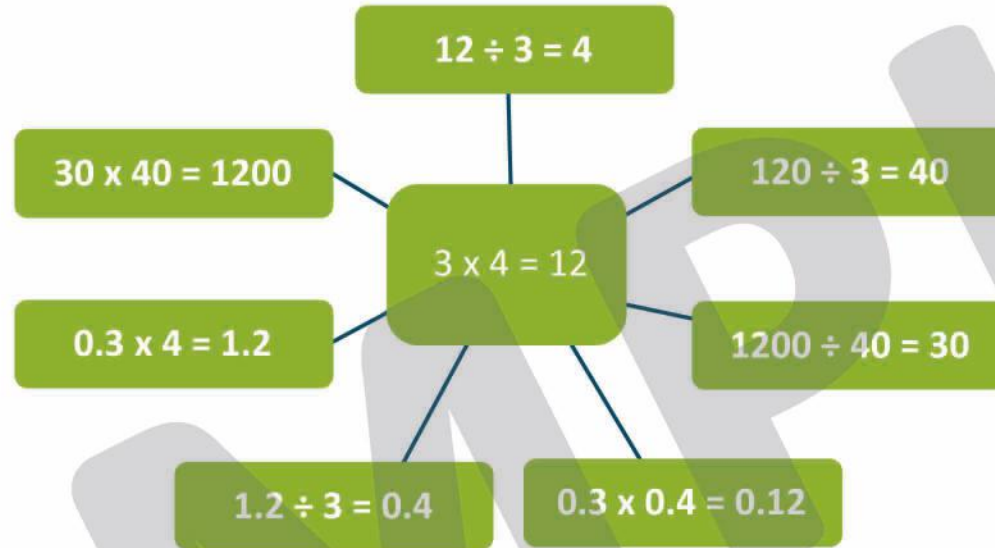
Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers

Establish whether a number up to 100 is prime and recall prime numbers up to 19

Recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)

**Mental Methods**

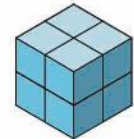


$1 \times 1 = 1^2$  (1 dot)  
 $2 \times 2 = 2^2$  (4 dots in a square)  
 $3 \times 3 = 3^2$  (9 dots in a square)

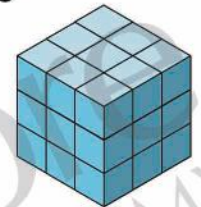
$1 \times 1 \times 1 = 1^3$



$2 \times 2 \times 2 = 2^3$



$3 \times 3 \times 3 = 3^3$



Multiplying and dividing whole numbers and decimals by 10, 100 and 1000

Place	Thousands	Hundreds	Tens	Ones	tenths	hundredths	thousandths
	Th	H	T	O	t	h	th
Place Value	1,000	100	10	1	1/10	1/100	1/1000



**Objectives**

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context

**Written Methods**

2307 x 8 =

Estimate: 2000 x 8 = 16000

Calculate: (Short multiplication)

$$\begin{array}{r} 2307 \\ \times \quad 8 \\ \hline 18456 \\ \hline \end{array}$$

1431 x 23 =

Estimate: 1431 x 20 = 28620

Calculate: (Long multiplication)

$$\begin{array}{r} \phantom{1}1431 \\ \times \quad 23 \\ \hline 4293 \\ 28620 \\ \hline 32913 \\ \hline \end{array}$$

Ensure children are able to express remainders either as remainder, fraction or decimal.

432 ÷ 5 =

**Estimate:** 400 ÷ 5 = 80

Calculate (short division)

432 ÷ 5 becomes

$$\begin{array}{r} 86 \text{ r}2 \\ 5 \overline{) 432} \end{array}$$

Answer: 86 remainder 2 or  $86\frac{2}{5}$  or 0.4

**Estimate:** 450 ÷ 15 = 30

Calculate: (Long division)

$$\begin{array}{r} 28 \text{ r}12 \\ 15 \overline{) 432} \\ \underline{300} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 12 remainder 12 or  $12\frac{12}{15} = 12\frac{4}{5}$  or 12.8

**Objectives**

Perform mental calculations, including with mixed operations and large numbers

Identify common factors, common multiples and prime numbers

Use their knowledge of the order of operations to carry out calculations involving the four operations

**Mental Methods**

They undertake mental calculations with increasingly large numbers and more complex calculations.

Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.

Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant figures.

Pupils explore the order of operations using brackets; for example,  $2 + 1 \times 3 = 5$  and  $(2 + 1) \times 3 = 9$ .

Common factors can be related to finding equivalent fractions.

Calculate  $900 \div 180$  using factors  $900 \div (90 \times 2) \rightarrow$

$$900 \div 90 = 10$$
$$10 \div 2 = 5$$
$$900 \div 180 = 5$$

A bag of four oranges costs thirty seven pence. How much do twelve oranges cost?



## Objectives

Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication

Divide numbers up to 4-digits by a two-digit whole number using the formal written method of short division where appropriate for the context divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context

## Written Methods

## Short division

$98 \div 7$  becomes

$$\begin{array}{r} 14 \\ 7 \overline{) 98} \end{array}$$

Answer: 14

$432 \div 5$  becomes

$$\begin{array}{r} 86 \text{ r}2 \\ 5 \overline{) 432} \end{array}$$

Answer: 86 remainder 2

$496 \div 11$  becomes

$$\begin{array}{r} 45 \text{ r}1 \\ 11 \overline{) 496} \end{array}$$

Answer:  $45 \frac{1}{11}$

## Long division

$432 \div 15$  becomes

$$\begin{array}{r} 28 \text{ r}12 \\ 15 \overline{) 432} \\ \underline{300} \\ 132 \\ \underline{120} \\ 12 \end{array}$$

Answer: 28 remainder 12

$432 \div 15$  becomes

$$\begin{array}{r} 28 \text{ r}12 \\ 15 \overline{) 432} \\ \underline{300} \quad 15 \times 20 \\ \underline{132} \\ \underline{120} \quad 15 \times 8 \\ 12 \end{array}$$

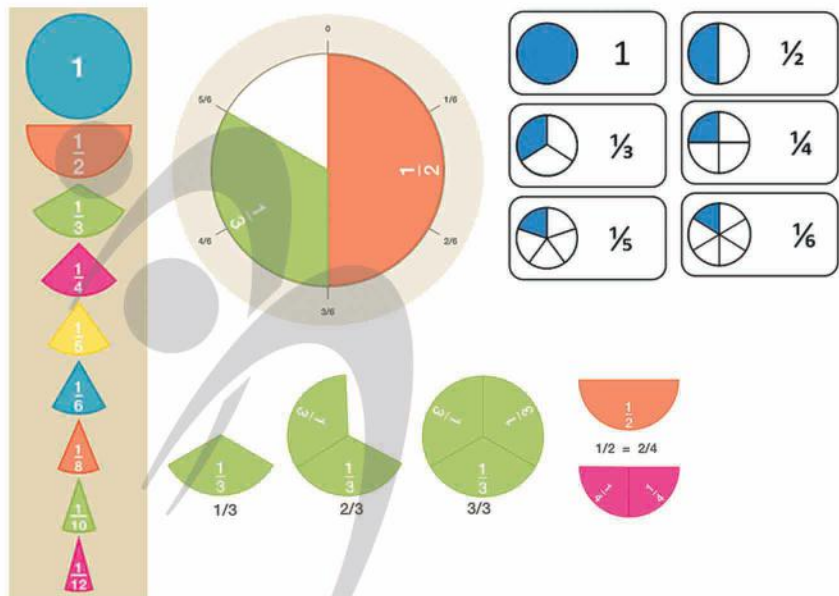
Answer:  $28 \frac{12}{15} = 28 \frac{4}{5}$

