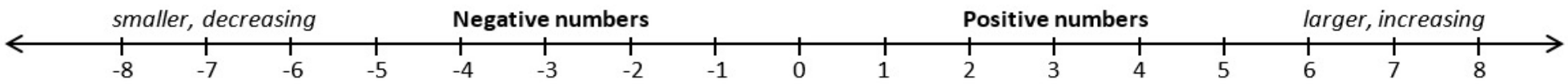
MATHEMATICS DEPARTMENT

Unit 1: Investigating Number Systems



Place Value

8	7	5	2	.	3	4	6
thousands	hundreds	tens	ones		tenths	hundredths	thousandths

The >, <, ≤, ≥ symbols and = are used compare numbers.

- > "greater than"
- < "less than"
- ≥ "greater than or equal to"
- ≤ "less than or equal to"

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Clip Numbers

13-17

Multiplying and dividing by powers of 10

10 000	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Multiplying

X 10 digits move LEFT **1** space
X 100 digits move LEFT **2** spaces
X 1000 digits move LEFT **3** spaces

Dividing

÷ 10 digits move RIGHT **1** space
÷ 100 digits move RIGHT **2** spaces
÷ 1000 digits move RIGHT **3** spaces

Rounding

The purpose of **rounding** is to make a number simpler but keep its value close to what it was.

The digit to the right of the rounding digit tells you if you should round up or down. If **is less than 5, round down.**
If the digit to the right of the rounding digit is **5 or more, round up.**

Key Words

Integer: A whole number

Decimal: A number that contains a point.

Negative Number: A number less than zero

Significant figures: The 'important' digits.

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Unit 2: Pattern Sniffing

Sequences

A sequence can be generated from a rule. For example, the rule could be "First term 7 and the term-to term rule add 4". This means the first number in the sequence will be 7 and then keep adding 4 to get more numbers which will give a sequence that starts 7, 11, 15, 19….

Square numbers

1, 4, 9, 16, 25, 36, 49, 64, 81, 100

Triangular Numbers

1, 3, 6, 10, 15, 21, 28, 36, 45, 55

Cube Numbers

1, 8, 27, 64, 125

Lowest Common Multiple (LCM)

Q - Find the LCM of 6 and 7:

6 – 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, …

7 – 7, 14, 21, 28, 35, 42, 49, 56, …

LCM = 42

Highest Common Factor (HCF)

Q – Find the HCF of 18 and 24

18 – 1, 2, 3, 6, 9, 18

24 – 1, 2, 3, 4, 6, 8, 12, 24

HCF = 6

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Clip Numbers

31-32, 34-36, 99-101,

Powers and Roots

$$10^4 = 10\times10\times10\times10 = 10000$$

$$\sqrt[3]{125} = 5 \text{ because } 5^3 = 125$$

Key Words

Sequence: A list which is in a particular order following a pattern

.

Term: Each particular part of a sequence

Prime Number: A number with exactly two factors – 1 and itself.

Factor: The numbers which fit into a number exactly.

Multiple: The numbers in the times table.

Highest Common Factor: The highest factor which is common for both numbers.

Lowest Common Multiple: The smallest multiple which is common to both numbers.

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Unit 3 – Exploring Calculation

Key Concept

B Brackets

I Indices

DM Division Multiplication

AS Addition Subtraction

Substitution - Formula

Substitution: This is where we replace certain words for the number that it is worth.

For example: The time in minutes to cook a chicken is given by the formula:

Time = 40 minutes per kilogram plus 20 minutes

a) 5kg chicken = 40 x 5 + 20 = 220 minutes
b) 2.5kg chicken = 40 x 2.5 = 120 minutes

Substitution - Expression

Substitution: This is where we replace the letter we see for the number that it is worth.

For example: If w = 6 and y = 5

Remember that 3y means 3 multiplied by the value of y.

a) w + 5 = 6 + 5 = 11

b) 3y – 2 = 3 x 5 – 2 = 15 – 2 = 13

c) 8w + 2y = 8 x 6 + 2 x 5 = 48 + 10 = 58

Key Words

Operation: In maths these are the functions × ÷ + -.

Commutative: Calculations are commutative if changing the order does not change the result.

Associative: In these calculations you can re-group numbers and you will get the same answer.

Indices: These are the squares, cubes and powers.

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24, 39-44, 120, 150, 780-783

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Unit 4: Generalising Arithmetic

Inverse Operations

To solve an equation we use inverse operations. For example:

? – 234 = 875

To find out what ? equals, we use the **inverse** of subtraction which is addition.

