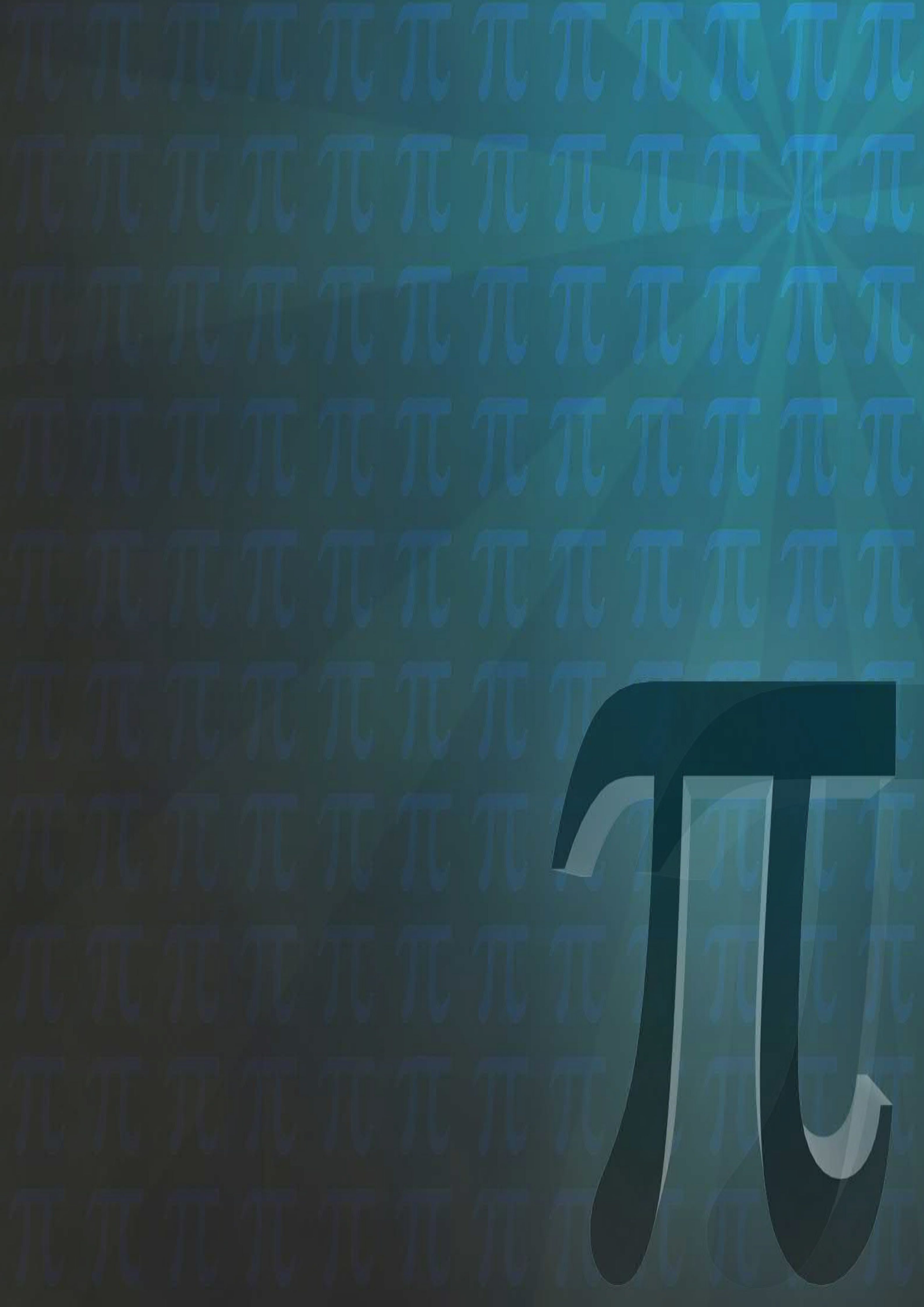
Exmouth Community College

KS4 Knowledge Organisers

MATHEMATICS

Units 1 - 10

FOUNDATION



Unit 1 Foundation Number

BIDMAS is the acronym to give the priority of operations:
Brackets, **Indices** (powers and roots), **Division** AND **Multiplication**, **Addition** AND **Subtraction**
Do anything in brackets first, then any indices, then, from left to right, and divisions or multiplications, then, from left to right, any additions or subtractions.
Video 211 - https://tinyurl.com/y98jn4wk

= means equals

≠ means not equals

≈ means roughly equals

A **function** is a rule that acts on a number. Eg) x2 (times 2)

An **inverse function** reverses the effect of a function

+ and – are inverse operations

x and ÷ are inverse operations

Key Points:

https://tinyurl.com/y7zu77l9

Squaring a number means multiplying it by itself. The result is a **square number**, e.g. $4^2 = 4 \times 4 = 16$ which is a square number
Video 226 - https://tinyurl.com/ya4v48rn
Cubing a number means multiplying it by itself twice. The result is a **cube number**, e.g. $4^3 = 4 \times 4 \times 4 = 64$ which is a cube number
Video 212 - https://tinyurl.com/ydd72o3d
The **square root** of a number is the number you must square to get the original number. It is the inverse of squaring $\sqrt{16} = 4$
Video 228 - https://tinyurl.com/yc28q7lv
The **cube root** of a number is the number you must cube to get the original number. It is the inverse of cubing, e.g. $\sqrt[3]{64} = 4$
Video 214 - https://tinyurl.com/y9q9m7nb

A prime number has two factors, itself and 1, – e.g. 2, 3, 5, 7, 11, 13, 17, 19, 23…
Video 225 - https://tinyurl.com/ybnk7z5n

To multiply powers of the same number, add the indices, e.g. $4^3 \times 4^8 = 4^{11}$
To divide powers of the same number, subtract the indices, e.g. $4^8 \div 4^3 = 4^5$
Video 174 - https://tinyurl.com/za9u7h2

Knowledge Check:

https://tinyurl.com/ya7obwjs

Rounding is where you approximate a number to make it more manageable.
If we round to decimal places, we get rid of all digits after the required decimal place. The final decimal place goes up by one if the first digit we ignore is 5 or more, e.g. 4.597 = 4.6 (1 d.p.)
Video 278 - https://tinyurl.com/y9x7ltoh
If we round to significant figures, we get rid of all digits after the required digits from the left (ignoring leading zeros). The final digit goes up by one if the first digit we ignore is 5 or more, e.g. 0.0465 = 0.047 (2 s.f.)
Video 279a - https://tinyurl.com/yakhqfup
To estimate we round all numbers in a calculation to 1 significant figure (1 s.f.).

A **factor** is a number you can multiply by to get a desired number, e.g. 2 is a factor of 8
Video 117 - https://tinyurl.com/zymmfev
A **multiple** is a number you can divide by an integer to get a desired number. Eg) 16 is a multiple of 8
Video 220 - https://tinyurl.com/yaudfco3
Highest Common Factor (**HCF**) is the highest factor that is common to two or more numbers, e.g. 4 is the HCF of 8 and 12
Video 219 - https://tinyurl.com/zel3pzq
Lowest Common Multiple (**LCM**) is the lowest multiple that is common to two or more numbers, e.g. 24 is the LCM of 8 and 12
Video 218 - https://tinyurl.com/y8hg8z35

Unit 2 Foundation Algebra

A term is a number, a letter, or a number and a letter multiplied together, e.g. 3, a, 2b, $4c^2$

Video 19 - https://tinyurl.com/hgw9ulw

Letters represent variables; the value can vary. Like terms contain the same letters or power of letters, or are just numbers, e.g. 3 and 4, 3a and 6a, b^3 and $2b^3$

To simplify an expression we can collect like terms, e.g. 3a + 2 + 4a = 7a + 2

Video 9 - https://tinyurl.com/z77lutd

We can also simplify multiplications by removing the multiplication symbol and divisions by making into a fraction, e.g. 2 x a = 2a, c ÷ d = c/d or

If we have an expression or equation and are given the value of a variable, we can substitute this value in, e.g. 3a+ b = c where a = 2 becomes 6 + b = c

Video 20 - https://tinyurl.com/zd6tv9j

A **formula** shows the relationship between terms, e.g. 4a + b = c

An **expression** is a collection of terms, e.g. 2a + 1

An **equation** is an expression equalling another,

e.g. 3b + 2 **=** 2d

An **inequality** is where two expressions don't, or don't necessarily, equal each other (**<**, **>**, **≤**, **≥**), e.g. 4f > 6

An **identity** is two expressions that always equal each other, regardless of the variables, e.g. 2(a + 5) **≡** 2a + 10

A **not equal** symbol shows that two expressions do not equal each other, e.g. 2a **≠** b

Video 16 - https://tinyurl.com/j5cdu68

To multiply terms, multiply any numbers, put non-like terms next to each other, and add powers of like terms, e.g. 2a x 3a x 4b = $24a^2b$

Video 18 - https://tinyurl.com/ybaxlv6k

To multiply the same variable with powers, add the indices, e.g. $2a^2$ x $4a^3$ = $8a^5$

To divide the same variable with powers, subtract the indices, e.g. $8a^5$ ÷ $2a^3$ = $4a^2$

Video 11 - https://tinyurl.com/ycvjot5b

To **expand brackets**, multiply the terms in the brackets by the multiplier, e.g. 5(a + 2) = 5 x a + 5 x 2 = 5a +10

Video 13 - https://tinyurl.com/hepjutn

To expand **double brackets**, multiply every term in on bracket by every term in the other, e.g. (a + b)(c + d) = a x c + a x d + b x c + b x d = ac + ad + bc + bd

Video 14 - https://tinyurl.com/ycptvous

To **factorise** expressions we reverse the expansion of brackets. We do this by dividing through by the **HCF** (highest common factor) and putting the HCF as the multiplier outside the brackets, e.g. 5a + 10b = 5(a + 2b)

Video 117 - https://tinyurl.com/zymmfev

To rearrange an equation (or inequality), always do the same to both sides of the equation and use the opposite operator to remove a term, e.g. a + 2b = c [- a]

2b = c – a [÷ 2]

$$b = \frac{c-a}{2}$$

We use this to change the subject of a formula.

