YEAR 11 – VECTORS...

@whisto_maths

What do I need to be able to do?

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

- Understand and represent vectors
- Use and read vector notation
- Draw and understand vectors multiplied by a scalar
- Draw and understand addition of vectors
- Draw and understand addition and subtraction of vectors

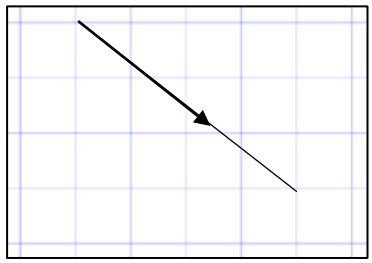
Keywords

Direction: the line our course something is going
Magnitude: the magnitude of a vector is its length
Scalar: a single number used to represent the multiplier when working with vectors
Column vector: a matrix of one column describing the movement from a point
Resultant: the vector that is the sum of two or more other vectors
Parallel: straight lines that never meet

Understand and represent vectors

Column vectors have been seen in translations to describe the movement of one image onto another

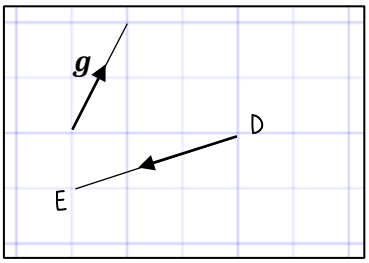
Movement along the x-axis → $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ ← Movement along the y-axis



Vectors show both direction and magnitude

The arrow is pointing in the direction from starting point to end point of the vector.	The direction is important to correctly write the vector
The magnitude is the length of the vector (This is calculated using Pythagoras theorem and forming a right-angled triangle with auxiliary lines)	The magnitude stays the same even if the direction changes

Understand and represent vectors



Vector notation $\overrightarrow{DE}$ is another way to represent the vector joining the point D to the point E

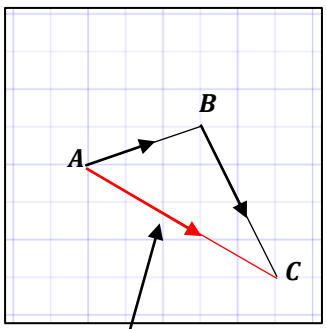
$\overrightarrow{DE} = \begin{pmatrix} -3 \\ -1 \end{pmatrix}$

The arrow also indicates the direction from point D to point E

Vectors can also be written in bold lower case so $\boldsymbol{g}$ represents the vector $\boldsymbol{g} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

Addition of vectors

$\overrightarrow{AB} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ $\overrightarrow{BC} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$



The resultant

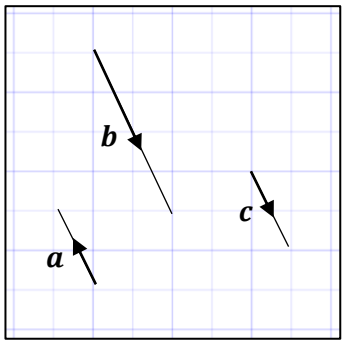
$$\overrightarrow{AB} + \overrightarrow{BC} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ -4 \end{pmatrix} = \begin{pmatrix} 3+2 \\ 1+-4 \end{pmatrix} = \overrightarrow{AC} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

Look how this addition compares to the vector $\overrightarrow{AC}$

$$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$$

Vectors multiplied by a scalar

Parallel vectors are scalar multiples of each other



$\boldsymbol{a} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$ $\boldsymbol{c} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$

$\boldsymbol{b} = 2 \times \boldsymbol{c} = 2\boldsymbol{c}$

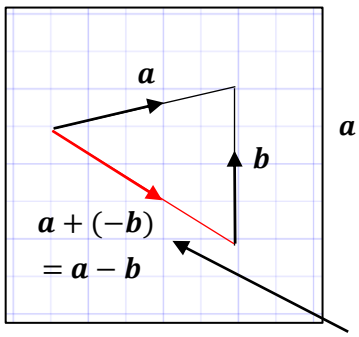
Multiply $\boldsymbol{c}$ by 2 this becomes $\boldsymbol{b}$. The two lines are parallel

$\boldsymbol{a} = -1 \times \boldsymbol{c} = -\boldsymbol{c}$

The vectors $\boldsymbol{a}$ and $\boldsymbol{c}$ are also parallel. A negative scalar causes the vector to reverse direction

$\boldsymbol{b} = -2 \times \boldsymbol{a} = -2\boldsymbol{a}$

Addition and subtraction of vectors



$\boldsymbol{a} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$

$$\boldsymbol{a} + (-\boldsymbol{b}) = \begin{pmatrix} 5 + & -0 \\ 1 + & -4 \end{pmatrix} = \begin{pmatrix} 5 \\ -4 \end{pmatrix}$$