$432 \div 15$  becomes

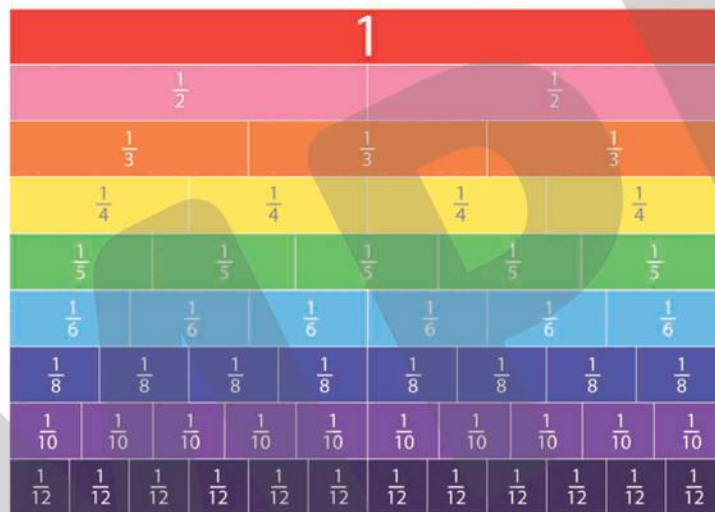
$$\begin{array}{r} 28.8 \\ 15 \overline{) 432.0} \\ \underline{30} \quad \downarrow \\ 132 \\ \underline{120} \quad \downarrow \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Answer: 28.8

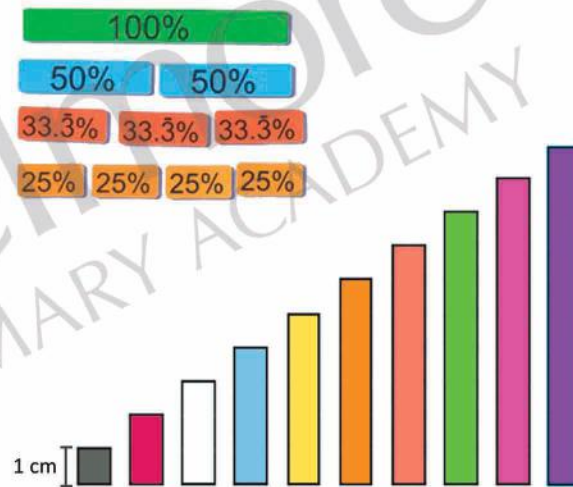
# Key representations to support conceptual understanding of Fractions/Decimals and Percentages



Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	tenths	hundredths	thousandths
M	HTh	TTh	Th	H	T	O	t	h	th



$\frac{1}{2} = 50\% = 0.5$





**Objectives**

Recognise, find and name a half as one of two equal parts of an object, shape or quantity

Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity

**Examples**

Children use their knowledge of fractions of shape to find fractions of quantities.

Children should be give practical apparatus to find halves and quarters of quantities within 20.

Record work pictorially.

