YEAR 7 – REASONING WITH NUMBER

Sets and probability

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify and represent sets
- Interpret and create Venn diagrams
- Understand and use the intersection of sets
- Understand and use the union of sets
- Generate sample spaces for single events
- Calculate the probability of a single event
- Understand and use the probability scale

Keywords

Set: collection of things
Element: each item in a set is called an element
Intersection: the overlapping part of a Venn diagram (AND ∩)
Union: two ellipses that join (OR ∪)
Mutually Exclusive: events that do not occur at the same time
Probability: likelihood of an event happening
Bias: a built-in error that makes all values wrong (unequal) by a certain amount, e.g a weighted dice
Fair: there is zero bias, and all outcomes have an equal likelihood
Random: something happens by chance and is unable to be predicted

Identify and represent sets

The **universal set** has this symbol ξ – this means EVERYTHING in the Venn diagram is in this set

A set is a collection of things – you write sets inside curly brackets { }

ξ = {the numbers between 1 and 50 inclusive}

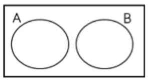
My sets can include every number between 1 and 50 including those numbers

A = {Square numbers}

A = {1, 4, 9, 16, 25, 36, 49}

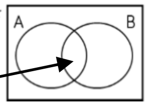
All the numbers in set A are square number and between 1 and 50

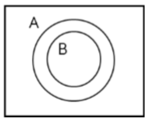
Interpret and create Venn diagrams



Mutually exclusive sets
The two sets have nothing in common
No overlap

Union of sets
The two sets have some elements in common – they are placed in the intersection

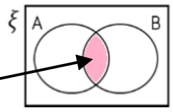




Subset
All of set B is also in Set A so the ellipse fits inside the set

The box
Around the outside of every Venn diagram will be a box. If an element is not part of any set it is placed outside an ellipse but inside the box

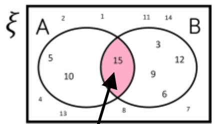
Intersection of sets



Elements in the intersection are in set A AND set B

The notation for this is $A \cap B$

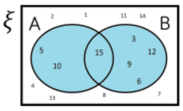
ξ = {the numbers between 1 and 15 inclusive}
A = {Multiples of 5} B = {Multiples of 3}



The element in $A \cap B$ is 15

In this example there is only one number that is both a multiple of 3 and a multiple of 5 between 1 and 15

Union of sets



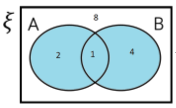
Elements in the union could be in set A OR set B

The notation for this is $A \cup B$

ξ = {the numbers between 1 and 15 inclusive}
A = {Multiples of 5} B = {Multiples of 3}

The elements in $A \cup B$ are 5, 10, 15, 3, 9, 6, 12

There are 7 elements that are either a multiple of 5 OR a multiple of 3 between 1 and 15



This Venn shows the **number of elements** in each set

Sample space – for single events

A sample space for rolling a six-sided dice is S = {1, 2, 3, 4, 5, 6}

A sample space for this spinner is S = {Pink, Blue, Yellow}

You only need to write each element once in a sample space diagram

- A Sample space represents a possible outcome from an event
- They can be interpreted in a variety of ways because they do not tell you the probability

Probability of a single event

$$\text{Probability} = \frac{\text{number of times event happens}}{\text{total number of possible outcomes}}$$

$P(\text{Blue}) = \frac{4}{10} = \frac{2}{5}$

There are 4 blue sectors

There are 10 sectors overall

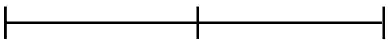
Probability notation P (event)

Probability can be a fraction, decimal or percentage value

$\frac{4}{10} = \frac{40}{100} = 0.40 = 40\%$

Probability is always a value between 0 and 1

The probability scale

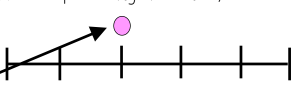


Impossible
0 or 0%

Even chance
0.5, $\frac{1}{2}$ or 50%

Certain
1 or 100%

The more likely an event the further up the probability it will be in comparison to another event (It will have a probability closer to 1)



There are 2 pink and 2 yellow balls, so they have the same probability

There are 5 possible outcomes
So 5 intervals on this scale, each interval value is $\frac{1}{5}$

Sum of probabilities

Probability is always a value between 0 and 1

The probability of getting a blue ball is $\frac{1}{5}$
∴The probability of NOT getting a blue ball is $\frac{4}{5}$

The sum of the probabilities is 1

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(white chocolate) = 1 – 0.15 – 0.35
= 0.5

YEAR 7 – LINES AND ANGLES

Constructing, measuring and using geometric notation

What do I need to be able to do?

By the end of this unit you should be able to:

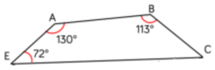
- Use letter and labelling conventions
- Draw and measure line segments and angles
- Identify parallel and perpendicular lines
- Recognise types of triangle
- Recognise types of quadrilateral
- Identify polygons
- Construct triangles (SAS, SSS, ASA)
- Draw Pie charts

Keywords

Polygon: A 2D shape made with straight lines
Scalene triangle: a triangle with all different sides and angles
Isosceles triangle: a triangle with two angles the same size and two angles the same size
Right-angled triangle: a triangle with a right angle
Frequency: the number of times a data value occurs
Sector: part of a circle made by two radii touching the centre
Rotation: turn in a given direction
Protractor: equipment used to measure angles
Compass: equipment used to draw arcs and circles.

Letter and labelling convention

The letter in the middle is the angle
The arc represents the angle



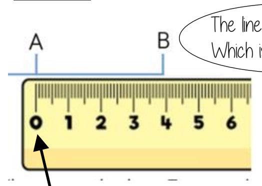
Angle Notation: three letters ABC
This is the angle at B = 113 °

Line Notation: two letters EC
The line that joins E to C.

Draw and measure line segments

Conversions 1cm = 10mm, 1m = 100cm

The line segment is 3.9cm
Which is 39mm



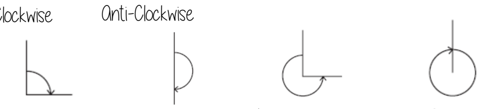
AB is a line segment (part of the line)

Make sure the start of the line is at 0.

Angles as measures of turn

Clockwise
Anti-Clockwise

East to South is a quarter turn clockwise



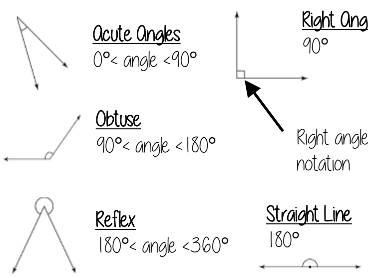
Quarter Turn
90°
Clockwise

Half Turn
180°

Three-quarter Turn
270°
Anti-Clockwise

Full Turn
360°

Classify angles



Acute Angles
0°< angle <90°

Right Angles
90°

Obtuse
90°< angle <180°

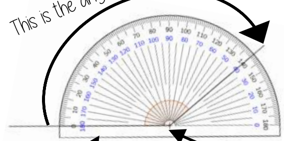
Right angle notation

Reflex
180°< angle <360°

Straight Line
180°

Measure angles to 180°

This is the angle being measured



Read from 0° on the base line.
Remember to use estimation.
This is an obtuse angle so between 90 ° and 180 °

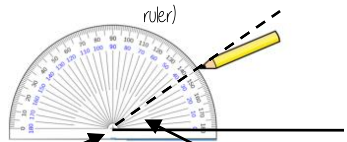
The base line follows the line segment

Make sure the cross is at the point the two lines meet

Draw angles up to 180°

Draw a 35° angle

Make a mark at 35° with a pencil And join to the angle point (use a ruler)

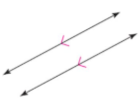


Make sure the cross is at the end of the line (where you want the angle)

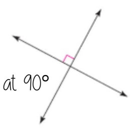
The angle

Parallel and Perpendicular lines

Parallel lines
Straight lines that never meet
(Have the same gradient)



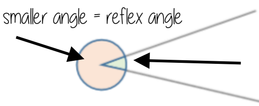
Perpendicular lines
Straight lines that meet at 90°



Angles over 180°

Use your knowledge of straight lines 180 ° and angles around a point 360 °

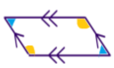
360 ° - smaller angle = reflex angle



Measure the smaller angle first (less than 180 °

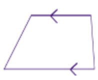
Properties of Quadrilaterals

Square
All sides equal size
All angles 90°
Opposite sides are parallel



Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

Rectangle
All angles 90°
Opposite sides are parallel



Trapezium
One pair of parallel lines

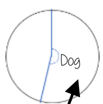
Rhombus
All sides equal size
Opposite angles are equal

Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

Draw Pie Charts

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

$\frac{32}{60}$ "32 out of 60 people had a dog"



This fraction of the 360 degrees represents dogs

$\frac{32}{60}$ X 360 = 192°

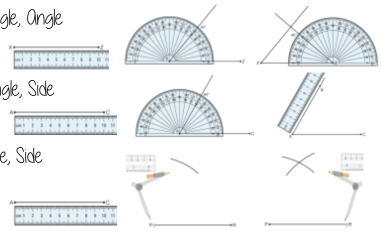
Use a protractor to draw This is 192°

SAS, SSS, ASA constructions

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side



Polygons

3	- Triangle
4	- Quadrilateral
5	- Pentagon
6	- Hexagon
7	- Heptagon
8	- Octagon
9	- Nonagon
10	- Decagon

If all the sides and angles are the same, it is a **regular** polygon

YEAR 7 - DEVELOPING GEOMETRY...

Line symmetry and reflection

What do I need to be able to do?