The resultant is $\boldsymbol{a} - \boldsymbol{b}$ because the vector is in the opposite direction to b which needs a scalar of -1

YEAR 11 – FUNCTIONS

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Use function machines		Corbett
• Substitute into expressions & formulae	95	
• Use function notation		
• Work with composite functions (H)	215	Corbett
• Work with inverse functions (H)	214a 214b	Corbett
• Use graphs of quadratic functions	160	
• Solve quadratic inequalities (H)	212	Corbett
• Understand & use trigonometric functions	168 173	

$$f(x) = 2x^2 + x - 1$$

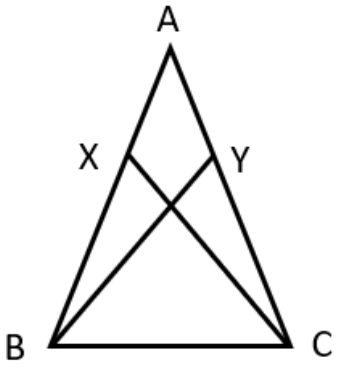
$$f(3) = 2(3)^2 + (3) - 1$$

Keywords

Function: an algebraic rule which shows how to calculate the output for a given input
Inverse function: reverses the effect of the original function
Variable: a letter which can take on different values in an algebraic expression
Evaluate: find the value of an expression when the variable is replaced by a given number
Composite function: takes the output of one function and uses it as the input of another function
Rearrange: change the subject of an equation by writing it in a different way
Intercept: where a line or curve crosses an axis on a graph

YEAR 11 – GEOMETRIC REASONING

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• 'Show that' with number		
• 'Show that' with algebra	193	Corbett
• 'Show that' with shape		Corbett
• 'Show that' with angles		
• 'Show that' with data		
• 'Show that' with vectors (H)	219	Corbett
• 'Show that' with congruent triangles		
• Use formal proof with congruent triangles (H)	166	



Keywords

Surd: a number that can't be simplified to remove a square root, such as $\sqrt{3}$
Term: a single part of an expression, such as $2x$ or $3mp$ or 8
Expression: a combination of two or more terms separated by + or - signs, such as $3x + 2y$ or $5p^2 - 6$
Identity: an equation that is always true, no matter what values are substituted for the variable, such as $4x \equiv 3x + x$
Similar: same shape and angles, but a different size
Congruent: identical in shape and size
Corresponding: a pair of matching angles or sides which are in the same position in two different similar or congruent shapes
Colinear: three or more points which lie on the same straight line

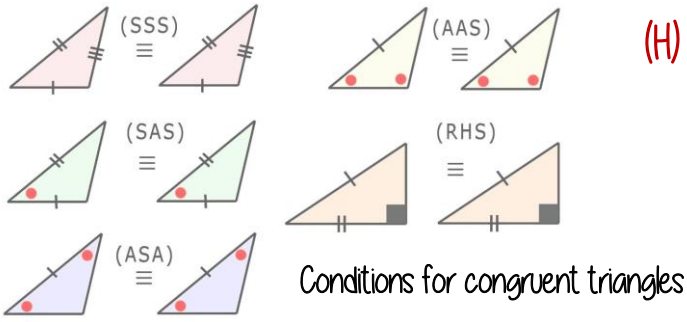
Some (but not all) key points:

