

Toynbee Curriculum

Knowledge Maps

MATHS

(Algebra)

Personal Best

Toynbee School



Sequences

Keywords:	Arithmetic / n th term / Geometric / Term / Quadratic / Iterate					
Definition / Description:	Arithmetic – a sequence where terms are found by adding or subtracting an equal amount.	n th term – The general rule of a number sequence.	Geometric - A sequence in which you find each term by multiplying the previous term by a fixed value.	Term – a part of an equation, expression or sequence.	Quadratic – A sequence where the difference increases or decrease by an equal amount each time	Iterate - a quantity arrived at by iteration.
Knowledge points:	Nth term of a linear sequence	Finding terms in a sequence	Nth term of a Quadratic sequence	Geometric Progression	Sequences by iteration	
Knowledge point examples:	<p>n: 1 2 3 4</p> <p> 2 5 8 11...</p> <p> +3 +3 +3 $3n - 1$</p> <p>The nth term of a linear sequence is always of the form $An \pm b$, where: A, is the difference between each term and the next term. b is the difference between the first term and A.</p> <p>n: 0 1 2 3 4</p> <p> 13 11 9 7 5</p> <p> +2 -2 -2 -2</p> <p> <u>$13 - 2n$</u></p> <p>In a descending sequence we find the <u>zero term</u> to discover what we are taking An way from.</p>	<p>From the sequence 5, 12, 19, 26, 33... work out the 50th term.</p> <p>The nth term of this sequence is $7n - 2$</p> <p>Find the 50th term by substituting $n=50$ into the rule, $7n - 2$</p> <p>$= 7 \times 50 - 2 = 350 - 2 = 348$.</p>	<p>Find the nth term in the sequence: 5, 9, 15, 23...</p> <p>Term 5 9 15 23</p> <p>1st Diff. 4 6 8</p> <p>2nd Diff. 2 2</p> <p>The second differences are constant (2) so the sequence is quadratic and the coefficient of n^2 is 1. So the nth term includes $1n^2$. To find the remainder of the nth term, we subtract $1n^2$ from our sequence and find the nth term of the linear sequence left over:</p> <p>5 9 15 23</p> <p>- - - -</p> <p>1 4 9 16</p> <p>4 5 6 7... The nth term of this sequence is $n + 3$.</p> <p><i>Nth term of quadratic sequence</i> $= n^2 + n + 3$</p>	<p>Geometric progression is a sequence of non-zero numbers where each term after the first is found by multiplying the previous one by a number.</p> <p><u>Find the next two terms of the sequence</u></p> <p>3 6 12 24...</p> <p> x2 x2 x2</p> <p>The term to term rule here is $\times 2$ therefore the next two terms are</p> <p>$24 \times 2 = 48$</p> <p>$48 \times 2 = 96$</p>	<p>Find the first four iterations of the iterative formula $x_{n+1} = 3x_n - 2$ with $x_1 = 2$.</p> <p>$x_2 = 3x_1 - 2$ $= 3 \times 2 - 2 = 4$</p> <p>$x_3 = 3x_2 - 2$ $= 3 \times 4 - 2 = 10$</p> <p>$x_4 = 3x_3 - 2$ $= 3 \times 10 - 2 = 28$</p> <p>$x_5 = 3x_4 - 2$ $= 3 \times 28 - 2 = 82$</p>	

Linked Knowledge	Notation and manipulation / Functions / Multiples, Primes, Factors / Index Numbers
-------------------------	--