Video 110 - https://tinyurl.com/y866296z

Key Points:

https://tinyurl.com/y9j5u8ws

Knowledge Check:

https://tinyurl.com/yb8a3eto

Graphs Tables and Charts (Unit 3 Foundation)

Frequency Tables

These are a useful and clear way of displaying data,
e.g. the table below shows the scores out of ten for 20 students.

Mark	Tally	Frequency
4	||	2
5	||	2
6	||||	4
7	𝍸	5
8	||||	4
9	||	2
10	|	1

Frequency means how often something occurs.

This means 5 students scored 7 marks in their test.

Grouped Frequency Tables

These contain sorted data in groups called **classes**,
e.g. the table below shows the ages of people taking swimming lessons.

Class Interval	Frequency
15 – 25	60
25 – 35	35
35 – 45	22
45 – 55	18
55 – 65	15

Total frequency will tell you the total number of people taking swimming lessons.

This means 18 people who took swimming lessons were between the ages of 45 and 55.

Classes or class widths

Comparative Bar Charts

The table shows the number of cars sold by Kitty and George in the first four months of 2014.

Video 147
Video 148

	January	February	March	April
Kitty	2	5	13	10
George	4	7	9	10

The chart has a key to make it easier to understand.

A **comparative bar chart** allows you to easily compare the number of cars Kitty and George sold each month.

Two-Way Tables

Video 319

These are used to show how data falls into 2 different categor-ies, for example gender and favourite sport to watch.

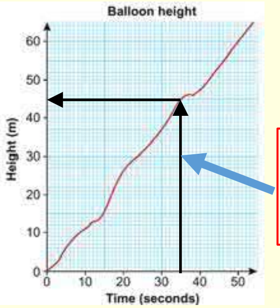
What is your favorite sport to watch on television?

	Football	Basketball	Baseball
Males	40	22	15
Females	12	16	45
Total	52	38	60

A two-way table divides data into groups in rows going across and columns going down the table.

Time-Series Graph

These are used to show how something changes over time. It is a line graph with time plotted along the horizontal axis
For example the height of a balloon at different times



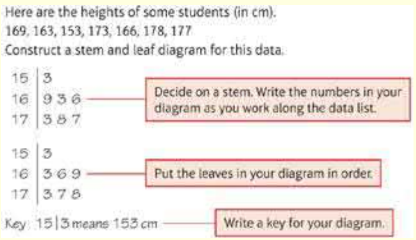
You can estimate the height of the balloon at different times using the graph

E.g. the height of the balloon at 35 seconds is approximately 45m as shown by the arrows on the graph

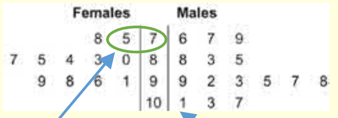
Stem and Leaf Diagrams

Video 169
Video 170

This shows numerical data split into a 'stem' and 'leaves'. The leaf is usually the last digit and the stem is the other digits.



A back-to-back stem and leaf diagram compares two sets of data, e.g. the ages of males and females.



5 | 7 means 75

10 | 1 means 101

Pie Charts

Video 163 - Drawing
Video 164 - Interpreting

This is a circle divided into **sectors.** Each sector represents a set of data.
Pie charts are excellent for displaying the most/ least popular type of something.

Plotting pie charts example

The table show the match results of a football team.

Result	Won	Drawn	Lost
Frequency	28	12	20

28 + 12 + 20 = 60

The total number of games is the total frequency.

1 game = 360° ÷ 60 games = 6° per game

360° in a circle

Work out the angle for **one** game.

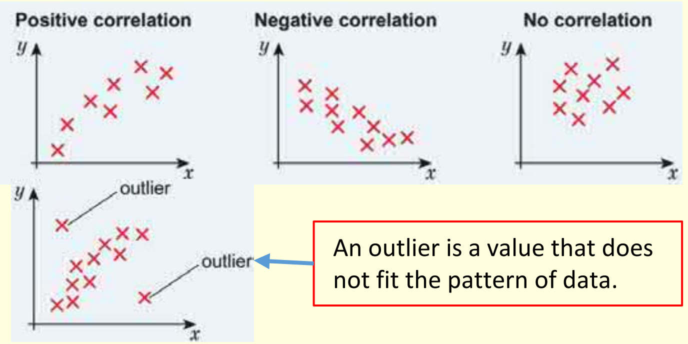
28 games won = 28 × 6° = 168°
12 games drawn = 12 × 6° = 72°
20 games lost = 20 × 6° = 120°

Work out the angle for each result.

Draw the pie chart. Give it a title and a key. Or label each section

Scatter Graphs

A scatter graph allows you to see the **relationship** between two sets of data, e.g. your height and your stride length. Correlation is used to describe a relationship between two **variables.**

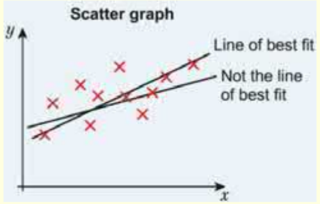


An outlier is a value that does not fit the pattern of data.

A line of best fit

Videos 165 - 168

This is a straight line drawn through the middle of the points on a scatter graph. It should pass as near as many points as possible and represents the **trend** of the points.



A line of best fit can be used to predict data values within the range of data given.
This is called **interpolation.**
It can also be used to predict data values outside the range of data given.
This is called **extrapolation.**

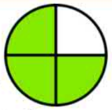
Unit 4 Foundation Fractions & Percentages

Corbett Maths video links: V142 V146 V234

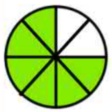
Fractions

The basics:

This pizza is ¾ shaded green



3 is the "numerator"
4 is the "denominator"



Notice that 6/8 is exactly the same amount.
(both numbers doubled)

Multiplying fractions:

Just multiply numerators, multiply denominators, and ***simplify*** if possible

$$\frac{2}{4} \times \frac{2}{4} = \frac{4}{16} \underset{\div 4}{\overset{\div 4}{=}} \frac{1}{4}$$

Simplifying involves dividing numerator and denominator by their HCF

...HCF is the Highest Common Factor

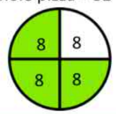
Fractions of amounts:

Use simpler fractions to find the fraction you actually want:

Eg. ¾ of 32: ¼ of 32 = 32 ÷ 4 = 8
so ¾ of 32 = 8 x 3 = 24

Divide by the denominator, Then multiply by the numerator

In this example, a whole pizza = 32



Simplifying fractions:

Divide numerator and denominator by HCF.
You should do this to any final answer fraction where possible.

Percentages of amounts

Calculator allowed?

Turn % into decimal (÷100) and "of" means "multiply".

e.g. 30% of £54 = 30 ÷100 x 54 = £16.20

e.g. 28% of £40 = 28 ÷100 x 40 = £11.20

Reverse percentages:

Use the logic of function machines, which can be run backwards.
You need to figure out the forwards multiplier first.

e.g. $30 dress reduced by 20%:

$30 → X 0.8 → $24

e.g. Sale price after 30% discount = £28

? → X 0.7 → £28

Original price £40 ← ÷ 0.8 ← £28

Calculator *not* allowed?

10% is your starting point.
10% means "a tenth of the amount"
(because 10% = 10/100 = 1/10)

You can work out all the other percentages you need by scaling up or down from 10%

e.g. 30% of £54?

10% = £5.40 (a tenth of 54 = 54/10)
20% = £10.80 (20% is double 10%)
30% = £16.20 (30% = 10% + 20%)

e.g. 28% of £40?

10% = £4

1% = 40p (divide 10% by 10)
2% = 80p (double 1%)
5% = £2 (half 10%)
20% = £8 (double 10%)

28% = these 4 added together, = £11.20

Fractions, decimals, percentages conversion

Example:

Fraction → (numerator ÷ denominator) → decimal → (X 100) → percentage

percentage → (÷ 100) → decimal → (Write as fraction out of 10, 100, or 1000, and simplify) → Fraction

Fraction 24/100 = 6/25
decimal 0.24
percentage 24%

Some examples:

1/10 =	10/100 =	0.1 =	10%
1/5 =	20/100 =	0.2 =	20%
3/10 =	30/100 =	0.3 =	30%
9/20 =	45/100 =	0.45 =	45%

People often assume a % cannot be over 100, but it can (just like a fraction can be improper* and a decimal can be over 1)

* top-heavy

Battenburg: adding

1. Draw the battenburg grid.
2. Put the fractions on the side, (left to right, top to bottom).
3. Eat the top left corner (cross it out).
4. Do the multiplications.
5. "**ADD** the peanut" (the yellow ones below).
6. Peanut answer is numerator, the remaining number is denominator.
7. Simplify the fraction, if possible.

$$\frac{1}{4} + \frac{1}{3} = \frac{7}{12}$$

	1	4
1	X	4
3	3	12

Divide top and bottom of fraction with the HCF that they share

Battenburg: subtracting

1. Draw the battenburg grid.
2. Put the fractions on the side, (left to right, top to bottom).
3. Eat the top left corner (cross it out).
4. Do the multiplications.
5. "**SUBTRACT** the peanut" (the yellow ones below).
6. Peanut answer is numerator, the remaining number is denominator.
7. Simplify the fraction, if possible.

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

	1	4
1	X	4
3	3	12

Divide top and bottom of fraction with the HCF that they share

Fractions:

To multiply fractions, just multiply numerators and denominators:

e.g. $\frac{2}{7} \times \frac{4}{5} = \frac{8}{35}$

To divide fractions, KFC (keep, flip, change)

e.g. $\frac{2}{7} \div \frac{4}{5} = \frac{2}{7} \times \frac{5}{4} = \frac{10}{28}$

simplify

Equations, Inequalities, Sequences (Unit 5 Foundation)

An **equation** contains an unknown number (letter) and an equals (=) sign.