875 + 234 = 1109 so ? = 1109

Expressions

I think of a number **x**. I double this number.

An expression to show this would be **2x**.

If I then added 4, my expression would be **2x+4**.

If I now multiply by 3 then my expression would be **3(2x+4)**

Cancellation

$$\frac{5\times7}{3\times7\times2}=\frac{5}{3\times2}=\frac{5}{6}$$

Distributive Law

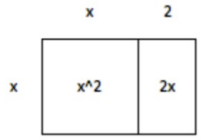
24 x 7 = 20 x 7 + 4 x 7

= 140 + 28

= 168

Expand Brackets

$x(x+2)=$



x^2+2x

Collecting like terms

When collecting like terms involving addition or subtraction, add/subtract the numbers in front of the letters.

If the like terms are multiplied, multiply the numbers in front of the letters and put the letters next to each other.

If the like terms are divided, divide the numbers in front of the letters.

Key Words

Inverse: 'undoes' an operation

Expression – An expression is a group of numbers, letters and operation symbols

Distributive law – Multiplying a number by a group of numbers added together is the same as doing each multiplication separately.

Like terms – terms with the same variables and powers

Expand brackets – 'get rid of' the brackets by multiplying every term inside the brackets by what is on the outside.

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Clip Numbers

12, 156, 157, 160, 161, 177,

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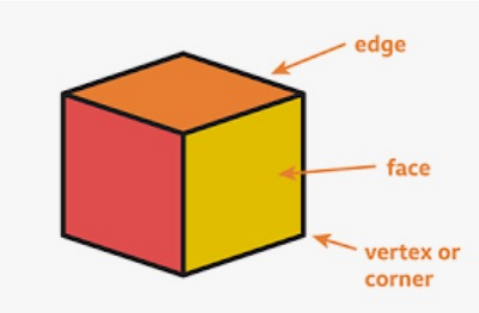
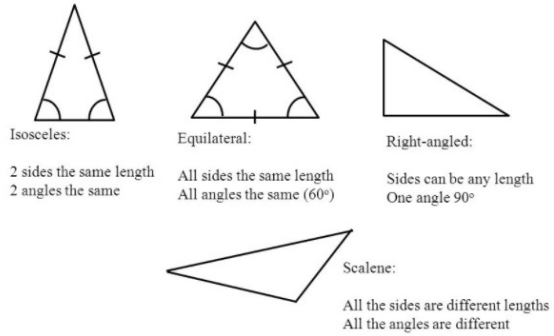
Unit 5: Exploring Shape

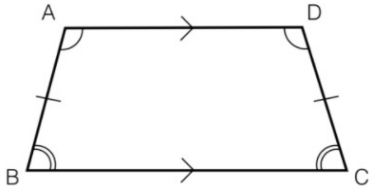
Properties of 3D Shapes



Triangles



2D Shapes and Notation



(a) Which two edges are of equal length?
(b) Write down a pair of equal angles.
(c) Write down a pair of different angles.
(d) True or false: this shape has two pairs of parallel sides.

a) AB and CD
b) BAD and ADC
c) ABC and BCD
d) False

Angle rules

- Angles around a point sum to 360°
- Angles on a straight line sum to 180°
- Angles in a triangle sum to 180°
- Angles in a quadrilateral sum to 360°
- Vertically opposite angles are equal

Key Words

Faces: A flat surface on a 3D shape

Edges: A line segment that joins two vertices

Vertices: The corners of a 3D shape

Right angles – Meet at 90 degrees

Parallel – Will never meet

Perpendicular – Meet at a right angle

Scalene – A triangle where all the sides and angles are different

Isosceles – A triangle with two sides and angles equal

Equilateral – A triangle where all the sides and angles are equal

Quadrilateral – 4 sided shape

Congruent – the same

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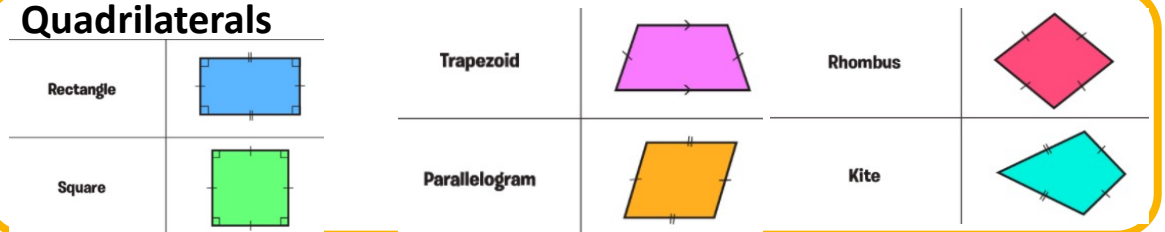
Clip Numbers
477-479, 557, 558, 822, 829,830