**Models and Images**

1 whole



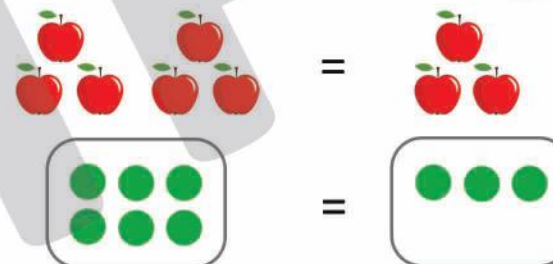
2 halves



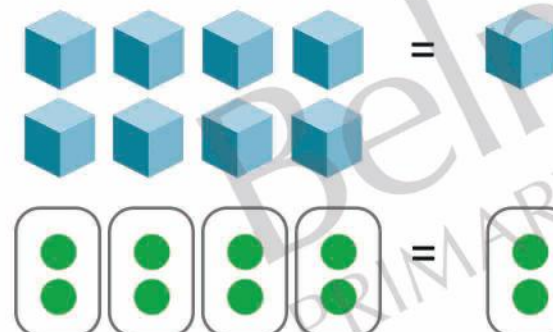
4 quarters



$\frac{1}{2}$  of 6 apples = 3 apples



$\frac{1}{4}$  of 8 cubes = 2 cubes



**Objectives**

Recognise, find, name and write fractions  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{2}{4}$ ,  $\frac{3}{4}$  and of a length, shape, set of objects or quantity

Write simple fractions for example,  $\frac{1}{2}$  of 6 = 3 and recognise the equivalence of  $\frac{2}{4}$  and  $\frac{1}{2}$

**Examples**

Children use their knowledge of unit and non-unit fractions of shapes to find fractions of quantities.

They relate this to find fractions of a length e.g.  $\frac{2}{4}$  of 1m =

Children need to relate finding a quarter to halving and halving again.

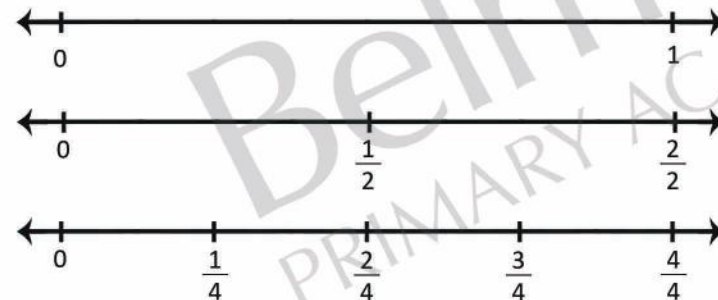
Pupils should count in fractions up to 10, starting from any number and using the  $\frac{1}{2}$  and  $\frac{2}{4}$  equivalence on the number line (Non Statutory Guidance)

**Models and Images**

If I can see  $\frac{1}{4}$  how many quarters can you see?



If I can see  $\frac{2}{3}$  how many thirds can you see?





## Objectives

Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one digit numbers or quantities by 10

Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators

Recognise and show, using diagrams, equivalent fractions with small denominators

## Examples

Encourage children to count up and down in tenths.

$$1 \div 10 = 1/10$$

$$2 \div 10 = 2/10$$

$$3 \div 10 = 3/10$$

Continue the pattern

*What do you notice?*

*What's the same?*

*What's different?*

Children can use fractions as an operator. For example:

$$1/4 \text{ of } 12 = 12 \div 4 = 3$$

Children can relate fractions to the division of integers

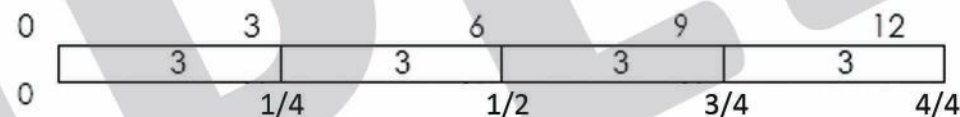
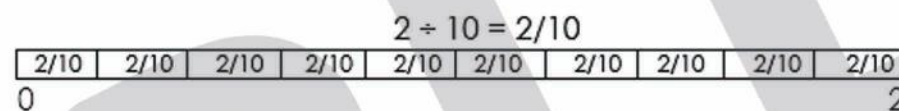
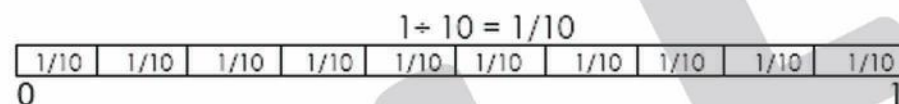
$$1 \div 4 = 1/4$$

