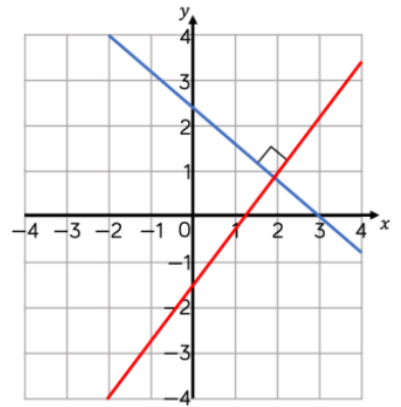


YEAR 11 — GRADIENTS & LINES

By the end of this unit you should be able to:	Mathswatch clip	Video tutorial
• Find equations of lines parallel to the axis	05	
• Plot straight lines	96	
• Interpret $y = mx + c$		Corbett
• Find the equation of a straight line		
• i) from a graph	159a	Corbett
• ii) given one point and a gradient	159b	
• iii) given two points	159b	Corbett
• Determine whether a point is on a line		
• Solve linear simultaneous equations graphically	140	MathsGenie
• Recognise when straight lines are perpendicular (H)	208	
• Find the equations of perpendicular lines (H)	208	MathsGenie



Keywords

Parallel: straight lines that never meet (equal gradients)

Horizontal: a straight line which goes from side to side, parallel to the x-axis

Vertical: a straight line which goes up and down, parallel to the y-axis

Intercept: the point where a line crosses the axis of a graph

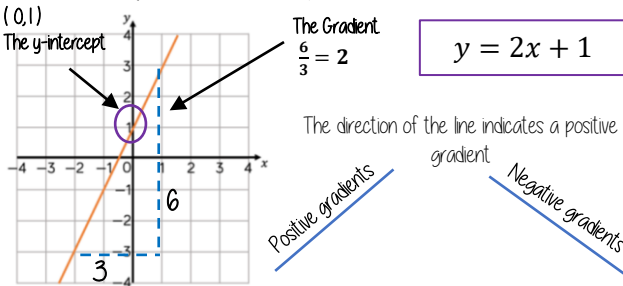
Gradient: the steepness (or slope) of a line. A negative gradient means the line slopes downhill

Substitute: put numbers in place of letters to find the value of an expression

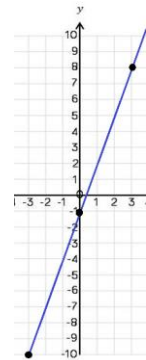
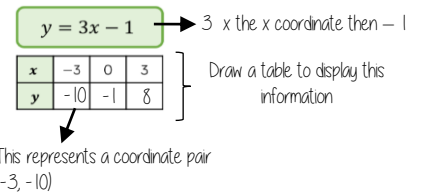
Reciprocal: the reciprocal of a number is 1 divided by that number.

Some (but not all) key points:

Find the equation from a graph



Plotting $y = mx + c$ graphs



You only need two points to form a straight line

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

Remember to join the points to make a line

Lines parallel to the axes



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

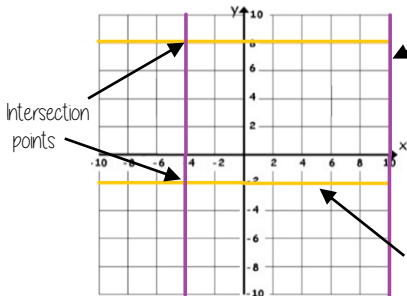
'a' can be ANY positive or negative value including 0

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

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

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

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



YEAR 11 — NON-LINEAR GRAPHS

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Plot & read from quadratic graphs	98	Corbett
• Plot & read from cubic graphs	161	MathsGenie
• Plot & read from reciprocal graphs	161	MathsGenie
• Recognise graph shapes		
• Identify & interpret roots & intercepts of quadratics	160	
• Understand & use exponential graphs (H)	194	Corbett
• Find and use the equation of a circle centre (0,0) (H)	197	Corbett
• Find the equation of the tangent to any curve (H)	208	Corbett



Keywords

Quadratic: an expression in which the highest power is 2, such as $x^2 - 5x + 3$

Cubic: an expression in which the highest power is 3, such as $8 + x^3$

Estimate: read approximate values from a graph

Asymptote: a line that a curve approaches, but never quite touches

Gradient: the steepness (or slope) of a line. A negative gradient means the line slopes downhill

Substitute: put numbers in place of letters to find the value of an expression

Reciprocal: a graph with an equation of the form $y = \frac{k}{x}$ where k is a number

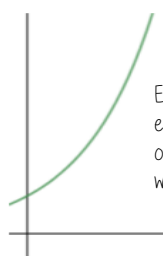
Roots: the solutions when an equation equals zero (often the x -intercepts of a graph)

Exponential: a graph with an equation of the form $y = k^x$ where k is a number

Tangent: a straight line touching a curve which can be used to estimate the gradient of the curve at that point