Quadrilaterals



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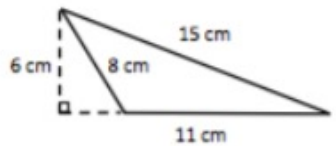
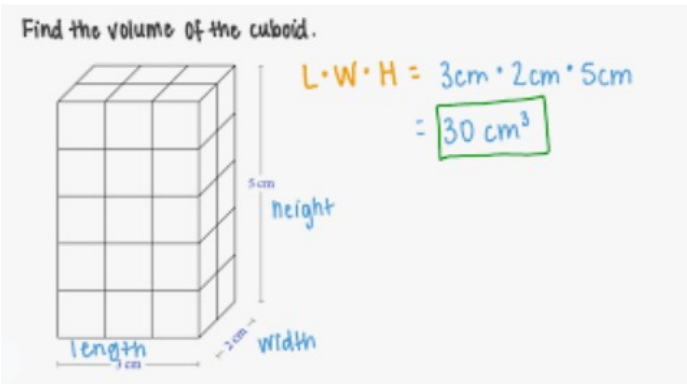
Unit 6: Reasoning with Measures

Perimeter

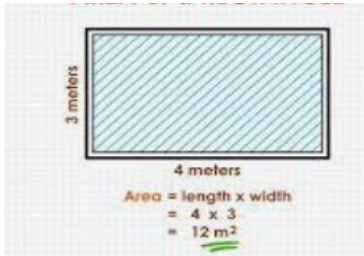


8+15+11 = 34cm

Volume

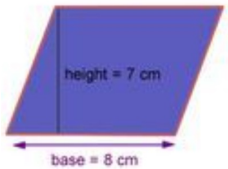


Area



The area of a Parallelogram equals the base times the height.

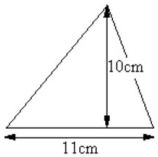
A = b x h



A = b x h
A = 8 x 7
A = 56 cm²

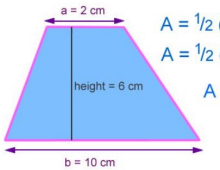
$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{perpendicular height}$$

$$= \frac{1}{2} \times 11 \times 10 = 55 \text{ cm}^2$$



The area of a Trapezium equals half the sum of the parallel sides, times the height between them.

A = ½ (a + b) x h



A = ½ (a + b) x h
A = ½ (2 + 10) x 6
A = 36 cm²

Key Words

Perimeter – the distance around the shape

Area - The amount of space inside a 2D shape

Volume – the amount of space inside a 3D shape

Composite – made up of more than one

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Clip Numbers

548 - 552, 554-559, 568-569

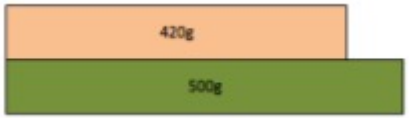
MATHEMATICS DEPARTMENT

Unit 7: Discovering Equivalence

Representing fractions

$\frac{4}{6}$

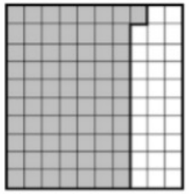
One quantity as a fraction or percentage of another



$$\frac{420}{500} = \frac{42}{50} = \frac{21}{25}$$

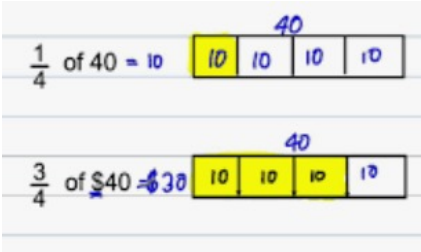
$$\text{Or } \frac{420}{500} = \frac{84}{100} = 84\%$$