ALGEBRAIC NOTATION AND MANIPULATION

Keywords:	Expression / Simplify / Term / Variable / Substitute / Coefficient / Equivalent / Solve / Expand / Factorise								
Definition / Description:	Expression: an algebraic statement	Simplify: collect like terms	Term: part of an expression	Variable: a quantity that can have different values	Substitute: exchange or replace	Coefficient: a number or letter multiplying a term	Solve: find the result	Expand: multiply out of brackets	Factorise: separate into factors
Knowledge points:	Use and interpret notation Use letter symbols to represent unknown numbers in equations		Substitute into formulae Swap letter symbols in formulae for numbers to solve for an unknown	Algebraic vocabulary Understand and use expressions, equations, formulae, identities, inequalities and terms		Simplify expressions Collect like terms, expanding brackets, factorising into brackets	Rearrange formulae Balance terms about the equation sign to make another unknown the subject of the formula	Equivalence and identities Use algebra to prove equivalent expressions and use the identity symbol	
Knowledge point examples:	ab in place of $a \times b$ $3y$ in place of $y + y + y$ and $3 \times y$ a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$ $\frac{a}{b}$ in place of $a \div b$		<i>Find the value of x^2 when $x = 5$</i> When $x = 5$, replace the x in x^2 with 5 to make $(5)^2$. $5^2 = 25$	Expression: $a + 1$ Equation: $b = a + 1$ Formula: $F = ma$ Identity: $2 + b \equiv b + 2$ Inequality: $a > 1$ Term: a or $2b$	<i>Simplify:</i> $a + b + 2a - 2b = a + 2a + b - 2b = 3a - b$ <i>Expand:</i> $3(x + 5) = (3 \times x) + (3 \times 5) = 3x + 15$ <i>Factorise:</i> $6c - 8d = 2 \times 3c - 2 \times 4d = 2(3c - 4d)$	<i>Rearrange: $y = 2x + 3$ to make x the subject</i> $y = 2x + 3$ (-3 on both sides) $y - 3 = 2x$ ($\div 2$ on both sides) $\frac{y - 3}{2} = x$	$b \times b \times b \equiv b^3$ $2(a + b) \equiv 2a + 2b$ $5x + 6x \equiv 11x$		
Linked Knowledge Maps	Functions (Incl. Composite / Inverse) / Inequalities / Solve Linear Equations / Solve Quadratic Equations								

AXES AND CO-ORDINATES

Keywords: Axis / Co-ordinate / Parallel / perpendicular / Gradient / Linear Graph / Reciprocal

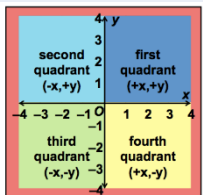
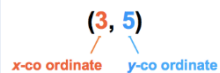
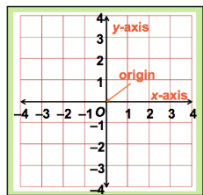
Definition / Description:

- Axis:** the axes are the reference lines that form the coordinate plane
- Co-ordinates:** 2 numbers that locate a specific point on a coordinate plane
- Parallel:** lines that never meet.
- Perpendicular:** Two lines at right angles to one another
- Gradient:** The steepness of a line
- Linear graph:** A visual representation of a straight line.
- Reciprocal:** What you multiply a number by to make 1.

Knowledge points:

- Co-ordinates and co-ordinate grid**
- Plotting graphs from a table**
A linear graph can be drawn by substituting values into a table,
- Graphs parallel to the y-axis**
A graph parallel to the y-axis will always be of the form $x = c$
- Graphs parallel to the x-axis**
A graph parallel to the x-axis will always be of the form $y = c$

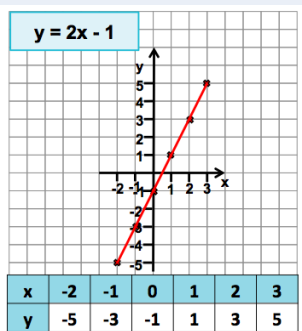
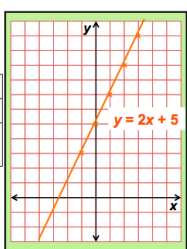
Knowledge point examples:



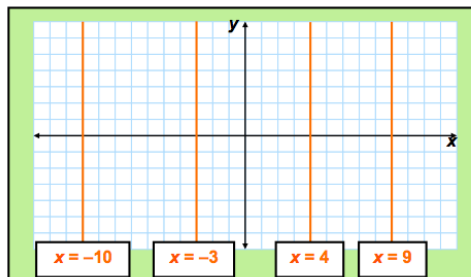
Draw the graph $y = 2x + 5$
Create a table of values

x	-1	0	1	2	3
y	3	5	7	9	11
Co-ordinate	(-1,3)	(0,5)	(1,7)	(2,9)	(3,11)

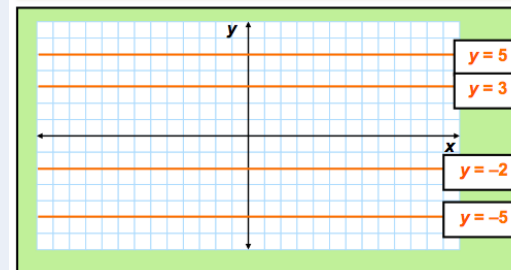
Plot the points on the graph
Draw a line through the points



All graphs of the form $x = c$
where c is any number, will be parallel to the y-axis and will cut the x-axis at the point $(c, 0)$.