You **solve** an equation by working out the value of the unknown.

Video 110 - https://tinyurl.com/y866296z

In an equation, both sides of the = sign have the same value (like balanced scales). As with balanced scales, the two sides remain equal if the same is done to both sides (**balancing method**).

In an equation with **brackets**, expand the brackets first.

To expand brackets, multiply everything within the brackets by any multiplier on the outside.

A **formula** is an equation with two or more **variables** (unknown numbers).

Values can be **substituted** into a formula to get results.

Video 113 - https://tinyurl.com/y76yatx2

Key Points:

https://tinyurl.com/y9cavj7r

An **integer** is a positive or negative whole number, or a zero.

< means **less than** (the thing on the left is less than the thing on the right)

> means **greater than** (left side greater than right side)

≤ means **less than or equal to** (like less than, but the two sides might be equal)

≥ means **greater than or equal to** (like greater than but the two sides might be equal)

Video 176 - https://tinyurl.com/y7py6cf9

You **MUST** do the **SAME** to **BOTH** sides of an equation or inequality
Video 178 - https://tinyurl.com/hkxkrvk

Inequalities can be shown on number lines with empty circles (for less than or greater than) or filled circles (if value could be equal) and arrows in correct direction.
Video 177 - https://tinyurl.com/y72g4v69

Knowledge Check:

https://tinyurl.com/y96fhs9v

Sequences are patterns of numbers that follow a rule.

The numbers in a sequence are called **terms**.

Video 286 - https://tinyurl.com/ydaj355k

The **term-to-term** rule describes how to get from one term to the next.

Video 287 - https://tinyurl.com/y7mp8hdf

The ***nth*** term of a sequence is how to work out the term given its position (n) in the sequence.

Video 288 - https://tinyurl.com/hs9qnsx

The ***nth*** term is sometimes called the **general term** of a sequence.

In a **linear sequence** (same difference between each pair of terms) the nth term is found by multiplying the position by the difference between the first and second terms, then adding or subtracting a constant to make the output when $n = 1$ actually equal the first term.

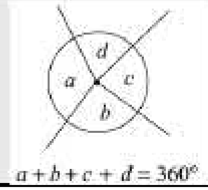
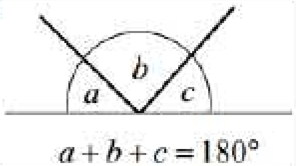
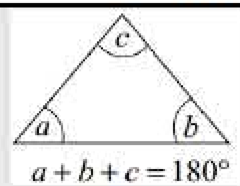
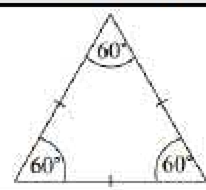
As with all mathematical calculations, please remember to use **BIDMAS**:

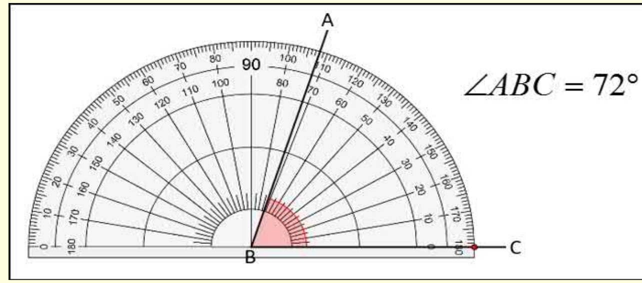
Brackets then **Indices** then **Division & Multiplication** then **Addition & Subtraction**

Video 211 - https://tinyurl.com/y98jn4wk

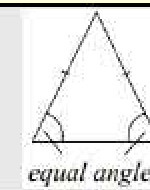
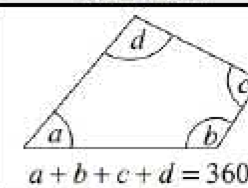
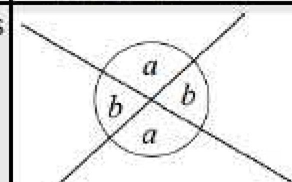
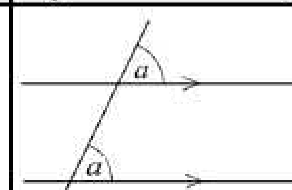
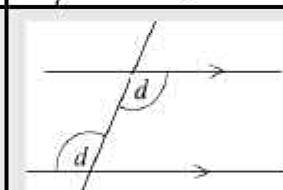
ANGLES (Unit 6 Foundation)

Exmouth Community College
Academy Trust

Angles at a point add up to 360°.	
Angles on a straight line add up to 180°.	
The interior angles in any triangle add up to 180°.	
The interior angles in an equilateral triangle are all 60°.	



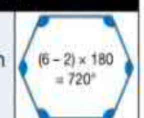
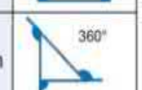
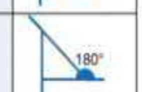
Videos	
Names of angles	V38
Angles in a triangle	v37
Angles on a line/ around a point	V35 V30
Angles and parallel lines	V25
Properties of special triangles	V327

An isosceles triangle has two angles of the same size.	
The interior angles in any quadrilateral add up to 360°.	
When two straight lines intersect, the opposite angles are equal.	
When a straight line intersects a pair of parallel lines, the **corresponding angles** are equal.	
When a straight line intersects a pair of parallel lines, the **alternate angles** are equal.	

Angle	**Vertically opposite**
Alternate	**Perpendicular**
Supplementary Co-interior	**Parallel lines**
Acute/Obtuse/ Reflex	**corresponding**

Key facts to memorise- polygon angle facts

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

Polygon angle facts	
Sum of interior angles in a polygon with n sides = (n − 2) × 180	
Sum of exterior angles in a polygon = 360°	
Interior angle + exterior angle = 180°	

Averages and Range (Unit 7 Foundation)

Mean, Median, Mode and Range

MEAN

$$\frac{\textit{Sum of all values}}{\textit{Number of values}}$$

video

MEDIAN

Middle value when numbers are placed in order

video

MODE

Most Common

video

RANGE

Largest value – smallest value

video

Practice:
Find the mean, median, mode and range of the following set of numbers

1, 3, 2, 8, 7, 9, 5, 4, 10, 2, 4,

Challenge Question

12	6	15	?

The mean of these 4 cards is 10, what is the missing number?

Mean from frequency table video

Averages and Range from a Frequency table

20 students scored goals for the school hockey team last month.
The table gives information about the number of goals they scored.

Goals scored	Number of students	Goals scored x no. of students
1	9	1 x 9 = 9
2	3	2 x 3 = 6
3	5	3 x 5 = 15
4	3	4 x 3 = 12
	20 students	42 goals scored

This means 9 students each scored 1 goal

Add a totals row to work out the total number of students and total goals scored

Add an extra column to work out the number of goals scored

Mean = Total number of goals scored divided by the number of students
= 42 ÷ 20 = 2.1 goals per student

Mode = Most common number of goals scored
= 1 (as 9 students scored 1 goal which is more than any other number of goals)

Median = The number in the middle = 2
If I wrote the goals scored by each student as a list it would look like:

$$\underbrace{1, 1, 1, 1, 1, 1, 1, 1, 1}_{\text{9 students scored 1 goal each}}, 2, 2, 2, 3, 3, 3, 3, 3, \underbrace{4, 4, 4}_{\text{3 students scored 4 goals each}}$$

The **median** is the middle number now that they are in order.

Range of the number of goals scored = 4 – 1 = 3

video

Stem and leaf Diagrams

This stem and leaf diagram shows the times, in seconds, for a group of swimmers to swim 100 m.
Find the median and the mode.

55	2	3	6			
56	3	3	7	8		
57	0	2	6	6	6	7
58	4	4	5			
59	3					

Key
55|2 means 55.2 seconds

Count the number of values; 17.

The median is the $\frac{n+1}{2}$th value.
There are 17 values, so $n = 17$.

$\frac{17+1}{2} = 9$

The median is the 9th value.

In a stem and leaf diagram the data is in order. So count up to the 9th value.

The median is 57.2 seconds.

Look for repeated values in the rows.
57| 0 2 **6** **6** **6** 7

The mode is 57.6 seconds.

Estimating the mean from a grouped frequency table

Estimated mean video

The table represents the scores of 30 students in a Maths test:

Our data has been grouped into classes

Score	Frequency
1–5	5
6–10	6
11–15	9
16–20	10

Work out an estimate for the mean.

Add a column to calculate the midpoint of each class. Use this as an estimate of the scores, because you don't know the exact values in each class

Score	Frequency, f	Midpoint of class, m	$m \times f$
1–5	5	3	15
6–10	6	8	48
11–15	9	13	117
16–20	10	18	180
Total	30	Total	360

Add a column, $m \times f$, to calculate an estimate of the total score for each class.

Estimate of mean $= \frac{360}{30} = 12$

Divide the total of the $m \times f$ column by the total frequency.

This is only an *ESTIMATE* for the mean as we are estimating the scores of the students by using the mid-point.

Practice Question:

Real In a survey, 30 small companies were asked how many employees they had. This table shows the results.

Number of employees	Frequency, f	Midpoint of class, m	$m \times f$
1–5	12		
6–10	7		
11–15	6		
16-20	5		
Total		Total	

Calculate an estimate for the mean number of employees per company.

Perimeter, Area and Volume

(Unit 8 Foundation)

VIDEOS: V44 V45 V49 V40 V355

Perimeter

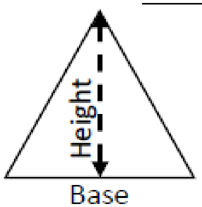
Is the distance round the edges of the shape

P = 5+4+5+4=18cm

Area

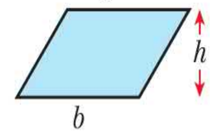
Is the inside of a shape.