Representing percentages

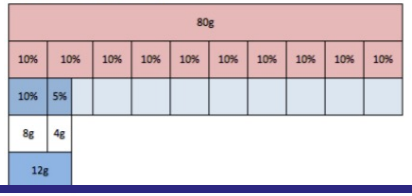


71%

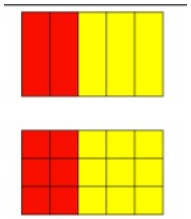
Fractions of an amount



Percentage of an amount

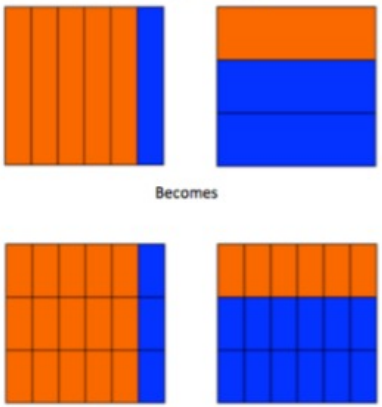


Equivalent fractions



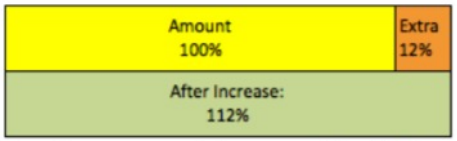
$$\frac{2}{5} = \frac{6}{15}$$

Comparing fractions

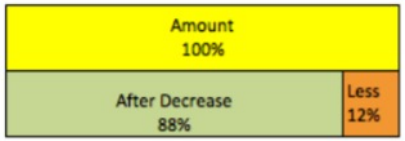


Percentage Changes

For example: Here is an amount increased by 12%



Here is an amount decreased by 12%



Key Words

Numerator: The top number in the fraction

Denominator - the bottom number in a fraction

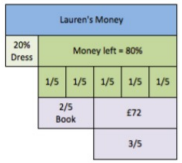
Convert – change

Multiplier - what we multiply by to find a percentage increase or decrease.

Integer – whole number

Word problems

Example: Lauren spent 20% of her money on a dress. She spent 2/5 of the remainder on a book. She had £72 left. How much money did she have at first?



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Clip Numbers

58-64, 84-90

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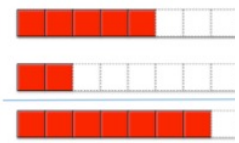
Unit 8: Reasoning with Fractions

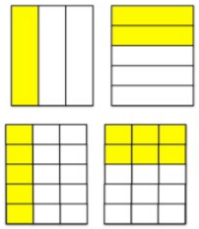
Add and subtract fractions

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



or 7/8 in total

$\frac{1}{3}+\frac{2}{5}$

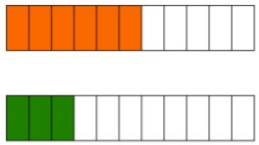


Multiplying fractions

For example, $\frac{9}{10}\times\frac{1}{3}$ is the same as asking what is one third of nine tenths

Dividing fractions

For example, $\frac{6}{11}\div 2=\frac{3}{11}$



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Clip Numbers

64-69, 351-352

Probability in words

The likelihood of an event can be described using words such as "certain, impossible, likely, unlikely, even chance". The probabilities can then be ordered by likelihood.

Probability scale

Probability is **always** on a scale from 0 to 1. 0 is impossible and 1 is certain.

Theoretical probability

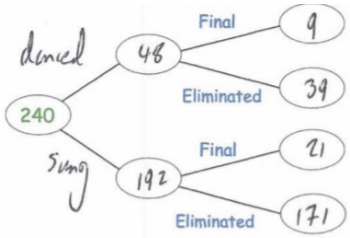
Probability of an event = $\frac{number\ of\ favourable\ outomes}{number\ of\ possible\ outcomes}$

Outcomes

240 acts took part in a talent show.

20% of the acts danced and the rest sang.
30 acts made it through to the final.
21 of the acts in the final sang.

Show this information on a frequency tree.



The probability of being eliminated after dancing is $\frac{39}{240}$

Key Words

Unit fraction: A fraction with 1 on the numerator

Mixed number: A number made up of an integer and a fraction

Improper fraction: Where the numerator is higher than the denominator

Proper fraction: When the numerator is less than the denominator

Probability – the chance of an event occurring

Theoretical probability – the number of ways an event could occur divide by the amount of possible events

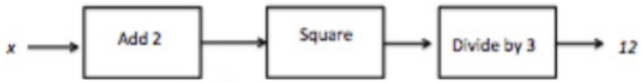
Frequency tree – a visual way of showing frequencies of events

MATHEMATICS DEPARTMENT

Unit 9: Solving Problems with Number

Read/Write Equations

Converting sequences of operations into function machines and hence into equations



This would become $\frac{(x+2)^2}{3} = 12$

Using <, > and = signs

< means less than so we can write 2 < 5
> means greater than so we could write 32 + 5 > 8 + 3

If x < 3, then that means that x could be any number less than 3 – so it could be -1, 2 or 1.81216. It could literally be **any** number less than 3.