All graphs of the form $y = c$
where c is any number, will be parallel to the x-axis and will cut the y-axis at the point $(0, c)$

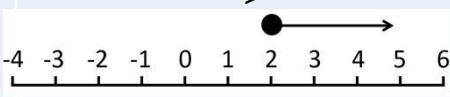
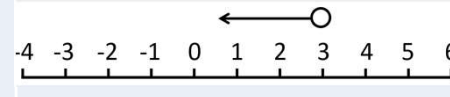
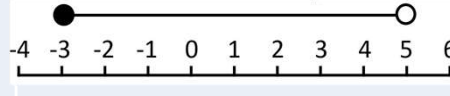
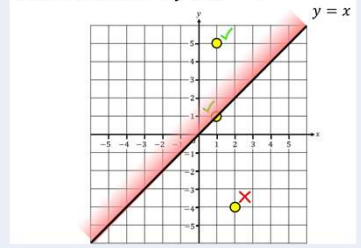
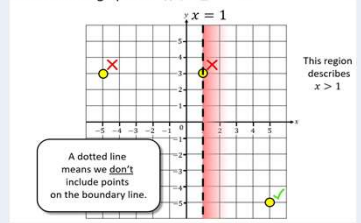
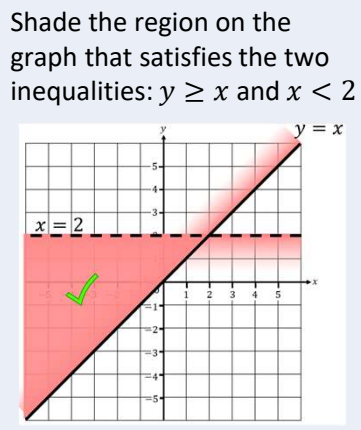
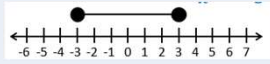
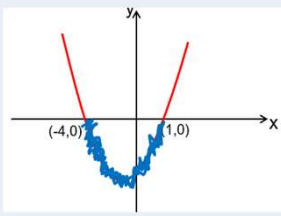


Linked Knowledge Maps
Functions / Non-Linear Graphs quadratic and cubic / Non-Linear Graphs other / Solving Linear Equations / Inequalities / Simultaneous equations / Sequences / Transformations / Linear Graphs / Linear Graphs – parallel and perpendicular lines

Functions

Keywords:	Functions, input, output, inverse function, composite function, flow charts				
Definition / Description:	A function is a relationship between variables. The inverse function is the reverse process. A composite function is the succession of two functions.				
Knowledge points:	Interpret simple functions as expressions with inputs and outputs	Understand and use the function notation	Solve equations that use the function notation	Interpret and use the inverse function	Interpret and use the composite function
Knowledge point examples:	<div style="display: flex; justify-content: space-between; align-items: center; margin-bottom: 10px;"> Input Output </div>  <p>Write down the output y as an expression in terms of x.</p> $y = 5x - 8$ <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 10px;"> Input Output </div>  <p>Work out the output when the input is 10</p> $(10 - 4) \div 2 = 3$	<p>Given that $f(x) = 4x - 5$ work out</p> <p>(a) $f(-6)$</p> <p>(b) $f(0.5)$</p> <p>(a) $4x - 6 - 5 = -29$</p> <p>(b) $4 \times 0.5 - 5 = -3$</p>	$f(x) = 3x + 2$ <p>Solve $f(x) = 0$</p> $3x + 2 = 0$ $3x = -2$ $x = -\frac{2}{3}$	$g(x) = \frac{7x-1}{2}$ <p>Find $g^{-1}(x)$</p> $y = \frac{7x-1}{2}$ $2y = 7x - 1$ $2y + 1 = 7x$ $x = \frac{2y + 1}{7}$ $g^{-1}(x) = \frac{2x + 1}{7}$	$f(x) = 5x + 1, g(x) = x^2$ $fg(x) = f(x^2)$ $= 5x^2 + 1$
Linked Knowledge Maps	Solving linear equations				