Area of **Rectangle** = length × width

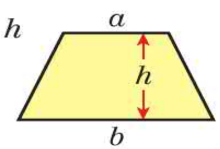


Area of **Triangle** = $\frac{1}{2}$ × base × height

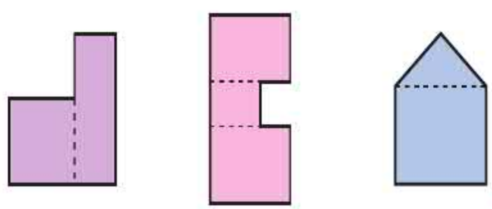
Area of a parallelogram = base × vertical height
$= b \times h$



Area of trapezium $= \frac{1}{2} \times (a + b) \times h$

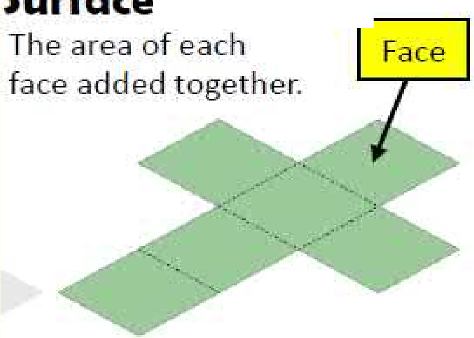


To find the area of a **compound shape**, draw lines to split the shape into simple shapes. Find the area of each shape separately. Add to find the total area.



Surface

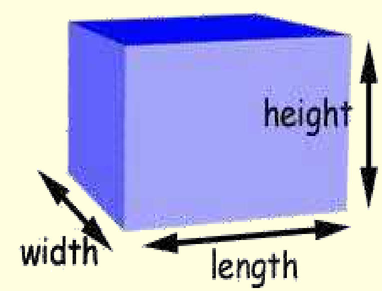
The area of each face added together.



Net of a cube

Volume

volume = length x width x height



The **volume** of a 3D solid is the amount of space it takes up. Volume is measured in mm^3, cm^3 or m^3.

Volume of a prism = area of cross-section × length

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Graphs (Unit 9 Foundation)

Co-ordinates

These are given in the form (X,Y). We go along the x axis and up or down the y axis.

Y intercept

This is the point where the line crosses the y axis. On the example the y intercept = +2

Gradient

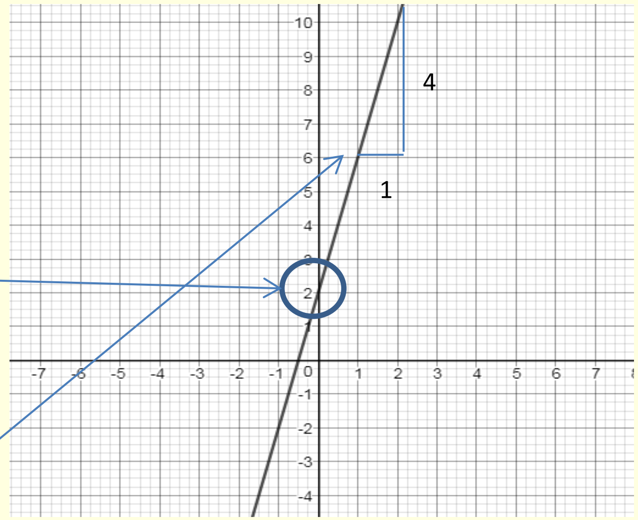
The steepness of a graph is called the **GRADIENT.** You can find the gradient by :

$$\frac{\text{Squares up or down}}{\text{Squares across}}$$

$\frac{4}{1}$

Gradient + 4

Gradient can be positive (/) or negative (\)



$Y = mx + c$

Gradient Y intercept

You can use the gradient and y intercept to write an equation for a line.
Equation for above line is y = 4x+ 2

Parallel Lines have the same gradient but a different y intercept. For example a parallel line for the above graph would be y = 4x – 3

Mid points is the point exactly in the middle. To find the coordinates add the x coordinates together and divide by 2 and do the same for the y coordinates.

Table of Values/ Plotting graphs

To find the coordinates of a straight line you can use a table of values.
Firstly create a function machine

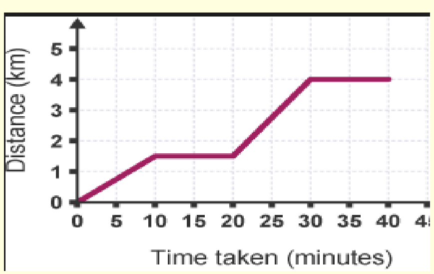
X → X4 → +2 → Y

Then input numbers from the x axis to find the y axis.
These create coordinates which you can then plot onto the graph and join up with a ruler.

X	0	1	2	3
Y	2	6	10	14

Distance time graphs

Represents a journey. The vertical axis represents the distance from starting point. The horizontal line represents time taken.
A horizontal line on a distance time graph represents an object at rest.
The gradient of the line represents the speed of the journey



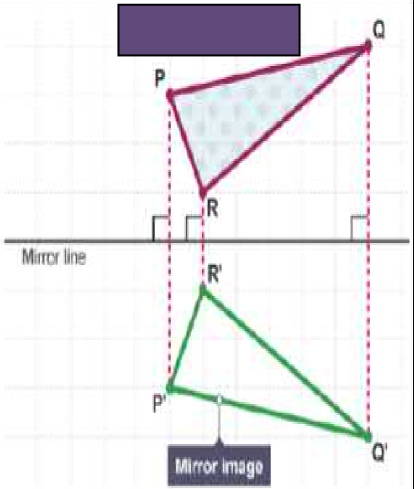
Transformations (Unit 10 Foundation)

Reflection

Every point in the image is the same distance from the mirror line as the original shape.

The line joining a point on the original shape to the same point on the image is perpendicular to the mirror line.

A reflection creates a congruent image



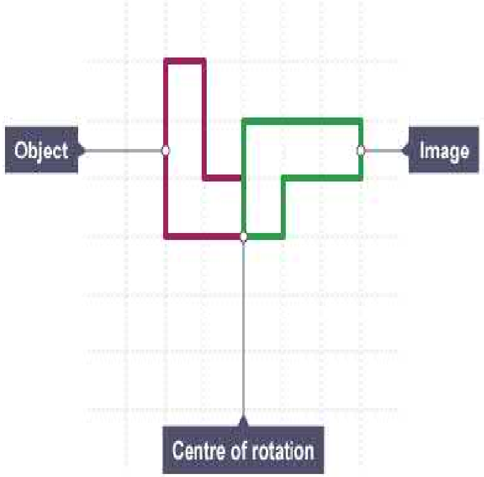
Rotation

Rotation turns a shape around a fixed point called the **centre of rotation**.

3 parts of a rotation

- the centre of rotation
- the angle of rotation
- the direction of rotation

A Rotation creates a congruent image



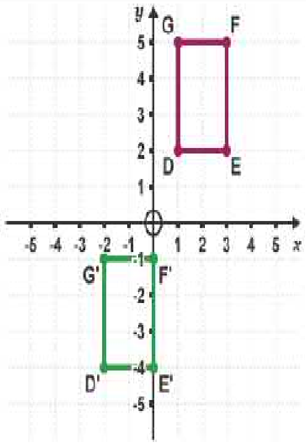
Translation

A **translation** moves a shape up, down or from side to side and creates a congruent image.

Column vectors are used to describe translations

$\begin{pmatrix}4\\-3\end{pmatrix}$ means translate the shape 4 squares to the right and 3 squares down.

$\begin{pmatrix}-2\\1\end{pmatrix}$ means translate the shape 2 squares to the left and 1 square up.



$\begin{pmatrix}-3\\-6\end{pmatrix}$

Enlargement

Enlarging a shape changes its size

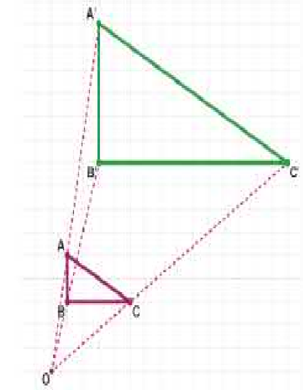
2 parts of an enlargement

- the scale factor
- the centre of enlargement

Fractional SF reduces the shape

Negative SF inverts the shape

An enlargement creates a similar shape



ABC has been enlarged by sf 3 about O.

Linked Prior Topics

Shapes

Scales

Angles

Straight line graphs

Vocabulary

Object – Starting shape

Image – Created by a transformation

Congruent – 2 shapes are exactly the same

Similar – 2 shapes with the same angles but different length sides

Perpendicular – Forms a 90º angle

Linked Future Topics

Transformation of functions

Similar shapes

Unit 11 Foundation Ratio & Proportion

RATIO

This is used to compare two or more amounts

Always draw boxes when dealing with ratio!

Writing a Ratio

The amount of one object compared with another. Eg there are 2 triangles to 5 squares

2:5

Simplifying a Ratio [Video 269]

You simplify a ratio by dividing the numbers by the HCF (Highest Common Factor)

Simplify 6:12

Divide both by 6

1:2

Simplify 3:9:15

Divide all numbers by 3

1:3:5

Simplify 6:1.5

Multiply both sides by 2

12:3

Divide both sides by 3

4:1

Sharing an Amount in a Ratio

[Video 270]

Mr Musson and Mr Coren get **£72** pocket money. They share it in the ratio **5:3**.