Show that $\frac{7}{10} < \frac{5}{6}$

Put both fractions over a common denominator then compare

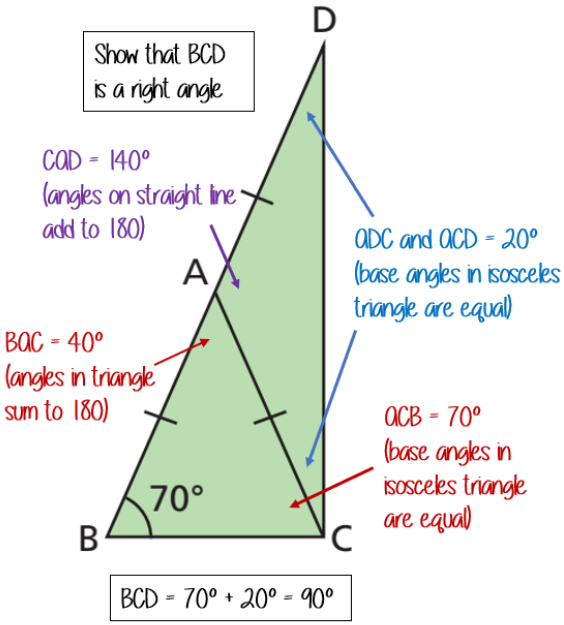
$\frac{7}{10}$ $\quad$ $\frac{5}{6}$

$\frac{21}{30}$ $<$ $\frac{25}{30}$



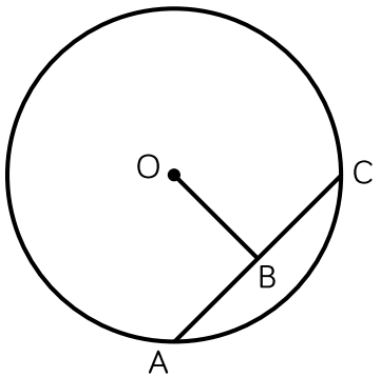
(H)

Conditions for congruent triangles



YEAR 11 – GEOMETRIC REASONING

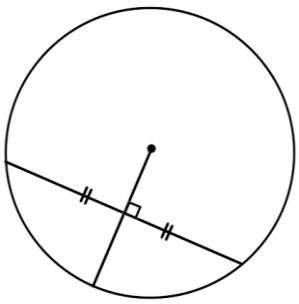
By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Use angles at a point (R)	45	Corbett
• Use angles in parallel lines & shapes (R)	120	Corbett
• Use interior & exterior angles in polygons (R)	123	Corbett
• Prove geometric facts		Corbett
• Solve problems involving vectors (R)	174 219	
• Use circle theorems (R) (H)		Corbett
• Circle theorem: Angle between radius & chord (H)		
• Circle theorem: Angle between radius & tangent (H)		
• Circle theorem: Two tangents from a point (H)		
• Circle theorem: Alternate segment theorem (H)		Corbett
• Pythagoras & trig ratios (H)	150b 168	Corbett Corbett Corbett



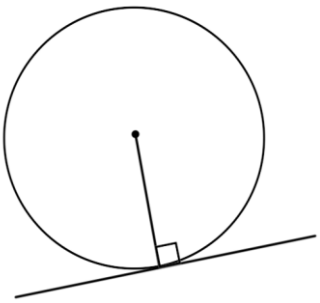
Keywords

Polygon: a 2D shape with straight sides
Regular: a shape with all side equal and all angles equal
Segment: the part of a circle cut off by a chord
Cyclic quadrilateral: put numbers in place of letters to find the value of an expression
Chord: a straight line connecting two points on a circles circumference
Bisect: cut into 2 equal parts
Tangent: a straight line which touches a circle at just one point
Hypotenuse: the side opposite the right angle in a right-angled triangle

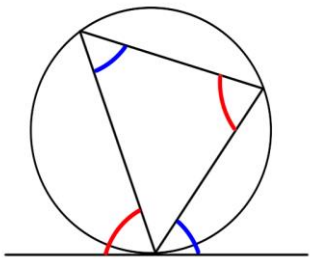
Some (but not all) key points:



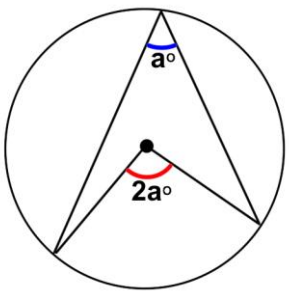
The perpendicular line from the center of a circle to a chord, bisects the chord



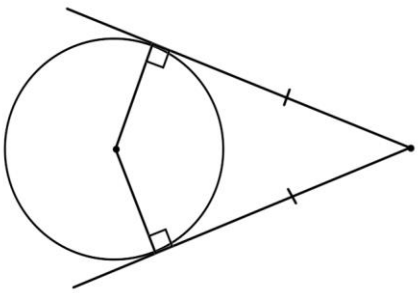
The angle between a tangent and the radius, at the point where the tangent touches the circle, is a right angle



The angle between a tangent and a chord is equal to the angle at the circumference in the alternate segment



The angle at the center of a circle is twice the angle at the circumference of the circle from the same arc



Two tangents drawn from a point to a circle are equal

YEAR 11 — ALGEBRAIC REASONING

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Simplify complex expressions		
• Find the rule for the nth term of a linear sequence (R)		Corbett
• Find the rule for the nth term of a quadratic sequence (R) (H)	213	Corbett
• Use rules for sequences		
• Solve linear simultaneous equations	162	Corbett
• Solve simultaneous equations with one quadratic (H)	211	Corbett
• Use formal algebraic proof (H)	193	Corbett
• Use inequalities in two variables (H)	198	Corbett