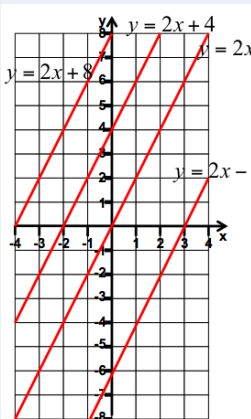
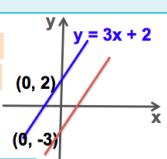
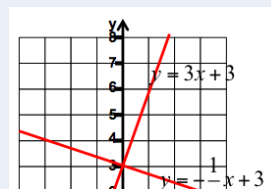
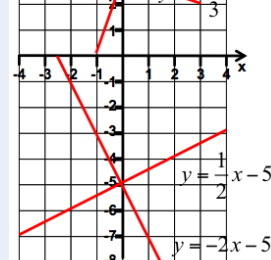

INEQUALITIES

Keywords:	Inequality, region, solve, equation, variable, linear, quadratic				
Definition / Description:	An inequality is a statement showing two quantities that are not equal. They can be represented on a number line and on a graph.				
Knowledge points:	Inequality notation Know correct conventions of open circle for strict inequality and closed circle for inclusive inequality	Represent Inequalities on a number line Show inequalities on a number line using correct notation	Solving linear inequalities Solve inequalities in one and represent solution set on a number line and using set notation.	Graphical Inequalities Represent inequalities on a coordinate grid	Solve Quadratic Inequalities Solve quadratics and represent answers on a number line and on a graph
Knowledge point examples:	$x > 1$ x is greater than 1 $x < 5$ x is less than 5 $x \geq 2$ x is greater or equal to 2 $x \leq 0$ x is less than or equal to 0 $-3 \leq x < 5$ x is greater or equal to negative 3, and smaller than 5	When we represent (plot) inequalities , we must show whether they include or exclude the starting number. <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block;"> ● includes ○ excludes </div> $x \geq 2$  $x < 3$  $-3 \leq x < 5$ 	$5y + 10 \leq 40$ $-10 \quad -10$ $\div 5 \quad \div 5$ $y \leq 6$ $3 < 2x - 7 \leq 9$ $+7 \quad +7$ $10 < 2x \leq 16$ $\div 2 \quad \div 2$ $5 < x \leq 8$ $\{6, 7, 8\}$	Where on the graph is... $y \geq x$?  Where on the graph is... $x > 1$?  A dotted line means we don't include points on the boundary line. Shade the region on the graph that satisfies the two inequalities: $y \geq x$ and $x < 2$ 	$x^2 \leq 9$ Form & solve an equation to find the two bounds . $x^2 = 9$ $x = 3$ or $x = -3$ $-3 \leq x \leq 3$  Solve the inequality $x^2 + 3x - 4 < 0$ 1. Factorise 2. Set $y = 0$ 3. Sketch function 4. It is < 0 so we shade in under the x axis.  $-4 < x < 1$
Linked Knowledge Maps	Solving linear equations Solving quadratic equations Linear graphs Non linear graphs including quadratic				