Draw a total of 8 boxes (5 + 3 = 8)

Split the money evenly between each box ($72 \div 8 = 9$)

Mr Musson gets 5 boxes = $5 \times 9 = £45$

Mr Coren gets 3 boxes = $3 \times 9 = £27$

£45 for Mr Musson £27 for Mr Coren

9	9	9	9	9	9	9	9

£72 in total

Writing in the Ratio 1:n

You need to divide **both** sides by the **same** amount until the correct number is down to 1

Write **7:21** in the ratio **1:n**

7:21

$\div 7$ $\div 7$

1:3

PROPORTION

Proportion compares a part with a whole

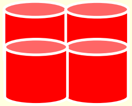
[Video 210]

Best Buy

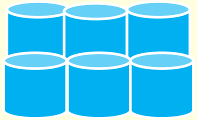
Video

This is about finding which item is better ***value for money***

Example 1



A pack of 4 tins of baked beans cost £1.96



A pack of 6 tins of baked beans cost £3

*Hint: Find the cost of **one** tin from each pack*

$£1.96 \div 4 = £0.49$

$=$ 49p per tin

$£3 \div 6 = £0.50$

$=$ 50p per tin

Therefore the pack of 4 tins is better value for money

Example 2

Radox hand wash is on sale at Boots and Superdrug

Boots

500ml bottle costs £2.24

Superdrug

200ml bottle costs 90p

*Hint: multiply both to the **same** amount of hand wash*

$\times 2$ 500ml = £2.24 $\times 2$

1000ml = £4.48

$\times 5$ 200ml = 90p $\times 5$

1000ml = £4.50

Therefore the bottle from boots is better value for money

This is an example of DIRECT PROPORTION

Unit 12 Foundation Right-Angled Triangles 1

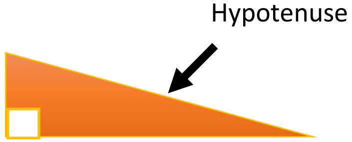
[Trigonometry Video 329, 330, 331]

Pythagoras Theorem

$a^2 + b^2 = c^2$

*Pythagoras is used to find missing sides in **Right-angled triangles***

Key Facts



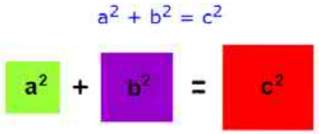
HYPOTENUSE

This is the longest side in a right-angled triangle and is **ALWAYS** opposite the right angle

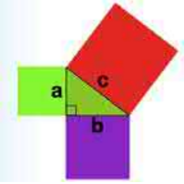
Method to find the hypotenuse

[Pythagoras video 257]

Square side a
Square side b
Add together
Square root



Method to find a shorter side



Square side c
Square side a/b (whichever is known)
Subtract a/b from c
Square root

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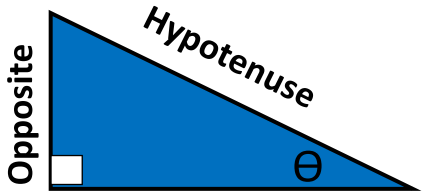
Trigonometry

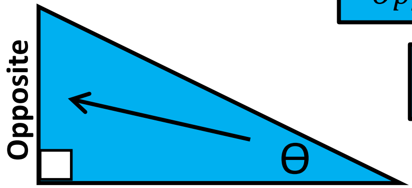
Used to find missing sides and angles in right-angled triangles

You must label your sides correctly

Always opposite the angle in question



Using the Tangent Ratio:



$Opp = \tan\theta \times Adj$

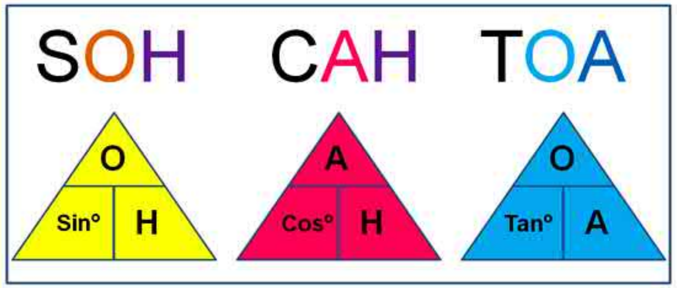
$Adj = \dfrac{Opp}{\tan\theta}$

$\tan^{-1}\theta = \dfrac{Opp}{Adj}$

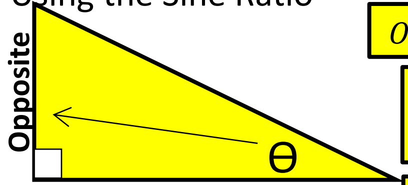
Press shift and then tan on your calculator

SOH – CAH – TOA Pyramids

Cover the letter which is the unknown value, and then Multiply for horizontal relationships and Divide for vertical relationships



Using the Sine Ratio



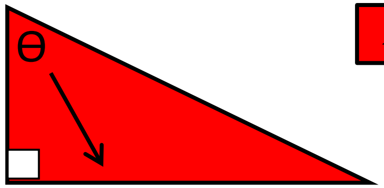
$Opp = \sin\theta \times Hyp$

$Hyp = \dfrac{Opp}{\sin\theta}$

$\sin^{-1}\theta = \dfrac{Opp}{Hyp}$

Press shift and then sin on your calculator

Using the Cosine Ratio:



Opposite

$Adj = \cos\theta \times Hyp$

$Hyp = \dfrac{Adj}{\cos\theta}$

$\cos^{-1}\theta = \dfrac{Adj}{Hyp}$

Press shift and then cos on your calculator

The ***probability*** of something (let's call it outcome **A**) happening is written as **P(A)**, and must be between 0 and 1.
If **P(A) = 0**, it is impossible.
If **P(A) = 1**, it is certain to happen.

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The probability of A not happening is written as **P(A')**. Since A will either happen or not happen,
P(A) + P(A') = 1

Video 250: Events not happening

We call the two outcomes above "mutually exclusive" – this means they cannot happen at the same time. The probabilities of all possible outcomes for an event always add up to 1, because one of them is certain to happen.

Unit 13 Foundation

Example:
Event: rolling **3** on a fair six-sided dice.

P(**3**) = 1/6
P(**3'**) = 5/6

These two outcomes are mutually exclusive and cover every possibility, so their probabilities **add up to 1**

Video 249: Independent Events

If the outcome of one event doesn't affect the outcome of another, we call those events independent. For example, **flipping a coin** and **rolling a dice** are independent of each other.

Experimental probability is about estimating probability based on **previous outcomes**, (unlike **theoretical** probability, which was used above and is based on **what should happen**). Experimental probability would be written as

Video 248: Relative Frequency

$$\frac{\textit{frequency of desired outcomes}}{\textit{total number of trials}}$$

"**Trials**" refers to what you actually do for your experiment (flipping a coin; counting cars as they drive past). Each time you do it counts as **one trial**.

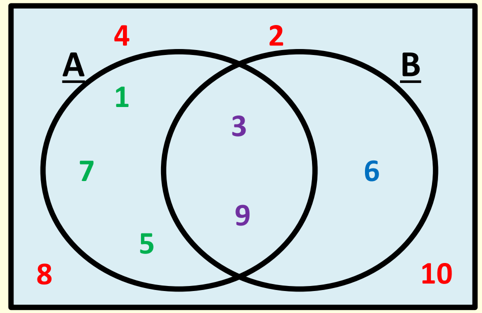
Example:
Experiment: spinning a fair four-numbered spinner 100 times (i.e. 100 **trials**)

Score	1	2	3	4
Frequency	23	26	30	21

Based on these results, the **P(1) = 23/100**, or **0.23**. To estimate **relative frequency**, multiply the number of intended trials by the experimental probability, e.g. for **200** trials, we would predict **46** results will be 1 because **200 x 0.23 = 46**, and **60** results will be 3 because **200 x 0.30 = 60**.

Venn diagrams show how two or more **sets** (groups) can overlap, and we can use them to calculate the probability of a given **element** (item in a set) being chosen. They can have each element individually written in them (Example 1), or just the quantity of each section (Example 2). The **universal set** (ξ) contains **everything** being considered.

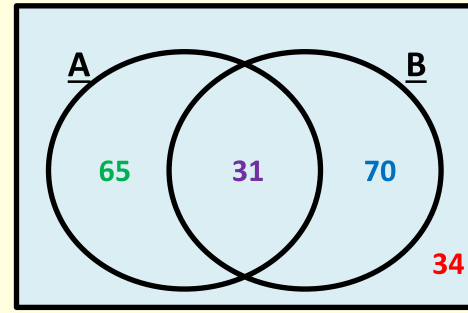
Example 1
ξ: Integers up to 10
A: Odd numbers
B: Multiples of 3



A∩B: **only** elements in both **A and B**
A∪B: **all** elements in **A or B or both**

If picking a number at random,
P(A∩B') = **3/10** P(A'∩B) = **1/10**
P(A∩B) = **2/10** P(A'∩B') = **4/10**

Example 2
ξ: Year 10 students (200 in total)
A: Students who walk to school
B: Students who like football



A∩B': elements in **A and not in B**
A'∩B: elements in **B and not in A**

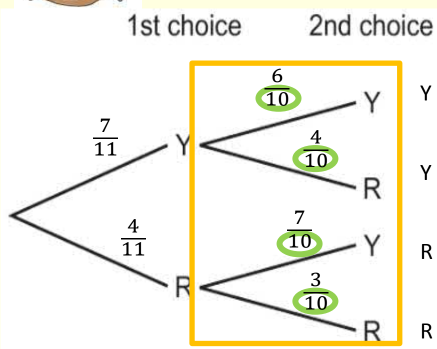
Video 380: Venn Diagrams

If picking a student at random,
P(A∩B') = **65/200** P(A'∩B) = **70/200**
P(A∩B) = **31/200** P(A'∩B') = **34/200**

Probability "tree" diagrams show the possible outcomes of multiple events one after the other. The "branches" are for each outcome and every set of branches adds to 1.

There are 11 balls in the bag, so the first choice is out of 11. The second choice is out of 10, since a ball has been taken out, so the denominators change

The second choice has two sets of branches because there are two possible scenarios for it (either after a yellow or after a red).