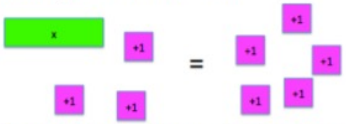
Equations with brackets

Example: $3(x+2) = -3$

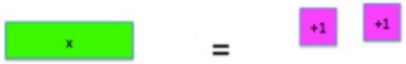
Solving equations

One step equations

Example 2: $x + 3 = 5$



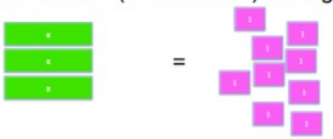
Now remove three +1 tiles from each side to leave $x = 2$



Two step equations

For example, to solve $3x + 1 = 10$

The only thing that can be done on both sides initially is to remove a 1 (or subtract 1). This gives us $3x = 9$



We can now share out the tiles evenly (using an array) to see the value of x. Here $x = 3$

Key Words

Equation – a statement that shows two expressions are equal

Function Machine – a way of writing math rules using a flow diagram

Equations with division

Using a bar model to represent the equation first to help deduce the operations to undo it.

For example, to solve $\frac{x}{3} + 4 = 7$

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Clip Numbers

151 - 155, 177-182

MATHEMATICS DEPARTMENT

Unit 10: Investigating Statistics

Mean, Median, Mode and Range

"Hey diddle diddle,
The median's the middle,
You add then divide for the mean,
The mode is the one you see the most
And the range is the difference between"

Pictograms

Pictograms must have categories, frequencies and a key.

Team	Number of house points
Diamond	★★½
Ruby	★★★
Sapphire	★★★½
Emerald	★★½

Key
★ = 8 points

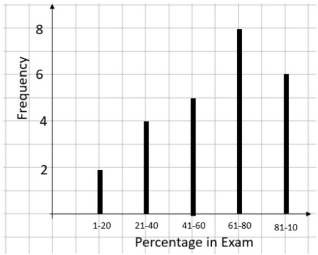
hegartymaths

Clip Numbers
404-410, 425-429

Vertical line charts

Vertical line charts make it easy to read averages such as the mode.

The scores for a class in a maths test are shown below:



Pie Charts

To construct pie charts we need to first calculate the angles of each category.

Treatment	Clients	Degrees
Manicure	24	24 × 6 = 144°
Pedicure	16	16 × 6 = 96°
Massage	15	15 × 6 = 90°
Eyebrows	5	5 × 6 = 30°

Key Words

Numerical data – data involving numbers

Categorical data – data involving words

Discrete data – can be counted

Continuous data – can be measured

Primary data – collected by the researcher

Secondary data – data collected by someone else.

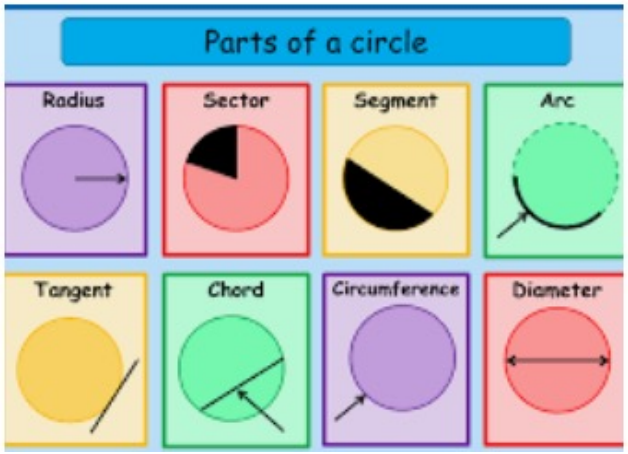
MATHEMATICS DEPARTMENT

Unit 11: Visualising Shape

Measurement

Use rulers and protractors to accurately measure the lengths of lines and sizes of angles. This means measuring to the nearest mm as well as being able to measure acute, obtuse and reflex angles.