Solve
$5x + 3y = 38$
$3x + 2y = 24$

Keywords

Term: a single part of an expression, such as $2x$ or $3mp$ or 8
Expression: a combination of two or more terms separated by + or - signs, such as $3x + 2y$ or $5p^2 - 6$
Coefficient: the number in front of the variable in a term, e.g. the 4 in $4x^3$
Quadratic : straight lines that never meet (equal gradients)
Quadratic sequence: in which the second differences between consecutive terms are constant
Geometric sequence: has a constant ratio between consecutive terms
Fibonacci sequence: each term is the sum of the previous two terms
Region: the part of a graph which represents inequalities in two variables

Some (but not all) key points:

Algebraic expressions for proof

An even number: $2n$
An odd number $2n + 1$
A multiple of 3 $3n$
Two consecutive odd numbers $2n + 1$ & $2n + 3$
An even number squared $(2n + 1)^2$
Two different even numbers $2n$ & $2m$

Simultaneous equations with one quadratic (H)

Solve the simultaneous equations
① $y = 2x^2$
② $y = 20 - 3x$

Show clear algebraic working.

Sub ① into ②
$2x^2 = 20 - 3x$
$2x^2 - 3x - 20 = 0$
$(2x - 5)(x + 4) = 0$
$x = 5/2$, $x = -4$
$y = 25/2$, $y = 32$

At this stage, you might need to use the quadratic formula to solve if it won't factorise

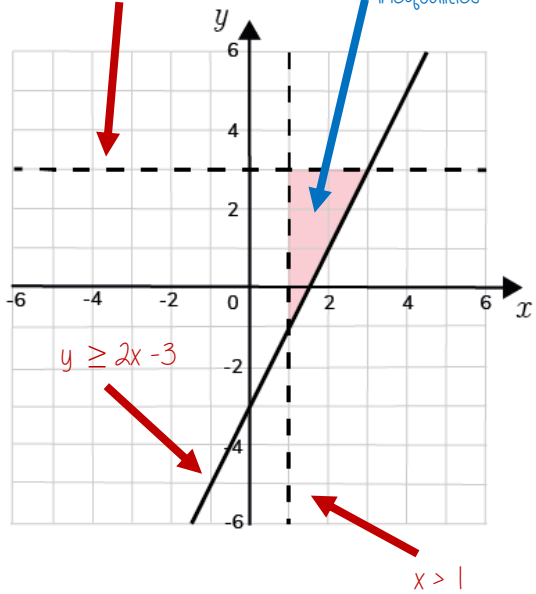
These coordinates are the points where the line $y = 20 - 3x$ intersects the curve $y = 2x^2$

$(\frac{5}{2}, \frac{25}{2})$ or $(-4, 32)$

Inequalities in two variables (H)

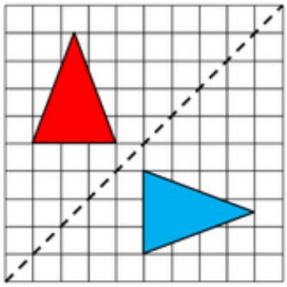
$y < 3$
dashed line because < not ≤

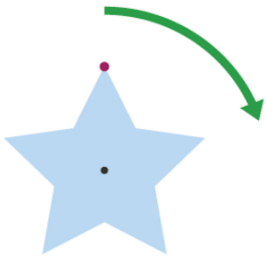
This shaded region satisfies all three inequalities



YEAR 11 — TRANSFORMING & CONSTRUCTING

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Perform & describe line symmetry & reflection	48	Corbett Corbett
• Perform & describe rotation/rotational symmetry	49	Corbett Corbett
• Perform & describe translations of shapes	50	Corbett Corbett
• Perform & describe enlargements of shapes (R)	148	Corbett Corbett
• Perform & describe negative enlargements of shapes (R) (H)	181a 181b	Corbett
• Identify transformations of shapes		
• Perform & describe a series of transformations of shapes	182	
• Identify invariant points & lines (H)		Corbett
• Perform standard constructions using ruler & protractor/compasses (R)	145a 145b	Corbett Corbett
• Solve loci problems	146	Corbett Corbett Corbett
• Understand & use trig graphs (H)	195a 195b	
• Sketch and identify translations of a graph of a given function (H)	122 196b	Corbett
• Sketch and identify reflections of a graph of a given function (H)	122 196b	Corbett