By the end of this unit you should be able to:

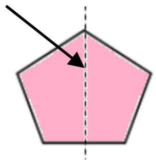
- Recognise line symmetry
- Reflect in a horizontal line
- Reflect in a vertical line
- Reflect in a diagonal line

Keywords

Mirror line: a line that passes through the center of a shape with a mirror image on either side of the line
Line of symmetry: same definition as the mirror line
Reflect: mapping of one object from one position to another of equal distance from a given line.
Vertex: a point where two or more-line segments meet.
Perpendicular: lines that cross at 90°
Horizontal: a straight line from left to right (parallel to the x axis)
Vertical: a straight line from top to bottom (parallel to the y axis)

Lines of symmetry

Mirror line (line of reflection)

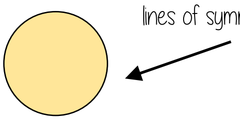


Rhombus
two lines of symmetry

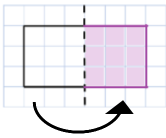
Parallelogram
No lines of symmetry

Shapes can have more than one line of symmetry... This regular polygon (a regular pentagon has 5 lines of symmetry)

A circle has an infinite amount of lines of symmetry

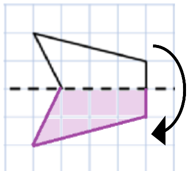


Reflect horizontally/ vertically (1)



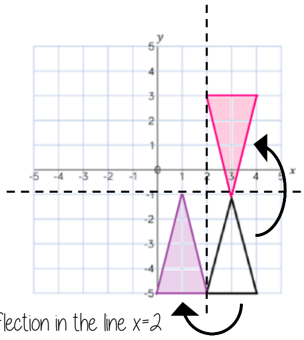
Note: a reflection doubles the area of the original shape

Reflection in a vertical line



Reflection in a horizontal line

Reflection on an axis grid

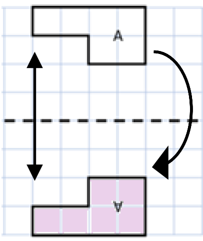


Reflection in the line y=-2

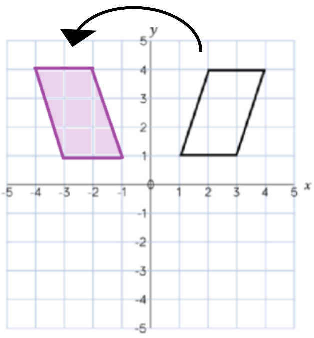
Reflection in the line x=2

Reflect horizontally/ vertically (2)

All points need to be the same distance away from the line of reflection



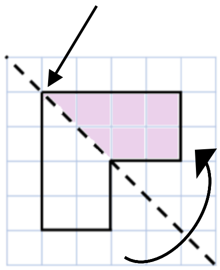
Reflection in the line y axis – this is also a reflection in the line x=0



Lines parallel to the x and y axis
REMEMBER
Lines parallel to the x-axis are y = ____
Lines parallel to the y-axis are x = ____

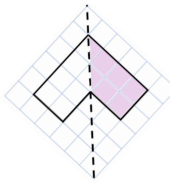
Reflect Diagonally (1)

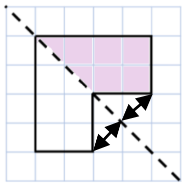
Points on the mirror line don't change position



Fold along the line of symmetry to check the direction of the reflection

Turn your image
If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)

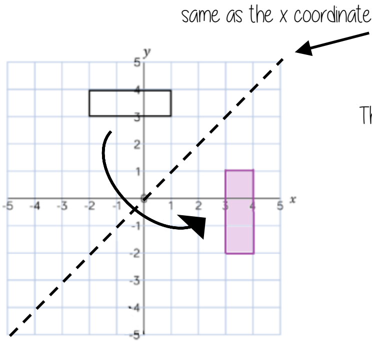




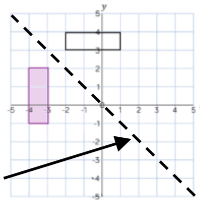
Drawing perpendicular lines
Perpendicular lines to and from the mirror line can help you to plot diagonal reflections

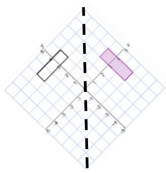
Reflect Diagonally (2)

This is the line **y = x** (every y coordinate is the same as the x coordinate along this line)



This is the line **y = - x**
The x and y coordinate have the same value but opposite sign





Turn your image
If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)

YEAR 7 - REPRESENTATIONS...

Working in the Cartesian plane

What do I need to be able to do?

By the end of this unit you should be able to:

- Label and identify lines parallel to the axes
- Recognise and use basic straight lines
- Identify positive and negative gradients
- Link linear graphs to sequences
- Plot y = mx + c graphs

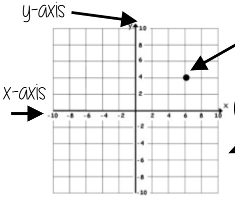
Keywords

Quadrant: four quarters of the coordinate plane.
Coordinate: a set of values that show an exact position.
Horizontal: a straight line from left to right (parallel to the x axis)
Vertical: a straight line from top to bottom (parallel to the y axis)
Origin: (0,0) on a graph. The point the two axes cross
Parallel: Lines that never meet
Gradient: The steepness of a line
Intercept: Where lines cross

Coordinates in four quadrants

y-axis

x-axis



Coordinate (x, y) (6, 4)

From the origin this coordinate is 6 places along the positive x axis and 4 places up the positive y axis.

(x, y)

Always the position on the x axis first

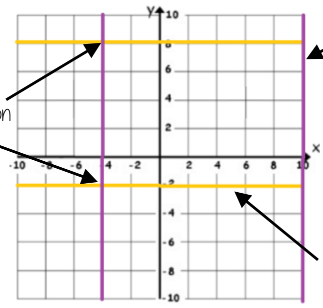
Always the position on the y axis second

(0, a) Will be always be a point on the y axis (a can be any number)

(a, 0) Will be always be a point on the x axis (a can be any number)

Lines parallel to the axes

Intersection points



All the points on this line have a x coordinate of 10

'a' can be ANY positive or negative value including 0

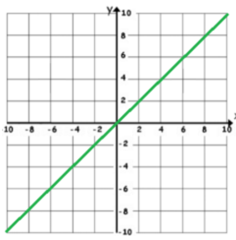
Lines parallel to the **y axis** take the form **x = a** and are **vertical**

Lines parallel to the **x axis** take the form **y = a** and are **horizontal**

All the points on this line have a y coordinate of -2

e.g (3, -2) (7, -2) (-2, -2) all lay on this line because the y coordinate is -2

Recognise and use the line y=x



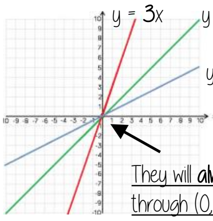
This means the x and the y coordinate have the same value

Examples of coordinates on this line: (0, 0) (-3, -3) (8, 8)

The axes **scale is important** – if the scale is the same y = x will be a straight line at 45°

Recognise and use the lines y=kx

The value of **k** changes the steepness of the line



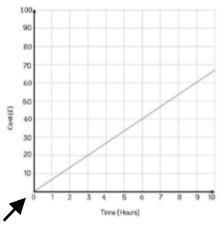
Note: y = x is the same as y = 1x

They will **always** go through (0,0)

The bigger the value of k the **steeper** the line will be.

The closer to 0 the value of k the closer the line will be to the x axis.

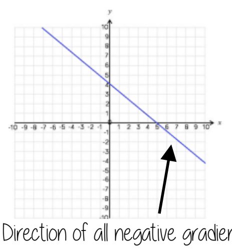
Direct Proportion using y=kx



The line must be straight to be directly proportional – variables increase at the same rate **k**

Direct proportion graphs always start at (0,0) as they are describing relationships between two variables

Lines with negative gradients

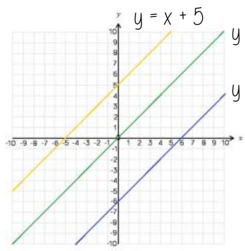


Any straight-line graph with a negative x value has a negative gradient

Eg y = -2x
y = -x y + x = 12

Direction of all negative gradients

Lines in the form y = x + a



All the lines are **parallel** because the gradients are the same

y = x + a

This is the line y=x when the y and x coordinate are the same

This shows the translation of that line.
e.g y = x + 5
Is the line y=x moved 5 places up the graph

5 has been added to each of the x coordinates

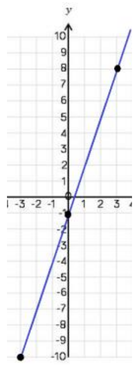
Plotting y = mx + c graphs

$y = 3x - 1$ → 3 x the x coordinate then – 1

x	-3	0	3
y	-10	-1	8

Draw a table to display this information

This represents a coordinate pair (-3, -10)



You only need two points to form a straight line

Plotting more points helps you decide if your calculations are correct (if they do make a straight line)

Remember to join the points to make a line

YEAR 7 - REASONING WITH NUMBER

Prime numbers and Proof

What do I need to be able to do?