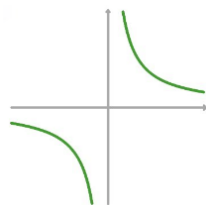
Some (but not all) key points:

Exponential graphs are often this shape

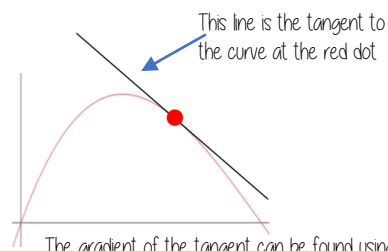


Exponential equations are often of the form $y = k^x$ where k is a number

Reciprocal graphs are often this shape

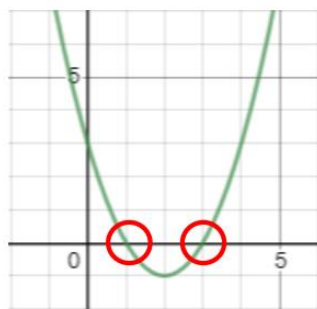


Exponential equations are of the form $y = \frac{k}{x}$ where k is a number



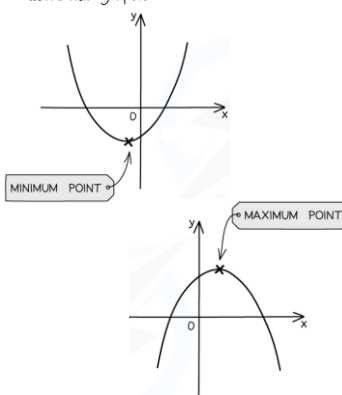
The gradient of the tangent can be found using

$\frac{\text{change in } y}{\text{change in } x}$

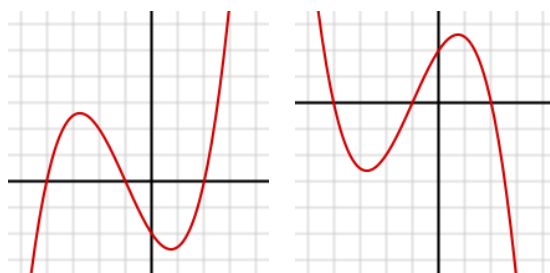


Roots are where the curve crosses the x -axis

Quadratic graphs



Cubic graphs generally look like these

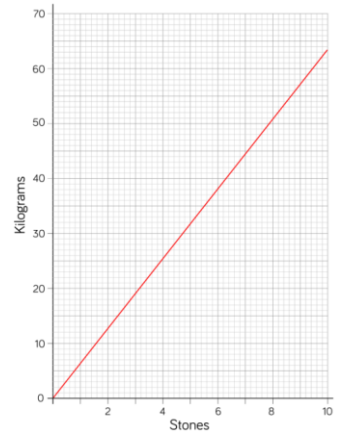


'Uphill' if the x^3 term is positive, such as $y = 2x^3 - 4x + 8$

'Downhill' if the x^3 term is negative, such as $y = -3x^3 + x^2 + 7$

YEAR 11 — USING GRAPHS

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Construct & interpret conversion graphs		Corbett Corbett
• Construct & interpret other real-life straight graphs		Corbett
• Interpret distance/time graphs	143	Corbett
• Construct distance/time graphs		Corbett
• Construct & interpret speed/time graphs	2.16a	MathsGenie
• Recognise & interpret graphs that illustrate direct & inverse proportion		Corbett
• Find approximate solutions to equations using graphs		Corbett
• Estimate the area under a curve. (H)	2.16a	Corbett



Keywords

Parallel: straight lines that never meet (equal gradients)

Horizontal: a straight line which goes from side to side, parallel to the x-axis

Vertical: a straight line which goes up and down, parallel to the y-axis

Intercept: the point where a line crosses the axis of a graph

Gradient: the steepness (or slope) of a line. A negative gradient means the line slopes downhill

Constant: unchanging. It will be a straight line on a graph, for example, a constant speed on a distance-time graph will be a straight diagonal line

Reciprocal: the reciprocal of a number is 1 divided by that number.