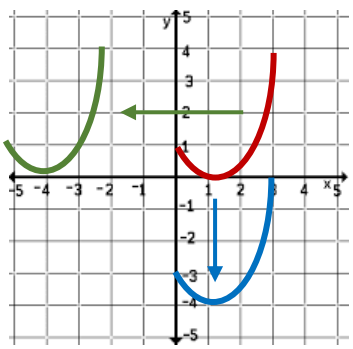




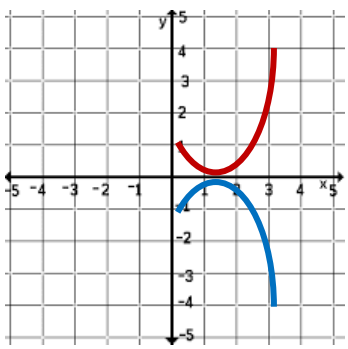
Keywords

Vertex: a corner of a shape
Line symmetry: when a shape can be divided into two identical halves by a mirror line
Order of rotational symmetry: the number of times a shape looks identical to the original, when rotated 360°
Translation: moving a shape side to side or up and down, without changing the shape's appearance
Invariant: points or lines on a shape which do not move when a particular transformation is applied
Construct: draw accurately, using compasses and/or a protractor.
Angle bisector: a line that splits an angle into two equal angles
Perpendicular bisector: a line passing through the midpoint between two points and perpendicular to the line between them
Locus/loci: the set of points whose position is determined by one or more rules
Equidistant: the same distance
Period: the distance it takes on a graph for a function to repeat itself. For example the period of a cos graph is 360°

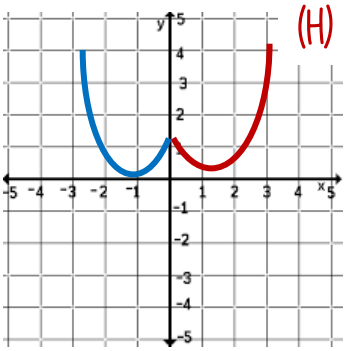
Some (but not all) key points:



$y = f(x)$
$y = f(x + 5)$ 5 to the left
$y = f(x) - 5$ 5 down



$y = f(x)$
$y = -f(x)$ Reflected in x-axis



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$y = f(x)$
$y = f(-x)$ Reflected in y-axis

YEAR 11 – REPRESENTING

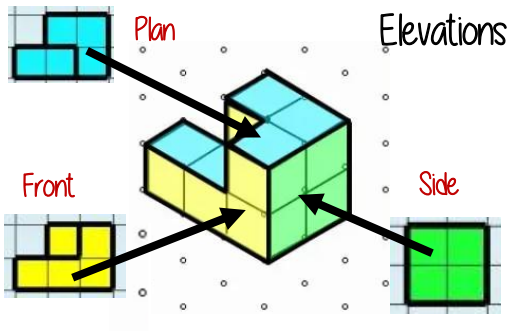
By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Work with organised lists	69	
• Use sample spaces & probability (R)		Corbett Corbett
• Use the product rule for counting (H)		Corbett
• Complete & use venn diagrams (R)	185 127b (H)	Corbett
• Construct & interpret plans & elevations (R)	51	Corbett
• Use data to compare distributions (R)		
• Interpret scatter diagrams (R)	129	Corbett

Starters	Mains
Soup	Chicken
Prawn Cocktail	Beef
Melon	Pizza

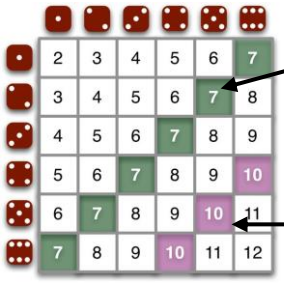
Keywords

Sample space: the set of all possible outcomes
Event: an outcome in probability e.g. rolling a six on a dice is an event
Systematic: careful and methodical
Product rule: a way of finding the total number of outcomes for two or more events by multiplying the number of outcomes for each event together.
Intersection: the crossover part of a venn diagram which represents elements that are in both set A and set B
Union: elements that are in either set A or set B or both.
Elevation: the view of a 3D shape when looked at from the side or front
Plan view: the view of a 3D shape from above
Isometric: a drawing of a 3D shape from an angle which allows the top, side and front of the shape to be visible.
Hypothesis: ta statement which might be true and can then be tested by statistical data
Range: the difference between the greatest and least values in a set of numbers
Outlier: a piece of data which is much greater or less than the rest of the data
Interquartile range: a measure of the spread of data - the difference between the upper and lower quartile values
Correlation: a way to describe whether two values, such as height and weight, are related
Causation: one event causes another to occur
Interpolate: using a line of best fit on a scatter graph to estimate a value from inside a set of data points
Extrapolate: estimating a value from outside a set of data points by extending a line of best fit on a scatter graph

Some (but not all) key points:



Sample space for adding two dice



Probability (total is 7) = 6/36

Probability (total is 10) = 3/36