$$4 \times 1/4 = 1$$

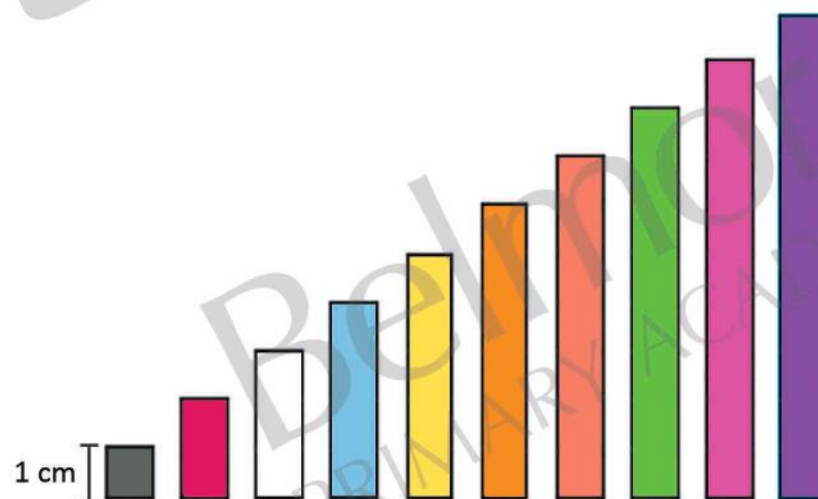
$$3 \div 4 = 3/4$$

$$3/4 \times 4 = 3 \text{ (} 12/4 \text{ or } 3/4 + 3/4 + 3/4 + 3/4 \text{)}$$

## Models and Images



Use Cuisenaire rods to develop vocabulary of equivalence



**Objectives**

Recognise and show, using diagrams, equivalent fractions with small denominators

Add and subtract fractions with the same denominator within one whole

Compare and order unit fractions, and fractions with the same denominators

**Examples**

Children need to relate and reason about why their diagrams are equivalent to a half - make connections between the numerator and the denominator.

For example:

$$\frac{1}{2} = \frac{4}{8}$$

The numerator will be half of the denominator.

Children should be encouraged to make the connection between their multiplication tables and equivalents. For example:

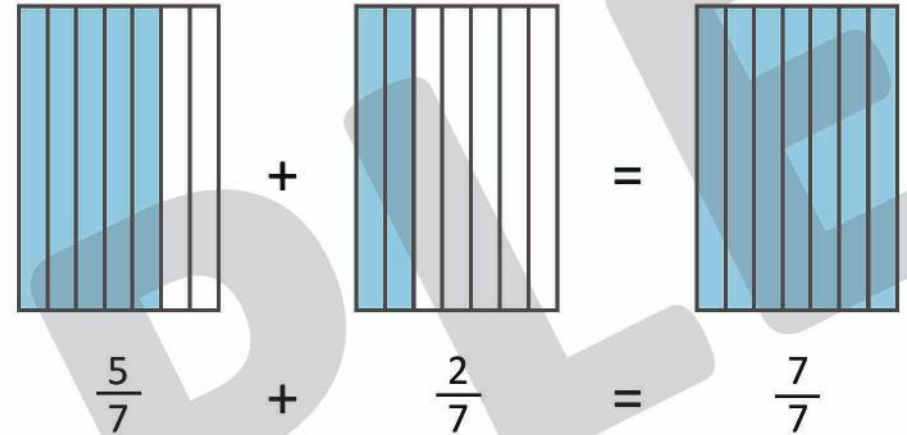
$$\frac{1}{3} = \frac{3}{9} \text{ because } 3 \times 3 = 9$$