By the end of this unit you should be able to:

- Find and use multiples
- Identify factors of numbers and expressions
- Recognise and identify prime numbers
- Recognise square and triangular numbers
- Find common factors including HCF
- Find common multiples including LCM

Keywords

Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number.
Prime: an integer with only 2 factors.
Conjecture: a statement that might be true (based on reasoning) but is not proven.
Counterexample: a special type of example that disproves a statement.
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)
HCF: highest common factor (biggest factor two or more numbers share)
LCM: lowest common multiple (the first time the times table of two or more numbers match)

Multiples

The "times table" of a given number

All the numbers in this lists below are multiples of 3

3, 6, 9, 12, 15…

$3x, 6x, 9x$ …

This list continues and doesn't end

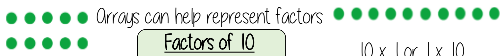
x could take any value and as the variable is a multiple of 3 the answer will also be a multiple of 3

Non example of a multiple

4.5 is not a multiple of 3 because it is 3 x 1.5

Not an integer

Factors



Arrays can help represent factors

5 x 2 or 2 x 5

Factors of 10
1, 2, 5, 10

10 x 1 or 1 x 10

The number itself is always a factor

Factors and expressions

x	x	x	x	x	x

$6x \times 1$ OR $6 \times x$

Factors of $6x$
6, x, 1, $6x$, $2x$, 3, $3x$, 2

x	x
x	x
x	x

$2x \times 3$

x	x	x
x	x	x

$3x \times 2$

Prime numbers

- Integer
- Only has 2 factors
- and itself

2

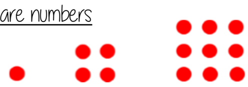
The first prime number
The only even prime number

Learn or how-to quick recall…

2, 3, 5, 7, 11, 13, 17, 19, 23, 29…

Square and triangular numbers

Square numbers



odd even odd

Representations are useful to understand a square number n^2

1, 4, 9, 16, 25, 36, 49, 64 …

Triangular numbers

Representations are useful – an extra counter is added to each new row

Add two consecutive triangular numbers and get a square number

1, 3, 6, 10, 15, 21, 28, 36, 45…

Common factors and HCF

1 is a common factor of all numbers

Common factors are factors two or more numbers share

HCF – Highest common factor

HCF of 18 and 30

18	1, 2, 3, 6, 9, 18
30	1, 2, 3, 5, 6, 10, 15, 30

Common factors (factors of both numbers)
1, 2, 3, 6

HCF = 6

6 is the biggest factor they share

Common multiples and LCM

Common multiples are multiples two or more numbers share

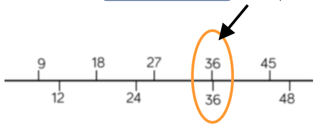
LCM – Lowest common multiple

LCM of 9 and 12

9	9, 18, 27, 36, 45, 54
12	12, 24, 36, 48, 60

LCM = 36

The first time their multiples match

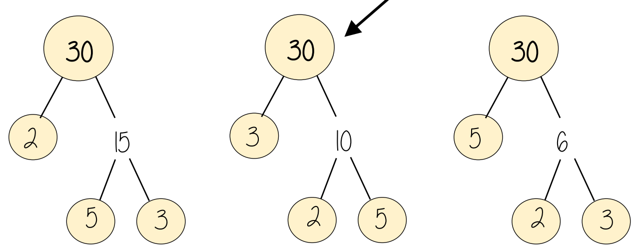


Comparing fractions

$\frac{3}{5}$ and $\frac{7}{10}$ ← Compare fractions using a LCM denominator → $\frac{6}{10}$ and $\frac{7}{10}$

Product of prime factors

Multiplication part-whole models



All three prime factor trees represent the same decomposition

Multiplication is commutative

30 = 2 x 3 x 5 ← Multiplication of prime factors

Using prime factors for predictions

eg 60	30 x 2	2 x 3 x 5 **x 2**
150	30 x 5	2 x 3 x 5 **x 5**

Conjectures and counterexamples

Conjecture

1, 2, 4….
The numbers in the sequence are doubling each time.

A pattern that is noticed for many cases

Counterexamples

Only one counterexample is needed to disprove a conjecture

YEAR 7 - APPLICATION OF NUMBER

Solving problems with multiplication and division

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand and use factors
- Understand and use multiples
- Multiply/ Divide integers and decimals by powers of 10
- Use formal methods to multiply
- Use formal methods to divide
- Understand and use order of operations
- Solve area problems
- Solve problems using the mean

Keywords

Array: an arrangement of items to represent concepts in rows or columns
Multiples: found by multiplying any number by positive integers
Factor: integers that multiply together to get another number.
Mili: prefix meaning one thousandth
Centi: prefix meaning one hundredth
Kilo: prefix meaning multiply by 1000
Quotient: the result of a division
Dividend: the number being divided
Divisor: the number we divide by

Factors


Arrays can help represent factors

5 x 2 or 2 x 5

Factors of 10
1, 2, 5, 10

10 x 1 or 1 x 10

The number itself is always a factor

Square numbers have an ODD number of factors

Factors of 4
1, 2, 4

Factors of 36
1, 2, 3, 4, 6, 9, 12, 18, 36

Be strategic - Lay factors out in pairs can help you not to miss any

Multiples

4	4	4	4	4

Bar models can represent by something is a multiple. Eg 20 is a multiple of 4

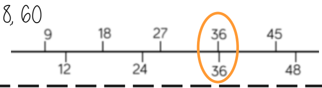
Lowest Common Multiples

LCM of 9 and 12

The first time their multiples match

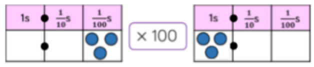
9	9, 18, 27, 36, 45, 54
12	12, 24, 36, 48, 60

LCM = 36



Multiply/ Divide by powers of 10

3 x 100 = 300



0.03 x 100 = 3

Repeated multiplication and division by powers of 10 is commutative

÷ 10 then ÷ 10 ⟶ ÷ 100

Metric conversions

Useful Conversions

mm $\xrightarrow{\div 10}$ cm $\xrightarrow{\div 100}$ m $\xrightarrow{\div 1000}$ km

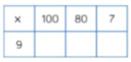
mm $\xleftarrow{\times 10}$ cm $\xleftarrow{\times 100}$ m $\xleftarrow{\times 1000}$ km

g $\xrightarrow{\div 1000}$ kg, g $\xleftarrow{\times 1000}$ kg

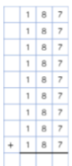
ml $\xrightarrow{\div 1000}$ L, ml $\xleftarrow{\times 1000}$ L

Multiplication methods

Long multiplication (column)



Grid method



Repeated addition

Less effective method especially for bigger multiplication

Estimations: Using estimations allows a 'check' if your answer is reasonable

Multiplication with decimals

Perform multiplications as integers
eg 0.2 x 0.3 ⟶ 2 x 3

Make **adjustments** to your answer to match the question: 0.2 x 10 = 2
0.3 x 10 = 3

Therefore 6 ÷ 100 = 0.06

Division methods

Short division

3584 ÷ 7 = 512

$$\begin{array}{r} 5\ \ 1\ \ 2 \\ 7\,\overline{)\,3\ {}^{3}5\ \ 8\ {}^{1}4} \end{array}$$

Complex division

÷ 24 = ÷ 6 ÷ 4

Break up the divisor using factors

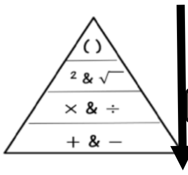
Division with decimals

The placeholder in division methods is essential – the decimal lines up on the dividend and the quotient

24 ÷ 0.02 ⟶ 24 ÷ 0.2 ⟶ 240 ÷ 2

All give the same solution as represent the same proportion.
Multiply the values in proportion until the divisor becomes an integer

Order of operations



Brackets
Indices or roots
Multiplication or division
Addition or subtraction

If you have multiple operations from the same tier work from left to right

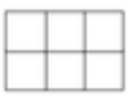
eg 10 – 3 + 5 ⟶ 10 - 3 ⟶ 7 + 5

6 x 4 + 8 x 2

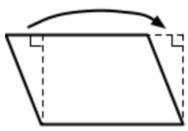
24 + 16 = 40

Area problems

Rectangle
Base x Perpendicular height

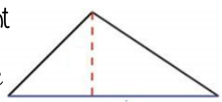


Parallelogram/ Rhombus
Base x Perpendicular height



Triangle
½ x Base x Perpendicular height

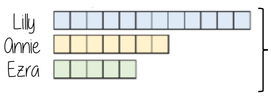
A triangle is half the size of the rectangle it would fit in



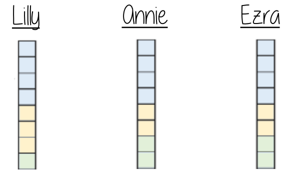
Mean problems

Mean – a measure of average
It gives an idea of the central value

Lilly, Annie and Ezra have the following cubes



Finding the mean amount is the average amount each person would have if shared out equally



The mean number of blocks would be 8 each

YEAR 7 - ALGEBRAIC THINKING…

Equality and Equivalence

What do I need to be able to do?

By the end of this unit you should be able to:

- Form and solve linear equations
- Understand like and unlike terms
- Simplify algebraic expressions

Keywords

Equality: two expressions that have the same value
Equation: a mathematical statement that two things are equal
Equals: represented by '=' symbol – means the same
Solution: the set or value that satisfies the equation
Solve: to find the solution.
Inverse: the operation that undoes what was done by the previous operation. (The opposite operation)
Term: a single number or variable
Like: variables that are the same are 'like'
Coefficient: a multiplicative factor in front of a variable e.g. 5x (5 is the coefficient, x is the variable)
Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

Equality

$$\underbrace{2 + 14}_{16} = \underbrace{5 + 5 + 6}_{16}$$

"Is equal to"

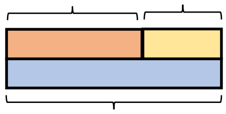
The sum on the left has the same result as the sum on the right

Saying it out loud sometimes helps you to understand equality

Fact Families

Use a bar model to display the relationships between terms and numbers.