Y then Y: $P(YY) = \frac{7}{11} \times \frac{6}{10} = \frac{42}{110}$

Y then R: $P(YR) = \frac{7}{11} \times \frac{4}{10} = \frac{28}{110}$

R then Y: $P(RY) = \frac{4}{11} \times \frac{7}{10} = \frac{28}{110}$

R then R: $P(RR) = \frac{4}{11} \times \frac{3}{10} = \frac{12}{110}$

To find the final probability, multiply along the branches as shown.

(For example, the probability of picking red both times is **12/110**).

Video 252: Tree Diagrams

Unit 14 Foundation   Multiplicative Reasoning

$0.1 = \frac{1}{10} = 10\%$ $0.01 = \frac{1}{100} = 1\%$

The original amount of something is always 100%, if it is increased then the final amount is more than 100%. If it is decreased then it is less than 100%.

To find out a percentage of something, convert the % to a decimal and multiply

e.g. Find 80% of 45
$0.8 \times 45 = 36$
V233

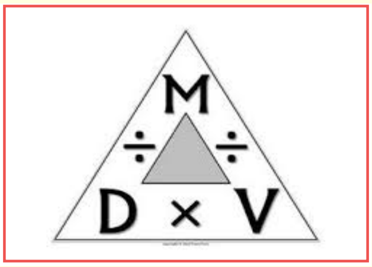
To calculate percentage change: $Percentage\ change = \frac{actual\ change}{original\ amount} \times 100$

Compound vs simple interest: in compound interest, you are paid interest on the amount. The second time interest is paid, it is paid on the *original* amount *and* the interest added before

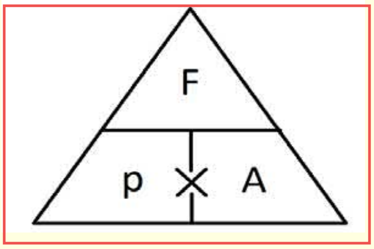
Calculating compound interest: $Final\ amount = initial\ amount \times interest\ rate^{time}$

V236

Density: is a measure of the mass of a sub stance contained in a certain volume
Usually measured in g/cm^3



V384



Pressure: is the force applied per unit area

Pressure is usually measured in N/m^2

V385

Kinematics Formulae: these are also called equations of motion, but you don't need to learn them in Maths.
v = final speed, u = initial speed, a = acceleration, t = time, s = distance

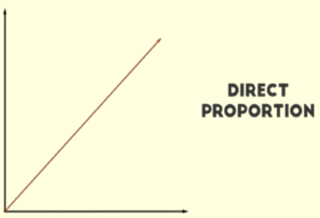
$$v = u + at$$
$$s = ut + \frac{1}{2}at^2$$
$$v^2 = u^2 + 2as$$

Velocity vs speed: velocity is speed in a certain dir ection (often measured in m/s)

Acceleration: is the rate of change of velocity (often measured in m/s^2)

Direct Proportion: if two quantities are in direct proportion, as one increases, the other increases by the same percentage

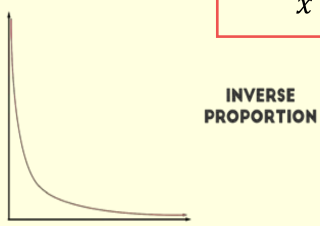
$$y \propto x$$
$$y = kx, where\ k\ is\ a\ constant\ value$$



V254

Indirect Proportion: is when one value increases as the other value decreases.

$$y \propto \frac{1}{x}$$
$$y = \frac{k}{x}$$



V255

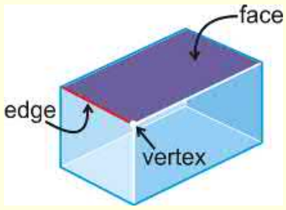
All videos are from www.corbettmaths.com

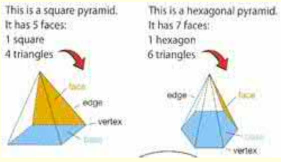
Unit 15 Foundation: Constructions, Loci and Bearings

Face: the flat edge of a 3D shape *Edge:* the lines where two faces meet

Vertex (pl. vertices): the corners that edges meet at

V5



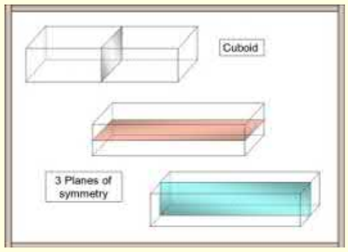


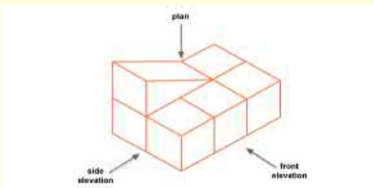
Pyramids: have a base that can be any shape and sloping triangular slides that meet at a point

Right prism: the sides are at right angles (perpendicular)

Plane: is a flat surface

Plane of symmetry: is when a plane cuts a shape in half so that the part on one side of the plane is identical to the other





Plan: is the view from above an object

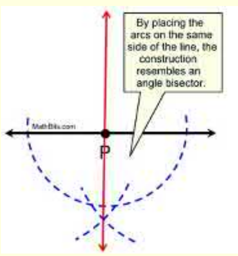
Front elevation: is the view of the front of an object

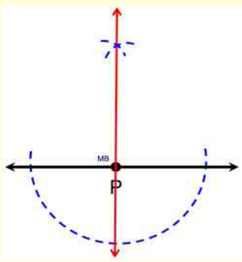
Side elevation: is the view from the side of an object

Drawing an accurate triangle: you can draw this with a ruler and protractor if you know three measurements (length of 2 sides and 1 angle OR length of 1 side and 2 angles)

V81
V82
V83

Scale: A scale is a ratio that shows the relationship between a drawn length and a real length, e.g. on a map.



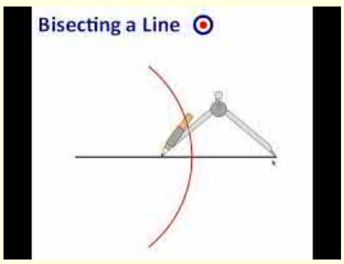


Angle bisector: Cuts an angle exactly in half.

V72

Constructions: Are accurate drawings made using a pair of compasses.

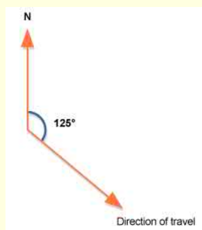
Bisecting a line: Means to cut exactly in half



V78

Locus (pl. loci): A set of all points that obey a given rule. A locus creates a bounded *region.*

Bearing: Is an angle measured in degrees clockwise from north.



All videos are from www.corbettmaths.com

Unit 16 Foundation

Expanding and factorising quadratics (double brackets)

Expanding a quadratic is just like multiplying 2-digit numbers – use a multiplication grid, then add your answers:

$$(x+2)(x+3) = x^2 + 2x + 3x + 6$$
$$= x^2 + 5x + 6$$

×	(x	+2)
(x	x^2	$+2x$
+3)	$+3x$	$+6$

(2+3) (2x3)

It's no coincidence!

Video 14: Expanding quadratics

Factorising a quadratic is the opposite of expanding it – you're putting it back into brackets (if you can). You can still use the grid, but do it in reverse:

$$x^2 + 7x + 12 = (x+3)(x+4)$$

×	(x	+3)
(x	x^2	$+3x$
+4)	$+4x$	$+12$

We know from expanding that the two numbers in my brackets will add to make 7, and multiply to make 12, so they must be 3 and 4 ($3x + 4x = 7x$ and $3 \times 4 = 12$)

Video 118: Factorising quadratics

Solving quadratics

Quadratic equations are written as equal to y, like so:

$$y = x^2 + bx + c$$

To find the solutions, we make them equal to 0 because the "*solutions*" are the "*x-intercepts*", where the graph crosses the x-axis. On the x-axis, the y-value would be zero (because we haven't moved up or down).

$$x^2 + 7x + 12 = 0$$

Then we can factorise to give two answers (one of the brackets must = 0).

$$(x+3)(x+4) = 0$$
$$x + 3 = 0 \text{ or } x + 4 = 0$$
$$\boldsymbol{x = -3} \text{ or } \boldsymbol{x = -4}$$

Video 266: Solving quadratics by factorising

If we can't factorise (sometimes the numbers don't work), we can use the **quadratic formula**:

$$\text{when } x^2 + bx + c = 0, \qquad x = \frac{b^2 \pm \sqrt{4c}}{2}$$

Video 267: Using the quadratic formula

Plotting a Quadratic Graph

To plot a quadratic, make the expression equal to y, then make a table using different values of x. For example:

$$y = x^2 - 4x + 5$$

If $x = 1, y = (1)^2 - (4 \times 1) + 5$

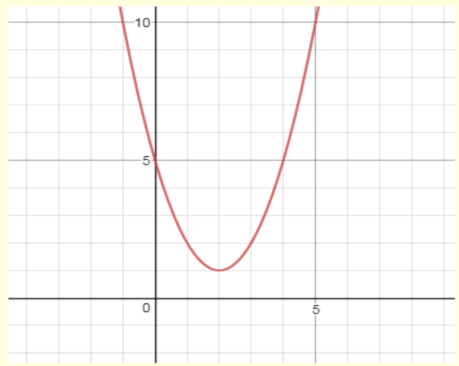
If $\boldsymbol{x = 1, y = 2}$

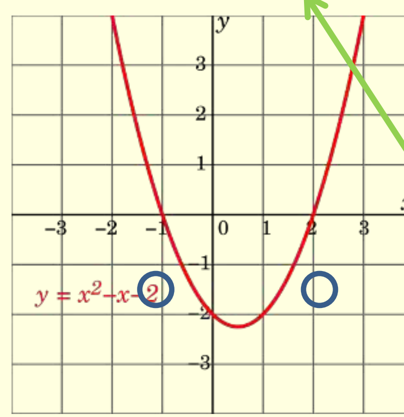
x	0	1	2	3	4
y	5	2	1	2	5

Video 264: Plotting a quadratic graph

Video 265: Sketching a quadratic graph using key coordinates

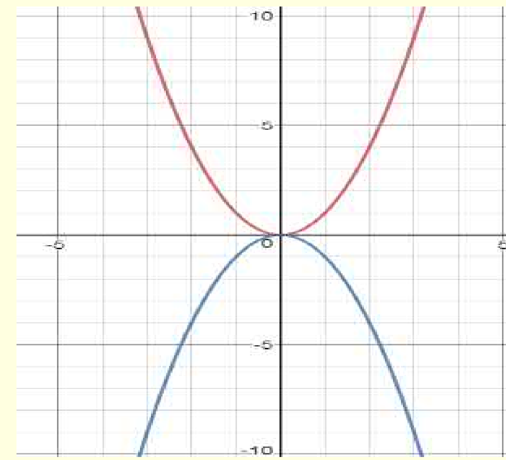
Based on the table above, the coordinates to plot would be: **(0, 5) (1, 2) (2, 1) (3, 2) (4, 5)**





Recognising a quadratic shape

All $y = x^2$ graphs will have the same symmetrical curved shape you see below, even if you can't see all of it. At any point on the line, the y-coordinate is the **square** of the x=coordinate



The upside down graph shows the equation $y = -x^2$, which is just the reflection of the positive version (the y-values have all become negative).