Children need to use practical resources/visual representations to support the comparison of fractions. For example




$$\frac{1}{3} > \frac{1}{4}$$

Children should also be taught how to order fractions on a number line

**Models and Images**





Objectives	Examples	Models and Images
<p>Recognise and show using diagrams, families of common equivalent fractions</p> <p>Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by tenths</p> <p>Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number</p> <p>Add and subtract fractions with the same denominator</p> <p>Recognise and write decimal equivalents of any number of tenths or hundredths</p> <p>Recognise and write decimal equivalents to <math>\frac{1}{2}</math>, <math>\frac{1}{4}</math>, <math>\frac{3}{4}</math></p> <p>Find the effect of dividing a one or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths</p> <p>Round decimals with one decimal place to the nearest whole number</p> <p>Compare numbers with the same number of decimal places up to two decimal places</p> <p>Solve simple measure and money problems involving fractions and decimals to two decimal places</p>	<p><math>1 \div 100 = \frac{1}{100}</math>  <math>2 \div 100 = \frac{2}{100}</math></p> <p><math>\frac{3}{7}</math> of 56 = 24</p> <p><math>\frac{3}{10}</math> of 120 = 36</p> <p><math>\frac{1}{4} = 12</math>  <math>\frac{3}{4} = 36</math></p> <p><math>\frac{3}{10} + \frac{4}{10} = \frac{7}{10}</math></p> <p><math>\frac{9}{100} - \frac{7}{100} = \frac{2}{100}</math></p> <p>Children can record on a number line equivalents between <math>\frac{1}{10}</math> and 0.1</p> <p>Count on and back in tenths as decimals and relate to counting on/back in 10ths (fractions)</p> <p><math>25 \div 10 = 2.5</math></p> <p>2 ones and 5 tenths</p> <p><math>25 \div 100 = 0.25</math>          0 ones, 2 tenths and 5 hundredths or 25 hundredths</p>	<p>Recognise and show using diagrams, families of common equivalent fractions</p> <div style="text-align: center;">  <p><math>\frac{1}{2}</math>      <math>\frac{2}{4}</math>      <math>\frac{4}{8}</math></p> </div> <p>Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number</p> <p>Use a bar model to help you represent and find:</p> <p><math>\frac{1}{7}</math> of 56 = <math>56 \div 7</math></p> <div style="text-align: center;">  </div> <p>a. <math>\frac{2}{7}</math> of 56    b. <math>\frac{3}{7}</math> of 56    c. <math>\frac{4}{7}</math> of 56    d. <math>\frac{4}{7}</math> of 28</p> <div style="text-align: center;"> <p><math>\frac{3}{5} + \frac{4}{5} = 1\frac{2}{5}</math></p>  </div>

**Objectives**

Add and subtract fractions with the same denominator and denominators that are multiples of the same number.

Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.

**Examples**

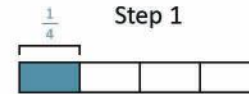
$5/6 - 2/6 = 3/6 = 1/2$

$1/3 + 5/9 = 8/9$

$5/6 \times 2 = 10/6 = 1 \frac{4}{6} = 1 \frac{2}{3}$

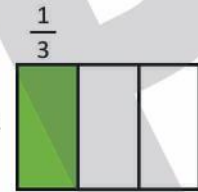
**Models and Images**

Add and subtract fractions with the same denominator and denominators that are multiples of the same number.

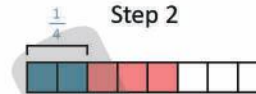


Draw the fraction with the smaller denominator. Shade the fraction.

$$\frac{1}{4} + \frac{3}{8} =$$

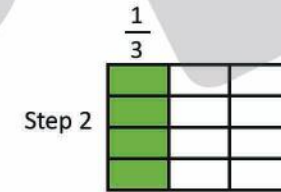


Step 1



Split the model to create the second denominator. Shade the other fraction.

$$\frac{1}{4} + \frac{3}{8} =$$

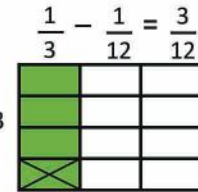


Step 2



Now the fractions have the same denominator, you can add the fractions.

$$\frac{2}{8} + \frac{3}{8} = \frac{2+3}{8} = \frac{5}{8}$$

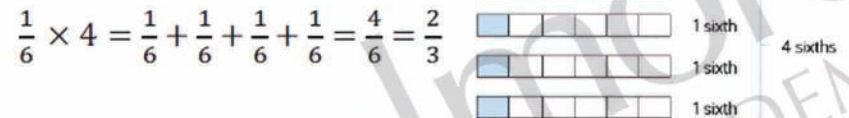


Step 3

Multiply proper fractions and mixed numbers by whole numbers supported by materials and diagrams.