13 7



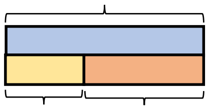
20

Model the information

13 + 7 = 20
7 + 13 = 20
20 – 7 = 13
20 – 13 = 7

Fact Family

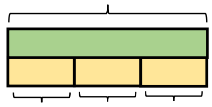
14



x 10

x + 10 = 14
10 + x = 14
14 – 10 = x
14 - x = 10

y



t t t

t + t + t = y
3 x t = y
3t = y
y – t – t = t
y ÷ 3 = t
y ÷ t = 3

Solve one step equations (+/-)

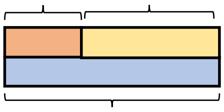
There is more to this than just spotting the answer

$\boxed{x + 42 = 59}$

x + 42 = 59
42 + x = 59

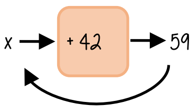
59 – x = 42
59 – 42 = x

x 42



59

Don't forget you know how to use function machines



$$x \xrightarrow{+42} 59$$

-42

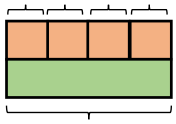
Solve one step equations (x/÷)

$$\boxed{\frac{f}{4} = 5}$$

f ÷ 4 = 5
f ÷ 5 = 4

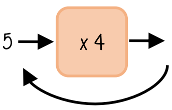
5 x 4 = f
4 x 5 = f

5 5 5 5



f

Don't forget you know how to use function machines



$$5 \xrightarrow{x\,4} f$$

÷ 4

Like and unlike terms

Like terms are those whose variables are he same

♥ and 3♥ are **like** terms

the variable is the same

★ 3♥ are **unlike** terms

the variables are NOT the same

Examples and non-examples

Like terms	Un-like terms
y, 7y	y, 7x
$2x^2$, x^2	$2x^2$, $2c^2$
ab, 10ba	ab, 10a
5, -2	5, -2t

Note here ab and ba are commutative operations, so are still like terms

Equivalence

Check equivalence by substitution
e.g. m= 10

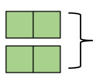
5m	2 x 2m	7m – 3m
5 x 10	2 x (2x 10)	(7x 10) – (3x 10)
= 50	= 2 x 20	= 70 – 30
	= 40	= 40

Equivalent expressions

Repeat this with various values for m to check

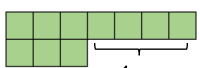
5m

2 x 2m



4m

7m – 3m



4m

Collecting like terms ≡ symbol

The ≡ symbol means equivalent to.
It is used to identify equivalent expressions

Collecting like terms
Only **like terms** can be combined

4x +5b –2x + 10b

4x $\boxed{+5b}$ –2x $\boxed{+10b}$

2x + 15b

Common misconceptions

$2x + 3x^2 + 4x \equiv 6x + 3x^2$

Although they both have the x variable x2 and x terms are un-like terms so can not be collected

YEAR 7 - ALGEBRAIC THINKING...

Sequences

What do I need to be able to do?

By the end of this unit you should be able to:

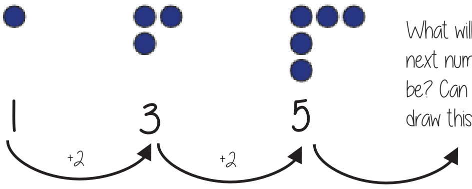
- Describe and continue both linear and non-linear sequences
- Explain term to term rules for linear sequence
- Find missing terms in a linear sequence

Keywords

Sequence: items or numbers put in a pre-decided order
Term: a single number or variable
Position: the place something is located
Rule: instructions that relate two variables
Linear: the difference between terms increases or decreases by the same value each time
Non-linear: the difference between terms increases or decreases in different amounts
Difference: the gap between two terms
Arithmetic: a sequence where the difference between the terms is constant
Geometric: a sequence where each term is found by multiplying the previous one by a fixed non zero number

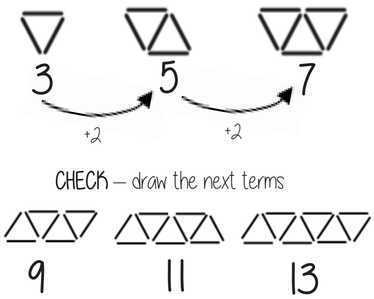
Describe and continue a sequence diagrammatically

Count the number of circles or lines in each image



What will the next number be? Can you draw this?

Predict and check terms

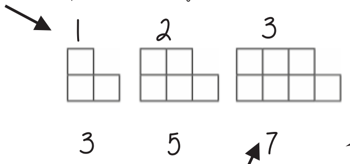


Predictions:
Look at your pattern and consider how it will increase.

eg How many lines in pattern 6?
Prediction - 13
If it is increasing by 2 each time - in 3 more patterns there will be 6 more lines

Sequence in a table and graphically

Position: the place in the sequence



"The **term** in **position** 3 has 7 squares"

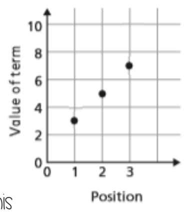
Term: the number or variable
(the number of squares in each image)

In a table

Position	1	2	3
Term	3	5	7

+2 +2

Graphically



Because the terms increase by the same addition each time this is **linear** – as seen in the graph

Linear and Non Linear Sequences

Linear Sequences – increase by addition or subtraction and the same amount each time
Non-linear Sequences – do not increase by a constant amount – quadratic, geometric and Fibonacci.

- Do not plot as straight lines when modelled graphically
- The differences between terms can be found by addition, subtraction, multiplication or division.

Fibonacci Sequence – look out for this type of sequence

0 1 1 2 3 5 8 ...

Each term is the sum of the previous two terms.

Continue Linear Sequences

7, 11, 15, 19...

How do I know this is a linear sequence?
It increases by adding 4 to each term.
How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference).
How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Continue non-linear Sequences

1, 2, 4, 8, 16 ...

How do I know this is a non-linear sequence?
It increases by multiplying the previous term by 2 – this is a geometric sequence because the constant is multiply by 2
How many terms do I need to make this conclusion?
At least 4 terms – two terms only shows one difference not if this difference is constant (a common difference).
How do I continue the sequence?
You continue to repeat the same difference through the next positions in the sequence.

Explain term-to-term rule

How you get from term to term

Try to explain this in full sentences not just with mathematical notation.
Use key maths language – doubles, halves, multiply by two, add four to the previous term etc.

To explain a whole sequence you need to include a term to begin at...

The next term is found by tripling the previous term. The sequence begins at 4.

4, 12, 36, 108...
x3 x3 x3
First term

YEAR 7 – PLACE VALUE AND PROPORTION…
FDP equivalence

What do I need to be able to do?

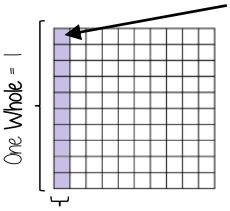
By the end of this unit you should be able to:

- Convert fluently between fractions, decimals & percentages

Keywords

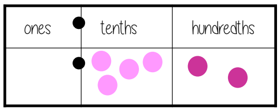
Fraction: how many parts of a whole we have
Decimal: a number with a decimal point used to separate ones, tenths, hundredths etc.
Percentage: a proportion of a whole represented as a number between 0 and 100
Place value: the numerical value that a digit has decided by its position in the number
Placeholder: a number that occupies a position to give value
Interval: a range between two numbers
Tenth: one whole split into 10 equal parts
Hundredth: one whole split into 100 equal parts
Sector: a part of a circle between two radius (often referred to as looking like a piece of pie)
Recurring: a decimal that repeats in a given pattern

Tenths and hundredths



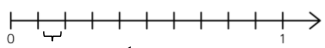
One **hundredth** (one whole split into 100 equal parts) $= \frac{1}{100} = 0.01$

One **tenth** (one whole split into 10 equal parts) $= \frac{1}{10} = 0.1$



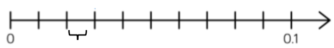
0 ones, 5 tenth and 2 hundredths
$0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01$
$= 0 + 0.5 + 0.02$
$= 0.52$

On a number line



One whole – split into 10 equal parts

One tenth $= \frac{1}{10} = 0.1$

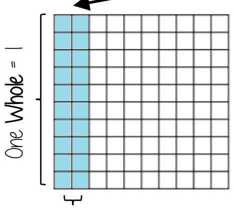


One tenth – split into 10 equal parts

One hundredth $= \frac{1}{100} = 0.01$

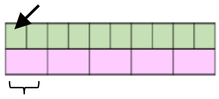
Fifths

Twenty hundredths



One Whole = 1

One tenth

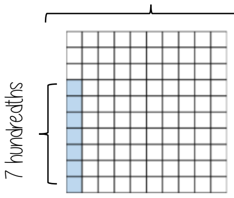


Two tenths = one fifth

One **fifth** (one whole split into 5 equal parts) $= \frac{1}{5} = 0.2$

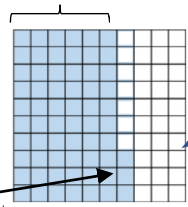
Percentages on a hundred grid

100% = a whole = 100 hundredths



7 hundredths
7 out of 100
7%

6 tenths



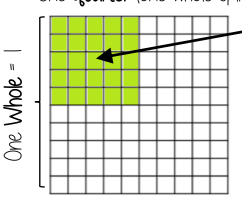
6 tenths and 3 hundredths
63 hundredths
63%

3 hundredths

Quarters

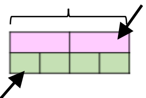
One **quarter** (one whole split into 4 equal parts) $= \frac{1}{4} = 0.25$

Twenty five hundredths



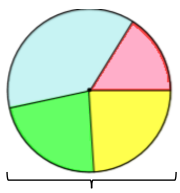
One whole

One half = 0.5



One quarter = 0.25

Simple pie charts

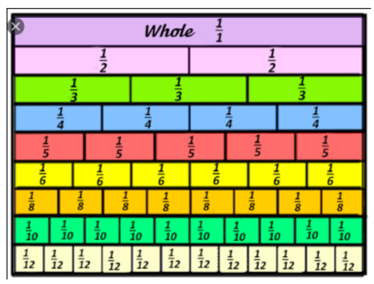


A pie chart has 360° so all FDP calculations are out of 360

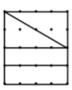
Split into 10 parts = 10% = 36°
Split into 2 parts = 50% = 180°
Split into 5 parts = 20% = 72°

Equivalent fractions

Represent equivalence with fraction walls



Fractions – on a diagram



The denominator is represented by EQUALLY sized parts – this is split into quarters

Fractions – on a number line

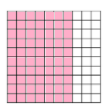
One whole split into 18 equal parts
18 is the **denominator**

This point is at the 6th part
6 is the **numerator**

$\frac{6}{18} \leftarrow \frac{3}{9} \leftarrow \frac{1}{3}$

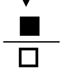
Convert FDP

$\frac{70}{100}$ → This also means 70 ÷ 100 → 70 out of 100 squares 70 "hundredths" = 7 "tenths" 0.7 →



→ 70 hundredths = 70%

Using a calculator



→ S⇌D Convert to a decimal

This will give you the answer in the simplest form

× 100 converts to a percentage

Be careful of recurring decimals
e.g. $\frac{1}{3} = 0.3333333 = 0.\dot{3}$
The dot above the 3

YEAR 7 - FRACTIONAL THINKING

Addition and subtraction of fractions

What do I need to be able to do?