Circles

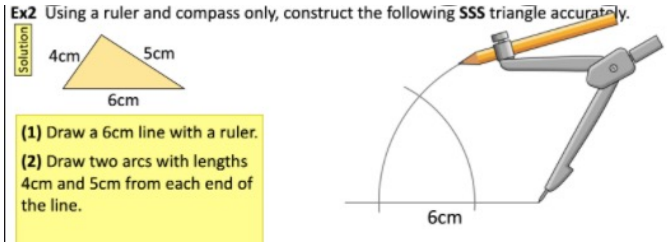


hegartymaths

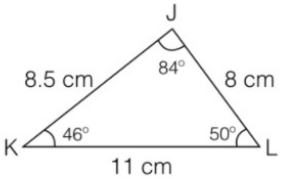
Clip Numbers

455-461, 683

Construct SSS triangles



Labelling



Write down:

(a) the length of KL
(b) the length of JK
(c) the length of JL
(d) the size of ∠JKL
(e) the size of ∠JLK
(f) the size of ∠KJL

a) 11cm
b) 8.5cm
c) 8cm
d) 46°
e) 50°
f) 84°

Key Words

Centre: The middle

Radius: the length from the centre of the circle to the outside of the circle

Diameter: the length from one side of the circle to the other, passing through the centre.

Circumference – the distance round the outside of the circle – the perimeter of the circle

Chord – A line from one side of the circle to the other, not passing through the centre.

Arc – part of the circumference

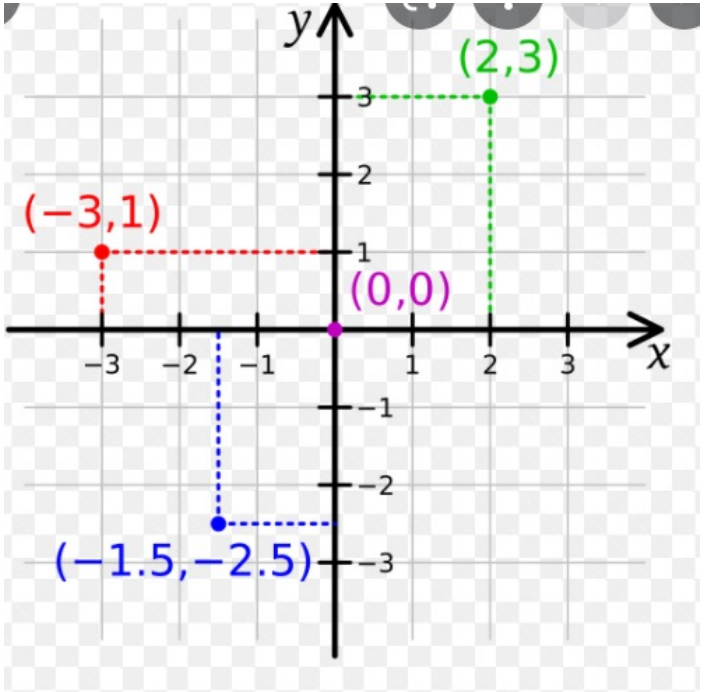
Sector – a section of the circle enclosed by two radii

Segment – a region enclosed by a chord and an arc.

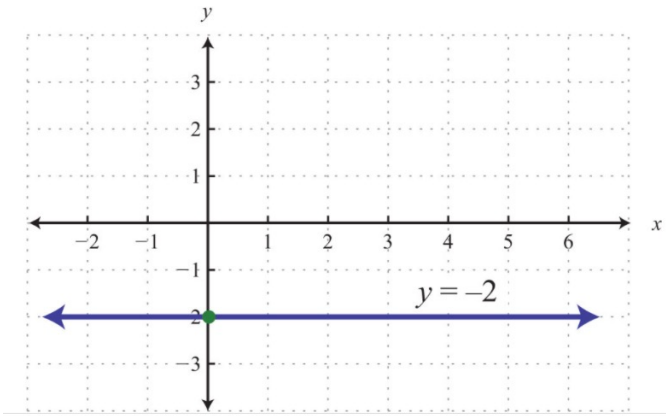
MATHEMATICS DEPARTMENT

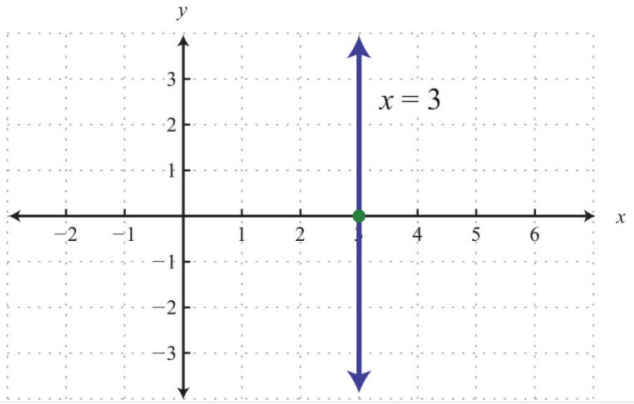
Unit 12: Exploring Change

Coordinates



Lines





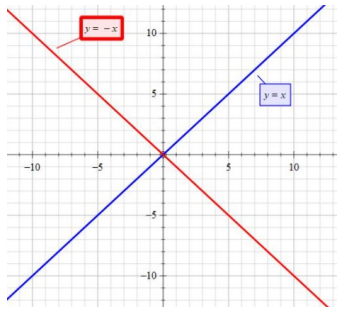
Key Words

Coordinate – numbers that indicate a position of a point on a graph

X-axis – the horizontal axis

Y-axis -the vertical axis

Origin – the coordinate (0,0)