On the diagram, the solutions are **-1** and **2** (circled), because that's where y = 0.

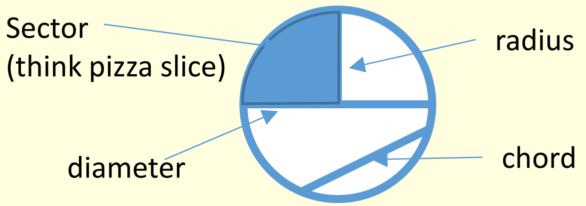
Some quadratics (like the one over there) do not cross the x-axis. This means they have no "solutions", because the y value never reaches 0!

Perimeter, Area and Volume 2

Video 61

Key Facts

Circumference = perimeter of a circle (units)
Area = space inside a 2D shape (units^2)
Volume = the space inside a 3D shape (units^3)

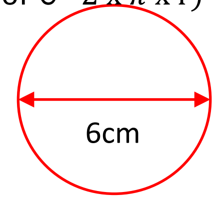


Circumference = video 60 | Area = Video 40

Circumference and Area of Circles

Circumference = $\pi \times$ *diameter* (or C=2 x π x r)

Area = $\pi \times$ *radius*^{2}

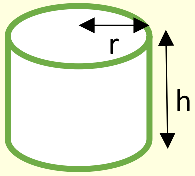


"πr^2 sounds like area to me, if you need the circumference you just use πd"

Remember our radius is half of our diameter

Volume and SA of cylinders

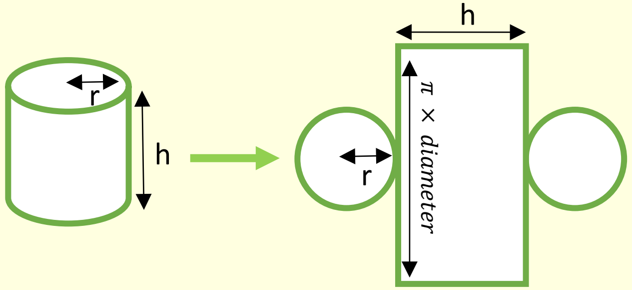
Volume = $\pi r^2 h$
V = $\pi \times$ *radius*^{2} $\times$ *height*



(this is just the area of one of the circles multiplied by how long your cylinder is)

Volume = video 357

Surface Area



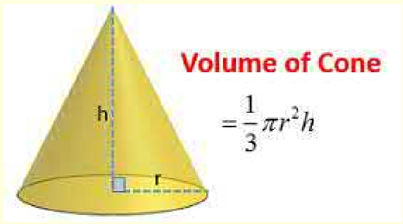
SA = 2 circle areas + rectangle area
SA = $2\pi r^2 + \pi dh$

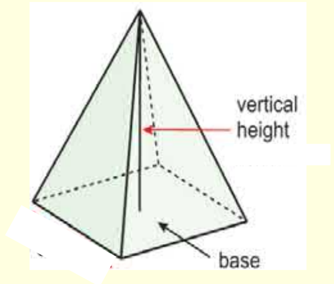
SA = video 315

Volume of pyramids and cones

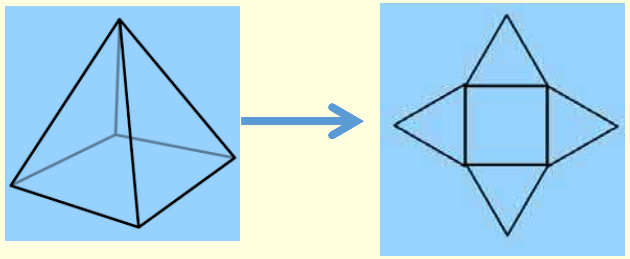
Volume of a Pyramid/Cone = $\frac{1}{3} \times$ ***area of base*** $\times$ ***vertical height***

Volume of cone = video 359 | Volume of pyramid = video 360



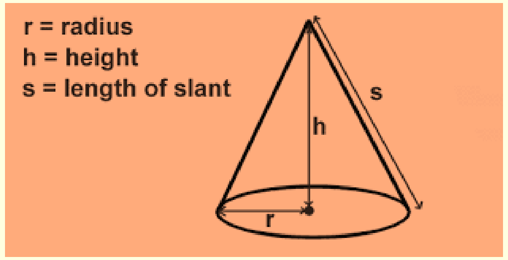


Surface Area of a Pyramid = total area of all faces



Area of all 4 triangles + area of the base

Surface Area of a Cone = $\pi \times$ ***radius*** $\times$ ***slant height***
= $\pi r l$



SA of Cone = video 314

Arc length = video 58

Semicircles and Sectors

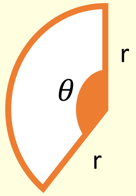
Perimeter of semi-circle = video 62

Perimeter

Perimeter = arc length + radius + radius

Arc length = $\frac{\theta}{360} \times \pi \times$ *diameter*

Arc length is a fraction of the circumference



Area

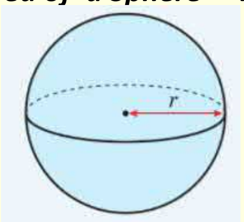
Video 46

Area = $\frac{\theta}{360} \times \pi \times$ *radius*^{2}

Volume and surface area of spheres

Volume of Sphere = $\frac{4}{3}\pi r^3$

Surface Area of a Sphere = $4\pi r^2$



SA = video 313 | Volume = video 361

Unit 17 Foundation

Multiplying and dividing fractions

To multiply fractions, just multiply the ***numerators*** and multiply the ***denominators*** (then simplify if you can!)

$$\frac{2}{3} \times \frac{3}{5} = \frac{2\times3}{3\times5} = \frac{6}{15} \left(= \frac{2}{5}\right)$$

Multiplying fractions

Dividing fractions

To divide by a fraction, multiply by the ***reciprocal*** (flip the numerator and denominator)

$$\frac{2}{3} \div \frac{3}{5} = \frac{2}{3} \times \frac{5}{3} = \frac{2\times5}{3\times3} = \frac{10}{9}$$

Combining indices

When multiplying indices with the same base value, ***add* the powers**:

$2^2 \times 2^3 = \underline{2 \times 2} \times \underline{2 \times 2 \times 2}$, so

$2^2 \times 2^3 = 2^{(2+3)} = 2^5$

Video 174: Laws of indices (including power of 0)

When dividing indices with the same base value, ***subtract* the powers**:

$$3^6 \div 3^2 = \frac{3\times3\times3\times3\times3\times3}{3\times3}$$

$$3^6 \div 3^2 = 3^{(6-2)} = 3^4$$

Power of 0

Unit 18 Foundation

Anything to the power of 0 is equal to 1, no matter what it is! We can show this by dividing two identical indices:

$3^2 \div 3^2 = 3^{(2-2)}$

$3^2 \div 3^2 = 3^0$

Since dividing a value by itself always gives the answer 1, we also know that:

$3^2 \div 3^2 = 1$, therefore $\mathbf{3^0 = 1}$

This works for all numbers AND letters!

Reciprocals

When two numbers are reciprocal, it means they ***multiply to make 1*** (they're a bit like "opposites").

So 2 and ½ are reciprocal because

2 x ½ = 1

Reciprocal fractions are the ***reverse*** of each other, as shown:

$$\frac{2}{3} \times \frac{3}{2} = \frac{2\times3}{3\times2} = \frac{6}{6} = 1$$

The numerator will always match the denominator, and we know that anything divided by itself is 1!

Negative indices

Raising something to a negative power is the same as raising the ***reciprocal*** (see left) to the positive power.

Video 175: Negative indices

$$3^{-2} = \left(\frac{1}{3}\right)^2 = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9} = \frac{1}{3^2}$$

It's no coincidence!

$$\text{Negative power} = \frac{1}{\textit{positive power}}$$

Standard form

Standard form is a way of writing very large or very small numbers using powers of 10 (multiplying/dividing by 10 until the decimal point is in the right place). The base number must always be between 1 and 10.

Video 300: Standard form

e.g. 5000000000000000000

can be written as

5 x 1000000000000000000,

which can then be written as

$\mathbf{5 \times 10^{18}}$

Clearly, the last way is quicker!

$$0.00000000004 = 4 \div 100000000000$$
$$= 4 \times 10^{-11}$$

NOTE:

When we divide, we use negative powers!