By the end of this unit you should be able to:

- Convert between mixed numbers and fractions
- Add/Subtract unit fractions (same denominator)
- Add/Subtract fractions (same denominator)
- Add/Subtract fractions from integers
- Use equivalent fractions
- Add/Subtract any fractions
- Add/Subtract improper fractions and mixed numbers
- Use fractions in algebraic contexts

Keywords

Numerator: the number above the line on a fraction. The top number. Represents how many parts are taken

Denominator: the number below the line on a fraction. The number represent the total number of parts

Equivalent: of equal value

Mixed numbers: a number with an integer and a proper fraction

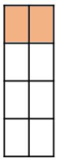
Improper fractions: a fraction with a bigger numerator than denominator

Substitute: replace a variable with a numerical value

Place value: the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right

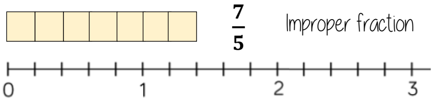
Representing Fractions

$\frac{1}{4}$ is represented in all the images

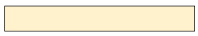


$1 \div 4$

Mixed numbers and fractions



$\frac{7}{5}$ Improper fraction



$1\frac{2}{5}$ Mixed number

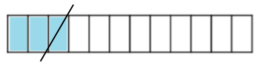
In this model 5 parts make up a whole

Fractions can be bigger than a whole

Add/Subtract unit fractions

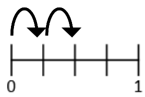
Same denominator

$\frac{1}{12} + \frac{1}{12} - \frac{1}{12}$



$= \frac{2}{12}$

$\frac{1}{4} + \frac{1}{4}$



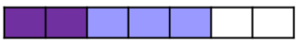
$= \frac{2}{4}$

With the same denominator ONLY the numerator is added or subtracted

Add/Subtract fractions

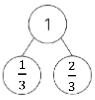
Same denominator

$\frac{2}{7} + \frac{3}{7}$



$= \frac{5}{7}$

Sequences



$\frac{1}{3},\ 1,\ 1\frac{2}{3},\ 2\frac{1}{3},\ 3, \ldots$

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

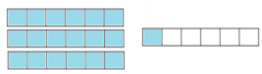
Represent this on a number line to help

Add/Subtract from integers

$1 - \frac{2}{6}$

$= \frac{4}{6}$

$3 + \frac{1}{6}$



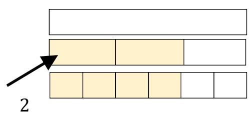
$= 3\frac{1}{6}$

The denominator indicates the number of parts a whole is made up of

Equivalent fractions

Numerator and denominator have the same multiplier

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



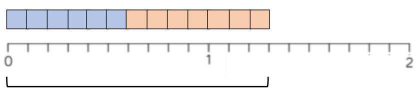
$\frac{1}{3} = \frac{2}{6}$

Add/Subtraction fractions (common multiples)

$\frac{3}{5} + \frac{7}{10}$

$\frac{6}{10} + \frac{7}{10}$

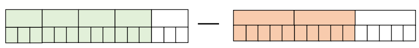
Addition/Subtraction needs a common denominator



$\frac{13}{10}$

Add/Subtraction any fractions

$\frac{4}{5} - \frac{2}{3}$



$\frac{12}{15} - \frac{10}{15}$

$= \frac{2}{15}$

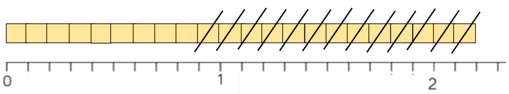
Use equivalent fractions to find a common multiple for both denominators

Add/Subtraction fractions (improper and mixed)

$2\frac{1}{5} - 1\frac{3}{10}$

$2\frac{2}{10}$

$\frac{22}{10} - \frac{13}{10} = \frac{9}{10}$



- Convert to an improper fraction
- Calculate with common denominator

Partitioning method

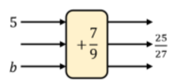
$2\frac{1}{5} - 1\frac{3}{10} = 2\frac{2}{10} - 1\frac{3}{10} = 2\frac{2}{10} - 1 - \frac{3}{10} = 1\frac{2}{10} - \frac{3}{10} = \frac{9}{10}$

Fractions in algebraic contexts

$k - \frac{5}{8} = 2$

Apply inverse operations

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



Form expressions with fractions

$b + \frac{7}{9} \longrightarrow b + \frac{7}{9}$

$p = 5 \quad m = 2$

$\frac{p}{8} + \frac{1}{m}$

Substitution

$\frac{5}{8} + \frac{1}{2}$

Fractions and decimals

$\frac{1}{10} = 0.1$

$\frac{1}{100} = 0.01$

Example $\frac{6}{10} + 0.3 \longrightarrow 0.6 + 0.3$

$\frac{6}{10} + \frac{3}{10}$

Remember to use equivalent fractions and common denominators

YEAR 7 - APPLICATION OF NUMBER

Fractions and percentages of amounts

What do I need to be able to do?

By the end of this unit you should be able to:

- Find a fraction of a given amount
- Use a given fraction to find the whole or other fractions
- Find the percentage of an amount using mental methods
- Find the percentage of a given amount using a calculator

Keywords

Fraction: how many parts of a whole we have
Equivalent: of equal value
Whole: a number with no fractional or decimal part
Percentage: parts per 100 (uses the % symbol)
Place Value: the value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right
Convert: change into an equivalent representation, often fraction to decimal to a percentage cycle.

Fraction of a given amount

Find $\frac{2}{5}$ of £205

The bar represents the whole amount

£205

£41	£41	£41	£41	£41

2 out of the 5 equal parts

2 x £41 = **£82**

£205 ÷ 5 = £41

Each part of the bar model represents £41

90

30	30	30
15	15	15

45

Use bar models for comparisons

$\frac{1}{3}$ of 90 = 30

$\frac{2}{3}$ of 45 = 30

$\therefore \frac{1}{3}$ of $90 = \frac{2}{3}$ of 45

Use a fraction of amount

$\frac{2}{3}$ of a value is 70. What is the whole number?

70

35	35	35

70 ÷ 2 = 35
Each part of the bar model represents 35.

35 x 3 = 105
The whole number is 105

The wording of the question is important to setting up the bar model

$\frac{3}{4}$ of a number is 63.

63

21	21	21	21

Find the whole

What is $\frac{1}{6}$ of the number?

84

14	14	14	14	14	14

= 14

Use the whole to find a given part

Find the percentage of an amount (Mental methods)

The whole represents 100%

10% = $\frac{1}{10}$ of the whole

0% 20% 40% 60% 80% 100%

10% = $\frac{1}{10}$ of the whole
50% = $\frac{5}{10}$ = $\frac{1}{2}$ of the whole
20% = $\frac{2}{10}$ = $\frac{1}{5}$ of the whole
5% = $\frac{1}{20}$ of the whole

Find 65% of 80

80

8	8	8	8	8	8	8	8	8	8

Method 1:
65% = 10% x 6 + 5%
= (8 x 6) + 4
= 52

Method 2:
65% = 50% + 10% + 5%
= 40 + 8 + 4
= 52

For bigger percentages it is sometimes easier to take away from 100%

Find the percentage of an amount (Calculator methods)

Using a multiplier

Find 65% of 80

Fraction, decimal, percentage conversion

65% = $\frac{65}{100}$ = 0.65 The multiplier

0.65 x 80 = **52**

Using the percent button

Find 65% of 80

This brings up the % button on screen
You will see 65%

Type 65
Press SHIFT ((%)
Press × 80 and then press =

You can also use the calculator to support non calculator methods and find 1% or 10% then add percentages together

"of" can represent 'x' in calculator methods

YEAR 7 - PROPORTIONAL REASONING...
Multiplying and Dividing Fractions

What do I need to be able to do?

By the end of this unit you should be able to:

- Carry out any multiplication or division using fractions and integers.
- Solutions can be modelled, described and reasoned

Keywords

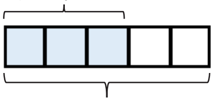
Numerator : the number above the line on a fraction. The top number. Represents how many parts are taken
Denominator: the number below the line on a fraction. The number represent the total number of parts.
Whole: a positive number including zero without any decimal or fractional parts.
Commutative: an operation is commutative if changing the order does not change the result.
Unit Fraction: a fraction where the numerator is one and denominator a positive integer.
Non-unit Fraction: a fraction where the numerator is larger than one.
Dividend : the amount you want to divide up.
Divisor: the number that divides another number.
Quotient: the answer after we divide one number by another. e.g. dividend ÷ divisor = quotient
Reciprocal: a pair of numbers that multiply together to give 1.