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Unit 13: Proportional Reasoning

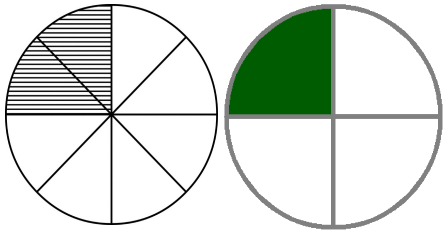
Proportion

Shaded : Unshaded

2 parts → 2:6 ← 6 parts

=

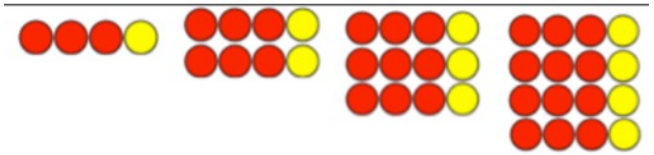
1:3



Writing as a fraction:

$\frac{1}{4}$ shaded, $\frac{3}{4}$ unshaded

These all show the ratio 3:1 as there is 3 red circles to 1 yellow circle.



Dividing a quantity in a given ratio

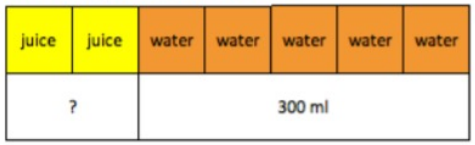
Use a bar model to represent and solve ratio and sharing problems. For example, if you are sharing £50 in the ratio 2:3. Then the 2 parts and the 3 parts together represent the £50.

Each 'part' 

rth £10. So 2 parts is £20 and 3 parts £30 giving a final answer of £20:£30

Solving problems

Example: *The ratio of juice to water in a recipe is 2:5. Elena has 300ml of water, how much juice is needed?* can be represented like this:



If the 300ml represents 5 parts the 1 part would be 60ml.
Then 2 parts is 120ml. So there is 120ml juice.

Key Words

Ratio: Relationship between two numbers.
Part: This is the numeric value '1' of, would be equivalent to.
Simplify: Divide both parts of a ratio by the same number.
Equivalent: Equal in value.
Convert: Change from one form to another.

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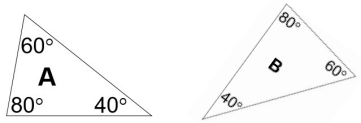
Unit 14: Describing Position

Key Concept

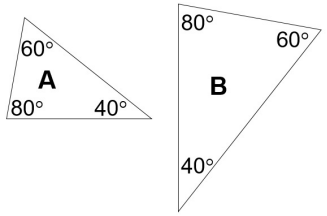
Properties of congruent shapes:

- The shapes will be exactly the same shape and size

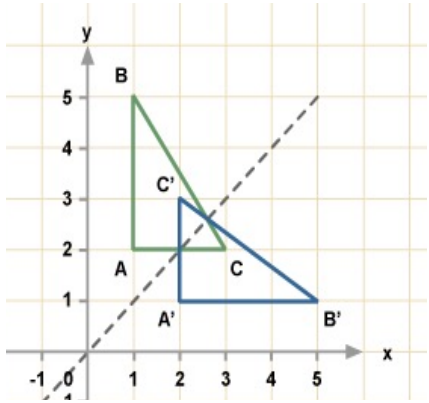


Properties of similar shapes:

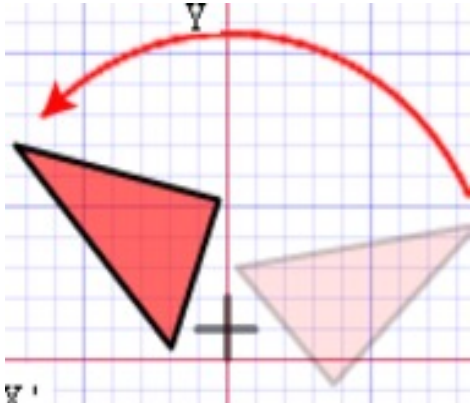
- The corresponding angles will be the same if shapes are similar.
- Corresponding edges must remain in proportion.