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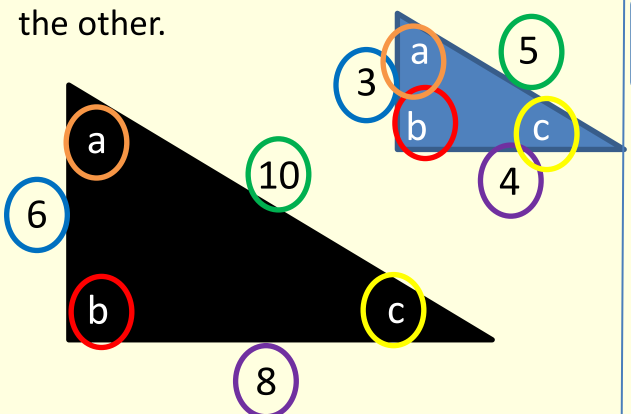
SIMILARITY

When shapes look the same but are different sizes, they are mathematically ***similar***. This means their *corresponding* ("matching") **angles** are **equal**, and their *corresponding* **sides** are in the **same ratio**. One shape is an *enlargement* of the other.



Congruence & Similarity definitions

How to find missing sides

VECTORS

Unit 19 Foundation

Column vectors describe horizontal and vertical "movement", a bit like how co-ordinates describe position. They look similar, but they're arranged in a column (hence the name), as shown below:

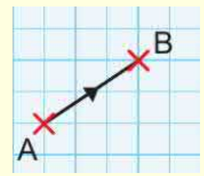
Column vectors

$\begin{pmatrix} x \\ y \end{pmatrix}$ x horizontal movement, y vertical movement

To get from A to B, you go 3 right, 2 up:

$\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (**a**)

Reverse: $\overrightarrow{BA} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$ (-**a**)



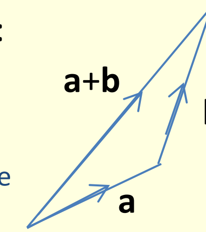
Vectors are labelled with a lower case letter, either **bold** or underlined.

You can combine vectors by adding their x and y values to give a *resultant* vector:

$\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ $\mathbf{a+b} = \begin{pmatrix} 3+4 \\ 2+1 \end{pmatrix} \begin{pmatrix} 7 \\ 3 \end{pmatrix}$

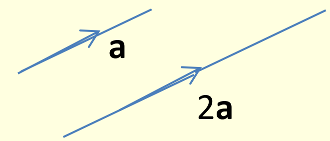
It would look like this:

We do this to move between points that don't have a vector between them – you can only go the way you know!

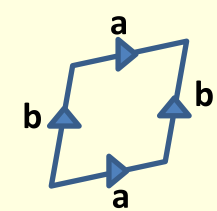


Vectors can also be multiplied:

$2\mathbf{a} = \begin{pmatrix} 3\text{x}2 \\ 2\text{x}2 \end{pmatrix} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$



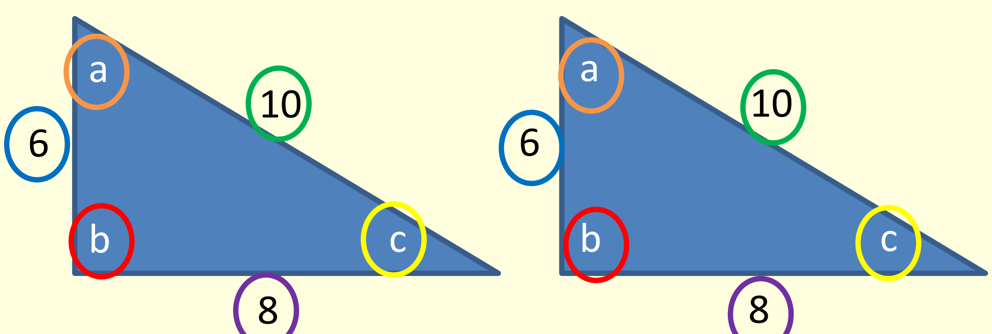
Parallel vectors can be represented using the same letter:



Algebraic vectors

CONGRUENCE

When shapes are identical, they are ***congruent***. All *corresponding* lengths and angles are **equal** – you could fit one perfectly on top of the other.



You can prove two triangles are congruent by showing that any of these combinations are matching (video here):

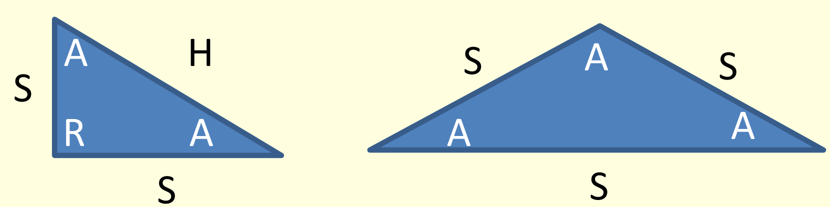
SSS (all three sides)

SAS (two sides and the angle between them)

ASA (two angles and the side which connects them)

AAS (two angles and the side after the second angle)

RHS (right angle, hypotenuse and one other side)*



*only applies to right-angled triangles

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Unit 20 Foundation   More Algebra

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Quadratic functions contain a term in x^2 but no higher power of x.
Video 266 - https://tinyurl.com/y8san5jm

Cubic functions contain a term in x^3 but no higher power of x.
Video 344 - https://tinyurl.com/yamclpto

Cubic functions can contain terms in x^2, x, and number terms.

When a cubic function is equal to zero it may have one, two, or three solutions. The solution to a cubic function equalling zero is there the graph crosses the x-axis. The solutions are commonly called **roots**.
Video 264 - https://tinyurl.com/y7u3d79a

The **reciprocal** function ($y = \frac{1}{\ }$) of a cubic function has the x- and y-axes as **asymptotes** to the graph.
Video 346 - https://tinyurl.com/yd8x2uz8

An asymptote is a line that the graph gets closer and closer to, but never actually touches.

When a graph has x and y in **direct proportion**, $y = kx$
Video 254 - https://tinyurl.com/htma465

When a graph has x and y **inversely proportional** to each other, $y = -$
Video 255 - https://tinyurl.com/yb2ur2yq

The graph of two quantities that are inversely proportional is a reciprocal graph.

Simultaneous equations are equations that are both true for a pair of variables (letters).

Video 296 - https://tinyurl.com/y9dbmoee

Simultaneous equations can be solved graphically by plotting both equations on the same coordinate grid. The point at which the lines cross (the point of **intersection**) has the coordinates that are the solution.

Simultaneous equations can also be solved by the elimination method. To do this, the coefficients of either the x or y terms must be equal (or equal with the opposite sign).
Video 295 - https://tinyurl.com/yadevfgk
Subtract (or add) the two equations to eliminate one of the terms. The remaining term can now be evaluated.

The **subject** of a formula is the letter on its own side of the equals sign.
Video 7 - https://tinyurl.com/yc6vax5f
You can change the subject of a formula using **inverse operations** (subtract to move an added term to the other side, etc).
Video 8 - https://tinyurl.com/yahmeoyn
An even number is a multiple of 2. $2m$ and $2n$ are general terms for even numbers where m and n are integers.

Key Points:

https://tinyurl.com/ybfxnjsj

Knowledge Check:

https://tinyurl.com/y9nl3tka

An **equation** has an equals sign (=). You can solve it to find one value of the letter (unknown/variable).

An **identity** has an equivalent (triple bar) sign (≡). The left hand side equals the right hand side for all values of the letter (unknown/variable).

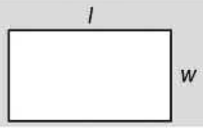
edexcel

Edexcel GCSE (9-1) Maths: need-to-know formulae

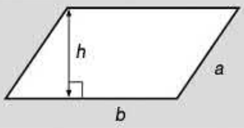
www.edexcel.com/gcsemathsformulae

Areas

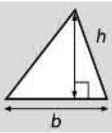
Rectangle = $l \times w$



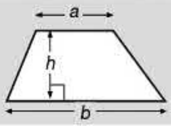
Parallelogram = $b \times h$



Triangle = $\frac{1}{2} b \times h$

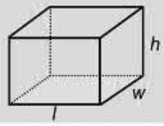


Trapezium = $\frac{1}{2}(a + b)h$

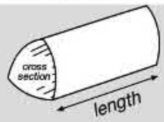


Volumes

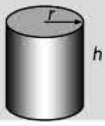
Cuboid = $l \times w \times h$



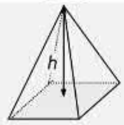
Prism = area of cross section $\times$ length



Cylinder = $\pi r^2 h$



Pyramid = $\frac{1}{3} \times$ area of base $\times h$

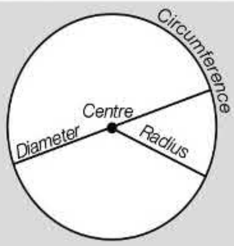


Circles

Circumference = $\pi \times$ diameter, $C = \pi d$

Circumference = $2 \times \pi \times$ radius, $C = 2\pi r$

Area of a circle = $\pi \times$ radius squared, $A = \pi r^2$



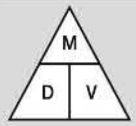
Compound measures

Speed

speed = $\dfrac{\text{distance}}{\text{time}}$

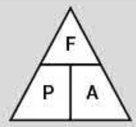
Density

density = $\dfrac{\text{mass}}{\text{volume}}$



Pressure

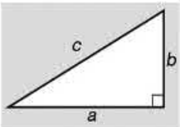
pressure = $\dfrac{\text{force}}{\text{area}}$



Pythagoras

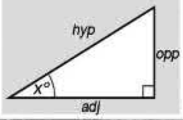
Pythagoras' Theorem

For a right-angled triangle, $a^2 + b^2 = c^2$



Trigonometric ratios (*new to F*)

$\sin x° = \dfrac{\text{opp}}{\text{hyp}}$, $\cos x° = \dfrac{\text{adj}}{\text{hyp}}$, $\tan x° = \dfrac{\text{opp}}{\text{adj}}$

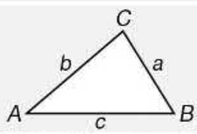


Trigonometric formulae

Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2} ab \sin C$



Quadratic equations

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Foundation tier formulae

Higher tier formulae

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