Representing a fraction

$\frac{\text{Numerator}}{\text{Denominator}}$

$\frac{3}{5}$

Number of parts represented
Numerator



Number of parts to make up the whole
Denominator

ALL PARTS of a fraction are of equal size

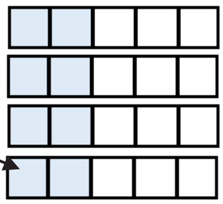
Repeated addition = multiplication by an integer

$4 \times \frac{2}{5} \longrightarrow \frac{2}{5} + \frac{2}{5} + \frac{2}{5} + \frac{2}{5}$

Revisit
When adding fractions with the same denominator = add the numerators

Integer (Whole number)

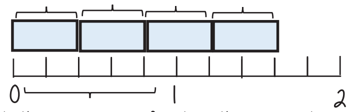
Each part represents $\frac{1}{5}$



$\frac{\text{How many parts are shaded?}}{\text{What each part represents}}$

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

$= 1\frac{3}{5}$



Each whole is split into the same number of parts as the denominator

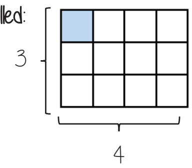
Multiplying unit fractions

$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

Parts shaded

Total number of parts in the diagram

Modelled:



Multiplying non-unit fractions

Shade in 3 parts

Repeat it on this many rows

$\frac{3}{4} \times \frac{2}{3}$

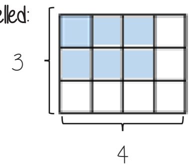
This many columns

This many rows

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

Parts shaded

Modelled:



Total number of parts in the diagram

Quick Multiplying and Cancelling down

$\frac{\overset{1}{\cancel{3}}}{5} \times \frac{4}{\cancel{9}_{3}}$

The 3 and the 9 have a common factor and can be simplified

Quick Solving
Multiply the numerators
Multiply the denominators

$\frac{1 \times 4}{5 \times 3} = \frac{4}{15}$

The reciprocal *When you multiply a number by its reciprocal the answer is always 1*

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

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

The reciprocal of 3 is $\frac{1}{3}$ and vice versa

Reciprocals for division

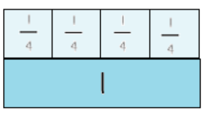
e.g

$5 \div \frac{1}{4} = 20$

$5 \times 4 = 20$

Multiplying by a reciprocal gives the same outcome

Dividing an integer by an unit fraction



$1 \div \frac{1}{4} = 4$

How many quarters are in 1?

"There are 4 quarters in 1 whole. Therefore, there are 20 quarters in 5 wholes"

$5 \div \frac{1}{4} = 20$

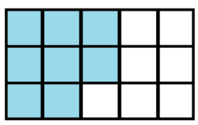
Dividing any fractions *Remember to use reciprocals*

$\frac{2}{5} \div \frac{3}{4}$

$\frac{2}{5} \times \frac{4}{3}$

Multiplying by a reciprocal gives the same outcome

Represented



$= \frac{8}{15}$

YEAR 7 - DEVELOPING NUMBER...
Number Sense

What do I need to be able to do?

By the end of this unit you should be able to:

- Round numbers to powers of 10 and 1 sf
- Round numbers to any dp
- Estimate solutions
- Calculate using order of operations
- Calculate with money, units of measurement and time

Keywords

Significant: Place value of importance
Round: Making a number simpler but keeping its value close to what it was.
Decimal: Place holders after the decimal point.
Overestimate: Rounding up – gives a solution higher than the actual value
Underestimate: Rounding down – gives a solution lower than the actual value.
Metric: A system of measurement.
Balance: The amount of money in a bank account
Deposit: Putting money into a bank account.

Round to powers of 10 and 1 sig figure

R

If the number is halfway between we "**round up**"

5495 to the nearest 1000

5000 ⬆ 6000

5475 to the nearest 100

5400 ⬆ 5500

5475 to the nearest 10

5470 ⬆ 5480

370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00037 to 1 significant figure is 0.0004

Round to the first non-zero number

Round to decimal places

2.46192 ← Focus on the numbers **after** the decimal point

"To 1dp" – to one number after the decimal
"To 2dp" – to two numbers after the decimal

2.46192 (to 1dp) - Is this closer to 2.4 or 2.5

2.4 ⬆ 2.5

2.4|6192 This shows the number is closer to 2.5

2.46192 (to 2dp) - Is this closer to 2.46 or 2.47

2.46 ⬆ 2.47

2.46|192 This shows the number is closer to 2.46

Estimate the calculation

Round to 1 significant figure to estimate

$4.2 + 6.7 \approx 4 + 7 \approx 11$ This is an **overestimate** because the 6.7 was rounded up more

The equal sign changes to show it is an estimation

$21.4 \times 3.1 \approx 20 \times 3 \approx 60$ This is an **underestimate** because both values were rounded down

It is good to check all calculations with an estimate in all aspects of maths – it helps you identify calculation errors.

Order of operations

R

Brackets Operations in brackets are calculated first

Other operations e.g. powers, roots,

Multiplication/ Division

They are carried out in the order from left to right in the question

Addition/ Subtraction

They are carried out in the order from left to right in the question

Calculations with money

Debit - You have £0 or more in an account

Credit - You have less than £0 in an account

Money calculations are to 2dp

Using a calculator – ensure you are working in the correct units.

£1.30 + 50p = 130 + 50 (in pence)
= 1.30 + 0.50 (in pounds)

£1 = 100p

Units are important: Useful Conversions

mm $\xrightarrow{\div 10}$ cm $\xrightarrow{\div 100}$ m $\xrightarrow{\div 1000}$ km

mm $\xleftarrow{\times 10}$ cm $\xleftarrow{\times 100}$ m $\xleftarrow{\times 1000}$ km

g $\xrightarrow{\div 1000}$ kg ; g $\xleftarrow{\times 1000}$ kg

ml $\xrightarrow{\div 1000}$ L ; ml $\xleftarrow{\times 1000}$ L

Metric measures of length

Kilo = 1000 x meter

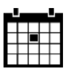
Centi - $\frac{1}{100}$ x meter

Milli - $\frac{1}{1000}$ x meter

Units of weight/ capacity

Weight = g, kg, t
Capacity (volume of liquid) = ml, L

Time and the calendar



1 Year – the amount of time it takes Earth to go around the sun 365 (and a quarter) **days**

Leap Year – 366 **days** (every 4 years)

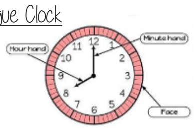
12 Months = one year = 52 weeks
31 days – **Jan, March, May, July, Aug, Oct, Dec**
30 days – **April, June, Sept, Nov**
28 days – **Feb** (29 leap year)

1 week – 7 days
Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday

1 day – 24 hours
1 hour - 60 minutes
1 minute – 60 seconds

Use a number line for time calculations!

Analogue Clock



12-hour clock
- Use am (morning) and pm (afternoon)
- Only use hour times up to 12

Digital Clock (24-hour times)

24-hour clock
- 0-11 (morning hours)
- 12-23 (afternoon hours)

YEAR 7 – REASONING WITH DATA…

Measures of location

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand and use mean, median and mode
- Choose the most appropriate average
- Identify outliers
- Compare distributions using averages and range

Keywords

Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency – or the typical value of all the data together
Total: all the data added together
Frequency: the number of times the data values occur
Represent: something that show's the value of another
Outlier: a value that stands apart from the data set
Consistent: a set of data that is similar and doesn't change very much

Mean, Median, Mode

The Mean

A measure of average to find the central tendency… a typical value that represents the data

24, 8, 4, 11, 8

Find the sum of the data (add the values) 55

Divide the overall total by how many pieces of data you have 55 ÷ 5

Mean = 11

The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8

Put the data in order 4, 8, 8, 11, 24

Find the value in the middle 4, 8, 8, 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8

This can still be easier if it the data is ordered first

4, 8, 8, 11, 24

Mode = 8

Choosing the appropriate average

The average should be a representative of the data set – so it should be compared to the set as a whole - to check if it is an appropriate average

Here are the weekly wages of a small firm

£240 £240 £240 £240 £240
£260 £260 £300 £350 £700

Which average best represents the weekly wage?

The Mean = £307
The Median = £250
The Mode = £240

Put the data back into context
Mean/Median – too high (most of this company earn £240)
Mode is the best average that represents this wage

It is likely that the salaries above £240 are more senior staff members – their salary doesn't represent the average weekly wage of the majority of employers

Identify outliers

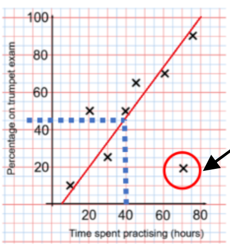
Outliers are values that stand well apart from the rest of the data

Outliers can have a big impact on range and mean. They have less impact on the median and the mode

Sometimes it is best to not use an outlier in calculations

Height in cm
152 150 142 158 182 151 153 149 156 160 151 144

Where an outlier is identified try to give it some context. This is likely to be a taller member of the group. Could the be an older student or a teacher?



Outliers can also be identified graphically e.g on scatter graphs

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency

Here are the number of runs scored last month by Lucy and James in cricket matches

Lucy: 45, 32, 37, 41, 48, 35
James: 60, 90, 41, 23, 14, 23

Lucy
Mean: 39.6 (1dp), **Median**: 38 **Mode**: no mode, **Range**: 16

James
Mean: 41.8 (1dp), **Median**: 32, **Mode**: 23, **Range**: 76

James has two extreme values that have a big impact on the range

"James is less consistent that Lucy because his scores have a greater range. Lucy performed better on average because her scores have a similar mean and a higher median"

YEAR 7 - REASONING WITH DATA...

The data handling cycle

What do I need to be able to do?

By the end of this unit you should be able to:

- Set up a statistical enquiry
- Design and criticise questionnaires
- Draw and interpret multiple bar charts
- Draw and interpret line graphs
- Represent and interpret grouped quantitative data
- Find and interpret the range
- Compare distributions

Keywords

Hypothesis: an idea or question you want to test
Sampling: the group of things you want to use to check your hypothesis
Primary Data: data you collect yourself
Secondary Data: data you source from elsewhere e.g the internet/ newspapers/ local statistics
Discrete Data: numerical data that can only take set values
Continuous Data: numerical data that has an infinite number of values (often seen with height, distance, time)
Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency – or the typical value of all the data together
Proportion: numerical relationship that compares two things

Set up a statistical enquiry

Write a suitable hypothesis → Design a data collection sheet → Pros/ Cons of sampling → Pros/ Cons primary or secondary data → Discrete or continuous data?

Features of a data collection sheet

Grouped or ungrouped categories

Data Title	Tally	Frequency
	~~IIII~~	

Total number of that group observed

Design and criticise a questionnaire

The Question - be clear with the question - don't be too leading/ judgemental

e.g How much pocket money do you get a week?