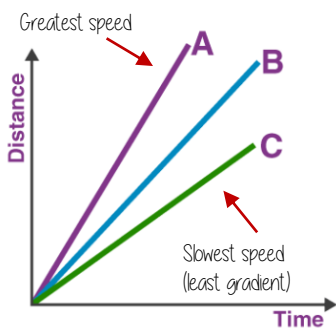
Convert: change between two different units of measurement, such as cm and inches

Direct proportion: two quantities which remain in the same ratio at all times

Inverse proportion: a relationship in which one quantity increases as the other decreases

Acceleration: the rate at which velocity changes

Some (but not all) key points:

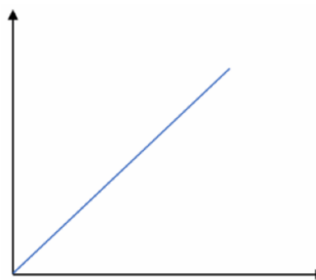
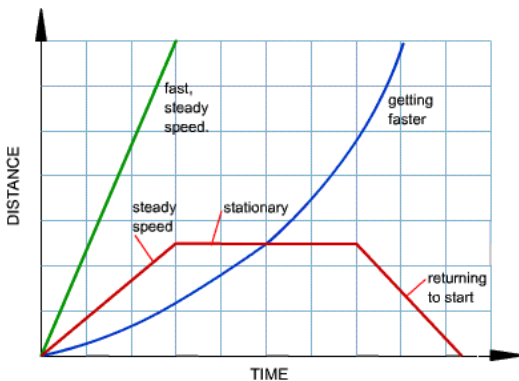


Convert \$60 to £

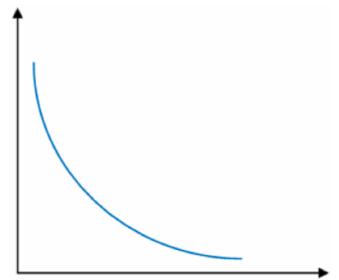


Step 1:
Go up from 60\$ until you hit the diagonal conversion line

Step 2:
Go across until you hit the axis and read off the value: £40



Direct proportion



Inverse proportion

YEAR 11 — EXPANDING & FACTORISING

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Expand & factorise with a single bracket	93 134a 94	
• Expand binomials	134b	
• Factorise quadratic expressions		Corbett
• Factorise complex quadratic expressions (H)	192	Corbett
• Solve equations equal to 0		
• Solve quadratic equations by factorisation	157	Corbett
• Solve complex quadratic equations by factorisation (H)		
• Complete the square (H)	209a 209b	Corbett
• Solve quadratic equations using the quadratic formula (H)	191	Corbett

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Keywords

- Expand:** multiply out terms to remove brackets
- Coefficient:** the number in front of a letter in an algebraic term, such as $5x^3$
- Quadratic:** an expression in which the highest power is 2, such as $x^2 - 5x + 3$
- Cubic:** an expression in which the highest power is 3, such as $8 + x^3$
- Estimate:** read approximate values from a graph
- Gradient:** the steepness (or slope) of a line. A negative gradient means the line slopes downhill
- Substitute:** put numbers in place of letters to find the value of an expression
- Reciprocal:** a graph with an equation of the form $y = \frac{k}{x}$ where k is a number
- Roots:** the solutions when an equation equals zero (often the x-intercepts of a graph)
- Exponential:** a graph with an equation of the form $y = k^x$ where k is a number
- Tangent:** a straight line touching a curve which can be used to estimate the gradient of the curve at that point

Some (but not all) key points:

Completing the square:

$$x^2 - 6x + 5$$

$$\Rightarrow (x - 3)^2 - 3^2 + 5$$

$$\Rightarrow (x - 3)^2 - 9 + 5$$

$$\Rightarrow (x - 3)^2 - 4$$

$a = 2$ $b = -8$ $c = -24$

$$2x^2 - 8x - 24 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The quadratic formula

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(2)(-24)}}{2(2)}$$

Solving a quadratic by using the quadratic formula

Solve complex quadratics by factorising:

$$2x^2 - 7x + 3 = 0$$

Factorise

$$(2x - 1)(x - 3) = 0$$

One of the brackets must equal zero

$$2x - 1 = 0 \quad \text{or} \quad x - 3 = 0$$

$$2x = 1 \quad \quad \quad x = 3$$

$$x = \frac{1}{2}$$

Solutions

$$x = \frac{8 \pm \sqrt{64 - (-192)}}{4}$$

$$x = \frac{8 \pm \sqrt{256}}{4}$$

$$x = \frac{8 \pm 16}{4} = 2 \pm 4$$

$$x = 6, -2$$

Solutions (often these may be decimals)

YEAR 11 — CHANGING THE SUBJECT

By the end of this unit you should be able to:	MathsWatch clip	Video tutorial
• Solve linear equations	135a	
• Solve linear inequalities	139	Corbett
• Form & solve equations & inequalities in context of shape	137	
• Change the subject of a simple formula	136	Corbett
• Change the subject of a complex formula		
• Change the subject when the subject appears more than once (H)	190	Corbett
• Solve equations by iteration (H)	180	Corbett

Make x the subject of the following formula:

$$y = \frac{x}{ab} + c$$

Keywords

Expand: multiply out terms to remove brackets

Coefficient: the number in front of a letter in an algebraic term, such as $5x^3$

Rearrange: change the subject of an equation by writing it in a different way

Iterate: keep repeating a process

Converge: tend towards a particular value

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