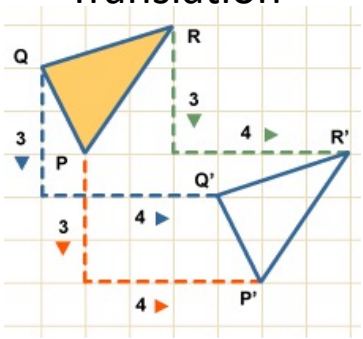
Reflection



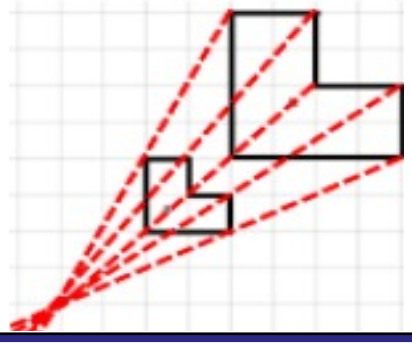
Rotation



Translation



Enlargement



Key Words

Transformation: This means something about the shape has 'changed'.
Reflection: A shape has been flipped.
Rotation: A shape has been turned.
Translation: A movement of a shape.
Enlargement: A change in size, either bigger or smaller.
Congruent: These shapes are exactly the same shape and same size but can be in any orientation.
Similar: Two shapes are mathematically similar if one is an enlargement of the other.

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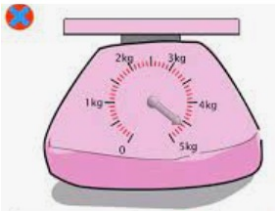
Unit 15: Measuring and Estimating

Measure

Measure, read and record data using standard units of length, mass, time and money.



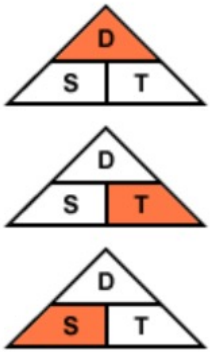
Estimate

Rounding each number to 1 s.f. can be used to help you **estimate** answers to difficult calculations. e.g.

$$\frac{5.38\times99.3}{19.246} \approx \frac{5\times100}{20}$$

$$= \frac{500}{20} = 25$$

Speed



Distance = Speed x Time

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Converting Mass

1 tonne = 1000kg

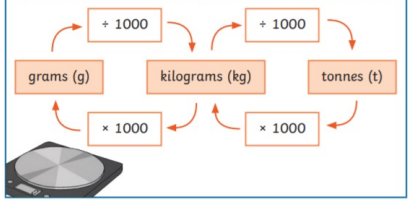
1000g = 1kg

$\frac{1}{10}$ kg = 0.1kg = 100g

$\frac{1}{4}$ kg = 0.25kg = 250g

$\frac{1}{2}$ kg = 0.5kg = 500g

$\frac{3}{4}$ kg = 0.75 = 750g



Converting Capacity

1000ml = 1l

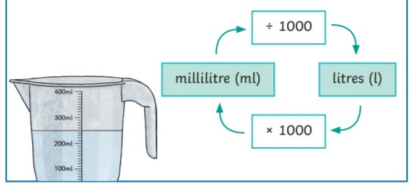
$\frac{1}{10}$ l = 0.1l = 100ml

$\frac{1}{4}$ l = 0.25l = 250ml

$\frac{1}{2}$ l = 0.5l = 500ml

$\frac{3}{4}$ l = 0.75l = 750ml

$\frac{1}{100}$ l = 0.01l = 10ml



Converting Length

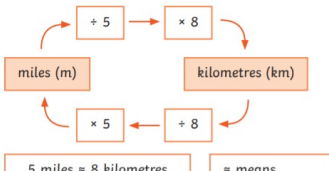
1000m = 1km

100cm = 1m

10mm = 1cm

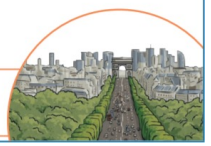
Miles to Kilometres

You might measure the length of a road or the distance between two cities in miles or kilometres.



5 miles ≈ 8 kilometres

≈ means approximately equal to



Key Words

Estimate – roughly calculate the value

Units – a type of measurement

Centi – 100

Kilo – 1000

Compound measures – measures that involve two or more different units

Rate of change – How one quantity changes in relation to another quantity

Capacity – the maximum amount that something can contain

Mass - How much matter is in an object

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