Responses – do you want closed or open responses? – do any options overlap? – Have you an option for all responses?

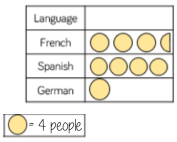
Zero option → ☐ £0 ☐ £0.01 - £2 ☐ £2.01 - £4 ☐ more than £4 ← More option

NOTE: For responses about continuous data include inequalities $<$ x $\leq$

Pictograms, bar and line charts R

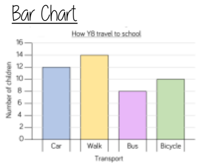
Represents quantitative data

Pictogram



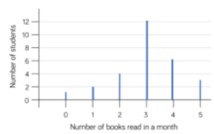
- Need to remember a key
- Visually able to identify mode

Bar Chart



- Gaps between the bars
- Clearly labelled axes
- Scale for the axes
- Title for the bar chart
- Discrete Data

Line Chart



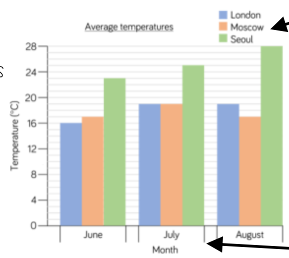
- Gaps between the lines
- Clearly labelled axes
- Scale for the axes
- Discrete Data

Multiple Bar chart

Compares multiple groups of data

- Clearly labelled axes
- Scale for axes
- Comparable data bars drawn next to each other

Key/ Colour code for separate groups of information



Gap between different categories of data

Draw and interpret Pie Charts R

Remember a circle has 360°

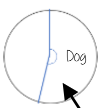
Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$ "32 out of 60 people had a dog"

Multiple method
As 60 goes into 360 – 6 times.
Each frequency can be multipled by 6 to find the degrees (proportion of 360)

This fraction of the 360 degrees represents dogs



$\frac{32}{60} \times 360 = 192°$

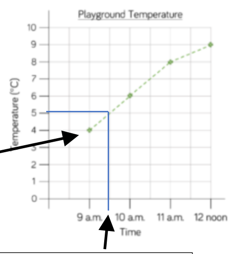
Use a protractor to draw
This is 192°

Represents quantitative, discrete data

Draw and interpret line graphs

- Commonly used to show changing over time
- The points are the recorded information and the lines join the points

Line graphs do not need to start from 0



More than one piece of data can be plotted on the same graph to compare data

It is possible to make estimates from the line
e.g temperature at 9.30am is 5°C

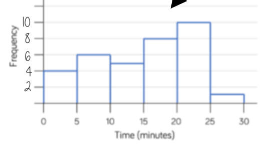
Grouped quantitative data

Time (minutes)	Frequency
$0 \leq t < 5$	4
$5 \leq t < 10$	6
$10 \leq t < 15$	5
$15 \leq t < 20$	8
$20 \leq t < 25$	10
$25 \leq t < 30$	1

"More than or equal to 25 and less than 30 minutes"

The use of inequalities shows that this will be a frequency diagram

This is a frequency diagram
There are no gaps between the bars



Grouping the data is useful if there is a large spread of data to begin with

Find and interpret the range

Difference between the biggest and smallest values

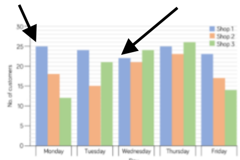
The range is a measure of **spread**

A smaller range means there is less variation in the results – it is more consistent data

A range of 0 means all the data is the same value

Shop 1 highest value

Shop 1 lowest value



Shop 1 has the smallest range – this indicates it has a more consistent flow of customers each week

Range of customers = 25 – 22 = 3 (Shop 1)

YEAR 7 - PLACE VALUE AND PROPORTION

Ordering integers and decimals

What do I need to be able to do?

By the end of this unit you should be able to:

- Understand place value and the number system including decimals
- Understand and use place value for decimals, integers and measures of any size
- Order number and use a number line for positive and negative integers, fractions and decimals;
- use the symbols $=, \neq, \leq, \geq$
- Work with terminating decimals and their corresponding fractions
- Round numbers to an appropriate accuracy
- Describe, interpret and compare data distributions using the median and range

Keywords

Approximate: To estimate a number, amount or total often using rounding of numbers to make them easier to calculate with
Integer: a whole number that is positive or negative
Interval: between two points or values
Median: A measure of central tendency (middle, average) found by putting all the data values in order and finding the middle value of the list.
Negative: Any number less than zero; written with a minus sign.
Place holder: We use 0 as a place holder to show that there are none of a particular place in a number
Place value: The value of a digit depending on its place in a number. In our decimal number system, each place is 10 times bigger than the place to its right
Range: The difference between the largest and smallest numbers in a set
Significant figure: A digit that gives meaning to a number. The most significant digit (figure) in an integer is the number on the left. The most significant digit in a decimal fraction is the first non-zero number after the decimal point.

Integer Place Value

Billions			Millions			Thousands			Ones		
H	T	O	H	T	O	H	T	O	H	T	O
		3	1	4	8	0	3	3	0	2	9

Placeholder

Three billion, one hundred and forty eight million, thirty three thousand and twenty nine

1 billion 1, 000, 000, 000
1 million 1. 000, 000

Intervals on a number line

0 20 40 60 80 100

Divide the difference by the number of intervals (gaps).
E.g. $100 \div 5 = 20$

Rounding to the nearest power of ten

If the number is halfway between we "**round up**"

5495 to the nearest 1000: 5000 — 6000 (5000)

5475 to the nearest 100: 5400 — 5500 (5500)

5475 to the nearest 10: 5470 — 5480 (5480)

Compare integers using $<, >, =, \neq$

$<$ *less than*
$>$ greater than
$=$ equal to
$\neq$ not equal to

Two and a half million $=$ 2 500 000
300 000 000 $=$ Three billion
Six thousand and eighty $<$ 68 000

Range *Spread of the values*

Difference between the biggest and smallest

3 9 8 12

Range: Biggest value – Smallest value
$12 - 3 = 9$
Range = 9

Median *The middle value*

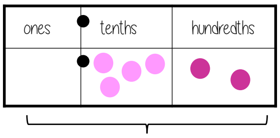
Example 1
4 3 9 8 12

Median: put the in order 3 4 8 9 12
find the middle number 3 4 8 9 12

Example 2
150 154 148
137 160 158

Median: put the in order
137 148 150 154 158 160
There are 2 middle numbers
Find the midpoint
152

Decimals



We say "nought point five two"

Five tenths and two hundredths

0 ones, 5 tenth and 2 hundredths
0 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.01 + 0.01
= 0 + 0.5 + 0.02
= 0.52

Decimal intervals on a number line

One whole spit into 10 parts makes tenths = 0.1
One tenth split into 10 parts makes hundredths = 0.01

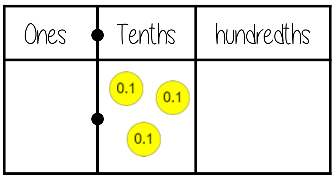
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

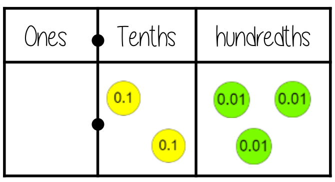
0 0.02 0.04 0.06 0.08 0.1

0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2

Comparing decimals

Which the largest of 0.3 and 0.23?





$0.3 > 0.23$
"There are more counters in the furthest column to the left"

0.30
0.23

Comparing the values both with the same number of decimal places is another way to compare the number of tenths and hundredths

Round to 1 significant figure

370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00000037 to 1 significant figure is 0.0000004

Round to the first non zero number

YEAR 7 - PROPORTIONAL REASONING...

Ratio and Scale

What do I need to be able to do?

By the end of this unit you should be able to:

- Simplify any given ratio
- Share an amount in a given ratio
- Solve ratio problems given a part

Solutions should be modelled, explained and solved.

Keywords

Ratio: a statement of how two numbers compare
Equal Parts:: all parts in the same proportion, or a whole shared equally
Proportion: a statement that links two ratios
Order: to place a number in a determined sequence
Part: a section of a whole
Equivalent: of equal value
Factors: integers that multiply together to get the original value
Scale: the comparison of something drawn to its actual size.

Representing a ratio

"For every 5 boys there are 3 girls"

This is the "whole" – boys and girls together

This represents the 5 boys   This represents the 3 girls

5:3

Double Number Line

This represents the 5 boys

This is the "whole" – boys and girls together

This represents the 3 girls

Order is Important

"For every dog there are 2 cats"

Dogs: Cats

1:2

The ratio has to be written in the same order as the information is given.

e.g. 2:1 would represent 2 dogs for every 1 cat. ✗

Simplifying a ratio

Cancel down the ratio to its lowest form

"For every 6 days of rain there are 4 days of sun"

6:4

rain   sun

÷ by 2

3:2

Find the biggest common factor that goes into all parts of the ratio

For 6 and 4 the biggest factor (number that multiplies into them is 2)

"For every 3 days of rain there are 2 days of sun" – when this happens twice the ratio becomes 6:4

Ratio 1:n (or n:1)

This is asking you to cancel down until the part indicated represents 1

Show the ratio 4:20 in the ratio of 1:n

4 : 20

1 : 5

The question states that this part has to be 1 unit. Therefore Divide by 4

This side has to be divided by 4 too – to keep in proportion

H the n part does not have to be an integer for this type of question

Units are important:

When using a ratio – all parts should be in the same units

Useful Conversions

mm $\xrightarrow{\times 10}$ cm $\xrightarrow{\times 100}$ m $\xrightarrow{\times 1000}$ km; km $\xrightarrow{\div 1000}$ m $\xrightarrow{\div 100}$ cm $\xrightarrow{\div 10}$ mm

g $\xrightarrow{\times 1000}$ kg; kg $\xrightarrow{\div 1000}$ g

ml $\xrightarrow{\times 1000}$ L; L $\xrightarrow{\div 1000}$ ml

Sharing a whole into a given ratio

James and Lucy share £350 in the ratio 3:4.
Work out how much each person earns

Model the Question

James: Lucy
3 : 4

James   Lucy   £350

Find the value of one part

Whole: £350
7 parts to share between
(3 James, 4 Lucy)

£350 ÷ 7 = £50

□ = one part = £50

Put back into the question

James: Lucy
3 : 4
x 50   x 50
£150:£200

James = 3 x £50 = £150

Lucy = 4 x £50 = £200

£350

Finding a value given 1:n (or n:1)

Inside a box are blue and red pens in the ratio 5:1.
If there are 10 red pens how many blue pens are there?