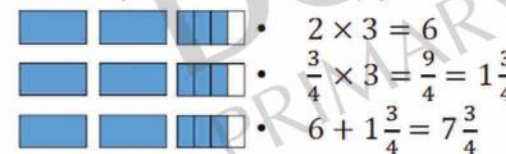
**PROPER FRACTIONS**

Work out  $\frac{1}{6} \times 4$  by counting in sixths.



**MIXED NUMBERS**

Partition your fraction to help you solve  $2 \frac{3}{4} \times 3$





**Objectives**

Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions.

**Examples**

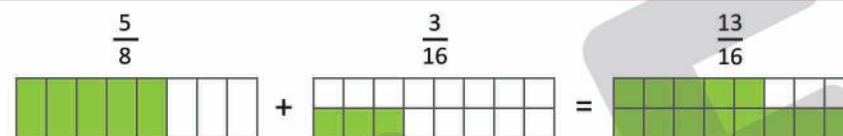
$$\frac{5}{8} + \frac{3}{16} = \frac{13}{16}$$

$$\frac{3}{5} + \frac{2}{9} = \frac{37}{45}$$

$$1\frac{2}{3} + 2\frac{1}{2} = 4\frac{1}{6}$$

$$\frac{6}{11} - \frac{3}{22} = \frac{9}{22}$$

**Models and Images**

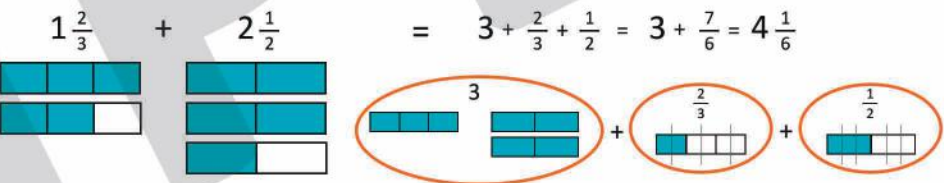


$\frac{3}{5} + \frac{2}{9}$

The LCM of 5 and 9 is 45... So the LCD is 45

$$\frac{3 \times 9}{5 \times 9} = \frac{27}{45} \quad \frac{2 \times 5}{9 \times 5} = \frac{10}{45}$$

So  $\frac{3}{5} + \frac{2}{9} = \frac{27}{45} + \frac{10}{45} = \frac{27+10}{45} = \frac{37}{45}$



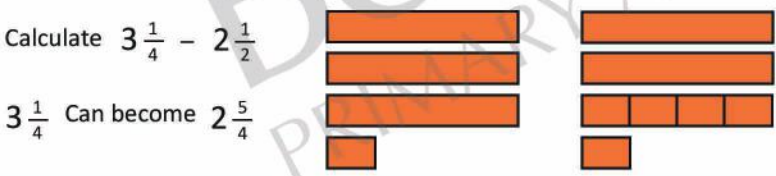
$\frac{6}{11} - \frac{3}{22}$

The LCM of 11 and 22 is 22... So the LCD is 22

We just need to change the  $\frac{6}{11}$

$$\frac{6 \times 2}{11 \times 2} = \frac{12}{22}$$

So  $\frac{6}{11} - \frac{3}{22} = \frac{12}{22} - \frac{3}{22} = \frac{12-3}{22} = \frac{9}{22}$



**Objectives**

**Examples**

**Models and Images**

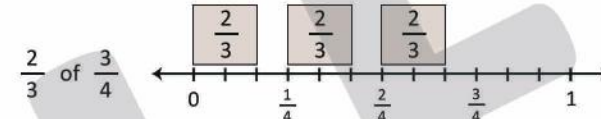
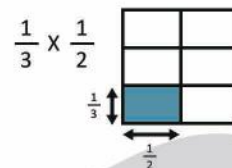
Multiply simple pairs of proper fractions, writing the answer in its simplest form

$$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$$

$$\frac{2}{3} \text{ of } \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$$

$$\frac{1}{2} \times \frac{2}{5} = \frac{1}{5}$$

Multiply simple pairs of proper fractions, writing the answer in its simplest form



**Example: What is**  $\frac{1}{2} \times \frac{2}{5}$

Step 1. Multiply the top numbers:

$$\frac{1}{2} \times \frac{2}{5} = \frac{1 \times 2}{2 \times 5} = \frac{2}{10}$$

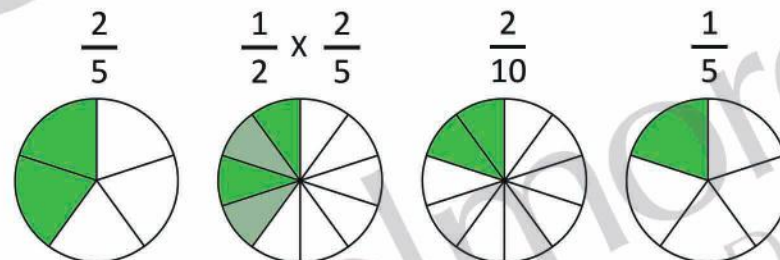
Step 2. Multiply the bottom numbers:

$$\frac{1}{2} \times \frac{2}{5} = \frac{1 \times 2}{2 \times 5} = \frac{2}{10}$$

Step 3. Simplify the fraction:

$$\frac{2}{10} = \frac{1}{5}$$

← This is like finding a half of  $\frac{2}{5}$



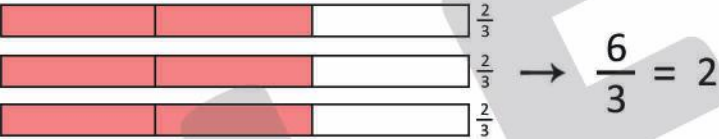

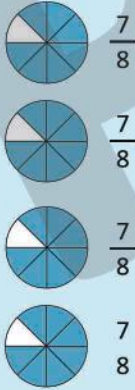
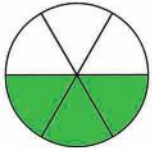

Do you see that half of two-fifths is two-tenths?

Do you also see that two-tenths is simpler as one-fifth?

The Rhyme:

♪ "Multiplying fractions: no big problem,  
Top times top over bottom times bottom.  
"And don't forget to simplify,  
Before it's time to say goodbye" ♪



Objectives	Examples	Models and Images
<p>Multiply and divide proper fractions by whole numbers</p>	$3 \times \frac{2}{3}$ $4 \times \frac{7}{8}$ $\frac{1}{2} \div 3$	<p><b>Example:</b></p>  $3 \times \frac{2}{3} \rightarrow \frac{6}{3} = 2$  $\frac{2}{5} \times 7 \rightarrow \frac{14}{5} = 3 \frac{3}{5}$ <div style="background-color: #ADD8E6; padding: 10px; border-radius: 10px;">  <math display="block">4 \times \frac{7}{8} = \frac{28}{8} = 3 \frac{4}{8} = 3 \frac{1}{2}</math> </div> <p>Divide proper fractions by whole numbers</p> $\frac{1}{2} \div 3$ <p>This means that we are finding one third of a half</p> <p>A Half      Divided by 3      This can be written as</p>   $= \frac{1}{6}$ $\frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3} = \frac{1}{6}$