Model the Question

Blue : Red
5 : 1

Blue pens

Red pens

One unit = 10 pens

□ = one part = 10 pens

Put back into the question

Blue : Red
5 : 1
x 10   x 10
50: 10

Blue pens = 5 x 10 = 50 pens

Red pens = 1 x 10 = 10 pens

There are 50 Blue Pens

Ratio as a fraction

Trees: Flowers
3 : 7

Trees

Flowers

Ratio

There are 3 parts for trees

Fraction of trees

$\frac{\text{Number of parts of in group}}{\text{Total number of parts}}$ $\frac{3}{10}$

Fraction

Tree parts 3 + Flower parts 7 = 10

Pi π

Circumference

Diameter

The ratio of a circles circumference to its diameter

YEAR 7 – PROPORTIONAL REASONING…

Multiplicative Change

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve problems and explain direct proportion
- Use conversion graphs to make statements, comparisons and form conclusions.
- Understand and use scale factors for length

Keywords

Proportion: a statement that links two ratios
Variable: a part that the value can be changed
Axes: horizontal and vertical lines that a graph is plotted around
Approximation: an estimate for a value
Scale Factor: the multiple that increases/ decreases a shape in size
Currency: the system of money used in a particular country
Conversion: the process of changing one variable to another
Scale: the comparison of something drawn to its actual size.

Direct Proportion

As one variable changes the other changes at the same rate.

4 cans of pop = £2.40

This is a multiplicative change

4 cans of pop = £2.40 $\xrightarrow{\times 0.5}$ 2 cans of pop = £1.20

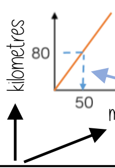
4 cans of pop = £2.40 $\xrightarrow{\times 3}$ 12 cans of pop = £7.20

This multiplier is the same In the same way that this would be for ratio

Sometimes this is easiest if you work out how much one unit is worth first
eg 1 can of pop = £0.60

Conversion Graphs

Compare two variables



This is always a straight line because as one variable increases so does the other at the same rate

Labelling of both axes is vital

To make conversions between units you need to find the point to compare – then find the associated point by using your graph.
Using a ruler helps for accuracy
Showing your conversion lines help as a "check" for solutions

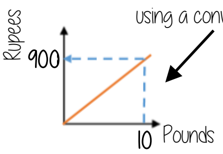
Conversion between currencies

£1 = 90 Rupees ← Currency is directly proportional

For every £1 I have 90 Rupees

£1 = 90 Rupees $\xrightarrow{\times 10}$ £10 = 900 Rupees

Currency can be converted using a conversion graph

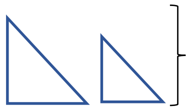


Convert 630 Rupees into Pounds

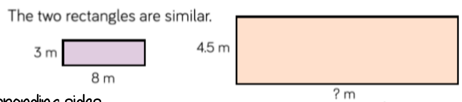
630 ÷ 90 = 7

£1 = 90 Rupees $\xrightarrow{\times 7}$ £7 = 630 Rupees

Ratio between similar shapes



Angles in similar shapes do not change. e.g if a triangle gets bigger the angles can not go above 180^0



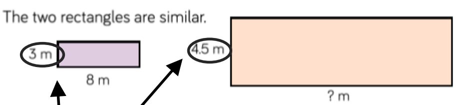
Corresponding sides

3m : 4.5m $\xrightarrow{\div 3}$ 1 m : 1.5 m

8m : 12m $\xleftarrow{\times 8}$ 1 m : 1.5 m

Note
Simplify to the same ratio

Understand Scale Factor



3 x 1.5 = 4.5

This is a multiplicative change

Use corresponding sides to calculate a scale factor

Missing length
8 x 1.5 = 12m

Scale factor can also be calculated by: $\frac{\text{Bigger corresponding side}}{\text{Smaller corresponding side}}$

Small corresponding side $\xrightarrow{\times \text{SF}}$ Big corresponding side

Big corresponding side $\xrightarrow{\div \text{SF}}$ Small corresponding side

Draw and interpret scale diagrams

A picture of a car is drawn with a scale of 1:30

For every 1cm on my image is 30cm in real life

The car image is 10cm

Image	Real life
1cm	30cm
10cm	300cm

(x 10)

The car in real life is 210cm

Image	Real life
1cm	30cm
7cm	210 cm

(x 7)

Interpret maps with scale factors

mm $\xrightarrow{\div 10}$ cm $\xrightarrow{\div 100}$ m $\xrightarrow{\div 1000}$ km

mm $\xleftarrow{\times 10}$ cm $\xleftarrow{\times 100}$ m $\xleftarrow{\times 1000}$ km

1 cm : 250 m

Ratios need to be in the same units

1 cm : 250m

250 x 100 = 25000

1 cm : 25000cm

For every 1cm on my map is 25000cm in real life.

YEAR 7 - LINES AND ANGLES

Geometric reasoning

What do I need to be able to do?

By the end of this unit you should be able to:

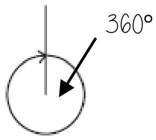
- Understand/use the sum of angles at a point
- Understand/use the sum of angles on a straight line
- Understand/use equality of vertically opposite angles
- Know and apply the sum of angles in a triangle
- Know and apply the sum of angles in a quadrilateral

Keywords

Vertically Opposite: angles formed when two or more straight lines cross at a point.
Interior Angles: angles inside the shape
Sum: total, add all the interior angles together
Convex Quadrilateral: a four-sided polygon where every interior angle is less than 180°
Concave Quadrilateral: a four-sided polygon where one interior angle exceeds 180°
Polygon: A 2D shape made with straight lines
Scalene triangle: a triangle with all different sides and angles
Isosceles triangle: a triangle with two angles the same size and two angles the same size
Right-angled triangle: a triangle with a right angle

Sum of angles at a point

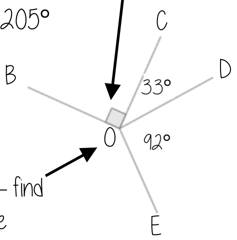
The sum of angles around a point is 360°



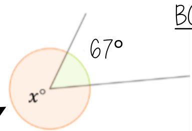
Find angle BOE

90° + 33° + 92° = 205°
360° - 205°
BOE = 155°

Angle notation – 90°



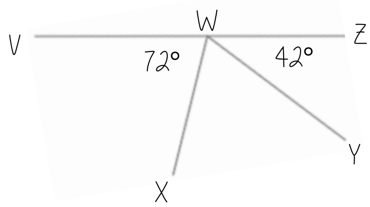
Angle notation – find this missing angle



360° - 67°
= 293 °

Sum of angles on a straight line

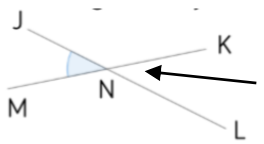
Adjacent angles that share a common point on a line add up to 180°



Find angle XWY

72° + 42° = 114°
180° - 114° = 66°

Vertically opposite angles

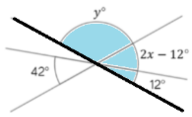


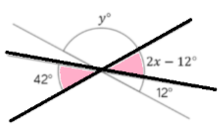
Angle JNM is vertically opposite to angle KNL

JNM = KNL

Vertically opposite angles are the same

Other angle rules still apply.
Look for straight line sums and angles around a point.



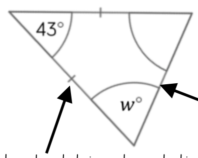


Form equations with information from diagrams:

$2x - 12 = 42$
$2x = 54$
$x = 27°$

Sum of angles in triangles

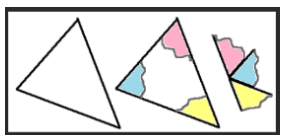
Sum of interior angles in a triangle = 180°



The two base angles will be the same size

Look at triangle notation. This indicates an isosceles triangle
∴ 180 - 43 = 137
137 ÷ 2 = 68.5°

A triangle can only have ONE right angle



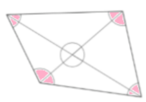
Have a go!
Tearing the corners from triangles forms a straight line which is therefore 180°

Sum of angles in quadrilaterals

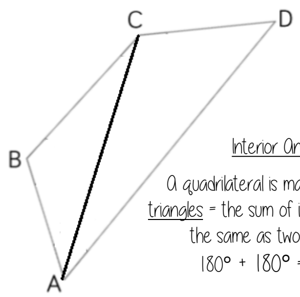
Sum of interior angles in a quadrilateral = 360°

Convex Quadrilateral

Concave Quadrilateral



Interior angles are those that make up the perimeter (outline) of the shape



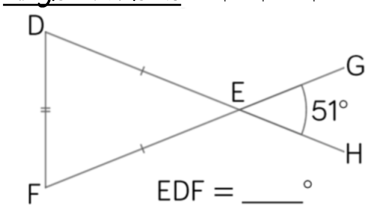
Interior Angles

A quadrilateral is made up of two triangles = the sum of interior angles is the same as two triangles:
180° + 180° = 360°

Angle Problems

Split up the problem into chunks and explain your reasoning at each point using angle notation

Keep working out clear and notes together



1. Angle DEF = 51° because it is a vertically opposite angle DEF = GEH
2. Triangle DEF is isosceles (triangle notation) ∴ EDF = EFD and the sum of interior angles is 180°
   180° - 51° = 129° 129° ÷ 2 = 64.5°
3. Angle EDF = 64.5°