SOLVING EQUATIONS

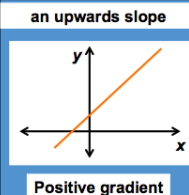
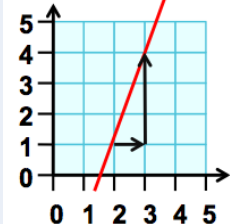
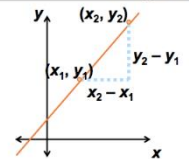
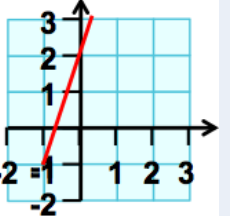
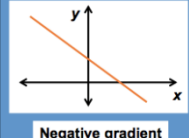
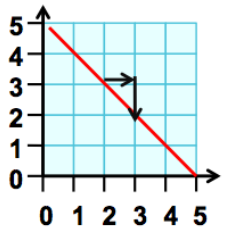
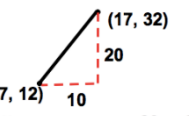
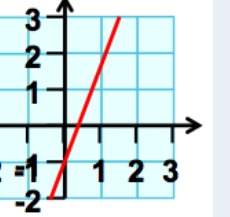
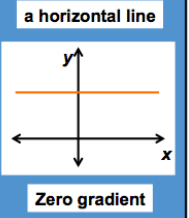
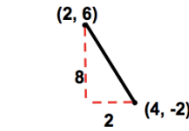
Keywords:	Solve / Equation / Coefficient / Inverse / Equal / Linear Equation					
Definition / Description:	Solve: To find the answer/value of something	Equation: A mathematical statement that shows two things are equal	Coefficient: A number or letter multiplying an algebraic term	Inverse: The reverse or opposite	Equal: An equals sign shows the equality between two expressions	Linear Equation: An equation where no variable has a power greater than one
Knowledge points:	Solve simple linear equations by using inverse operations Solve simple linear equations with integer coefficients where the unknown appears on one or both sides of the equation or where the equation involves brackets Set up a simple linear equation to solve problems					
Knowledge point examples:	<p>One Step</p> $3a = 15$ $\begin{matrix} (\div 3) & & (\div 3) \\ a = 5 \end{matrix}$	<p>Two Step</p> $4a - 3 = 17$ $\begin{matrix} (+3) & & (+3) \\ 4a = 20 \\ (\div 4) & & (\div 4) \\ a = 5 \end{matrix}$	<p>With Brackets</p> $2(a + 3) = 11$ $\begin{matrix} (-6) & & (-6) \\ 2a + 6 = 11 \\ (\div 2) & & (\div 2) \\ 2a = 5 \\ a = 2.5 \end{matrix}$	<p>Unknowns on both sides</p> $3a + 7 = 5a + 11$ $\begin{matrix} (-3a) & & (-3a) \\ 7 = 2a + 11 \\ (-11) & & (-11) \\ -4 = 2a \\ (\div 2) & & (\div 2) \\ a = -2 \end{matrix}$	<p>Forming and solving equations:</p> <p><i>Jack is y years old. His brother John is 5 years older than him. The sum of their ages is 21. How old is Jack?</i></p> $y + y + 5 = 21$ $2y + 5 = 21$ $\begin{matrix} (-5) & & (-5) \\ 2y = 16 \\ (\div 2) & & (\div 2) \\ y = 8 \end{matrix}$ <p><u>Jack is 8 years old</u></p>	
Linked Knowledge Maps:	Algebraic Manipulation and Notation / Linear Graphs / quadratic equations / inequalities / simultaneous equations / linear sequences					

LINEAR GRAPHS – PARALLEL AND PERPENDICULAR LINES

Keywords:	Axis / Co-ordinate / Parallel / perpendicular / Gradient / Linear Graph / Reciprocal																
Definition / Description:	Axis: the axes are the reference lines that form the coordinate plane	Co-ordinates: 2 numbers that locate a specific point on a coordinate plane	Parallel: lines that never meet.	Perpendicular: Two lines at right angles to one another	Gradient: The steepness of a line	Linear graph: A visual representation of a straight line.	Reciprocal: What you multiply a number by to make 1.										
Knowledge points:	Parallel lines: Lines that have the same gradient	Finding the equation of a parallel line Parallel lines have the same gradient no matter the intercept		Perpendicular lines Perpendicular lines meet or join at right angles	Negative reciprocal If the gradients of two lines have a product of -1 they are perpendicular.	Finding the equation of a perpendicular line Find the gradient of the perpendicular line by finding the negative reciprocal.											
Knowledge point examples:		<p>Find the equation of a line parallel to the line $y = 3x + 2$</p> <p>Both have the same gradient: $m = 3$ The y-intercept: $c = -3$ $y = 3x - 3$</p>  <p>Find the equation of the line parallel to the line $y = 4x - 5$ and intercepts the y axis at (0,6)</p> <p>Both have the same gradient: $m = 4$ The y-intercept: $c = 6$ $y = 4x + 6$</p> <p>Find the equation of the line parallel to the line $y = 2x + 3$ and passes through the points (3,5)</p> <p>Both have the same gradient: $m = 2$ Sub in (3,5) into the equation: $5 = 2(3) + c$ $y = 2x - 1$</p>		 	<table border="1"> <thead> <tr> <th>Gradient of the line</th> <th>Gradient of the perpendicular line</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>-1/3</td> </tr> <tr> <td>-2</td> <td>1/2</td> </tr> <tr> <td>-1/4</td> <td>4</td> </tr> <tr> <td>4/5</td> <td>-5/4</td> </tr> </tbody> </table>	Gradient of the line	Gradient of the perpendicular line	3	-1/3	-2	1/2	-1/4	4	4/5	-5/4	<p>Find the equation of the line perpendicular to the line $y = 3x + 2$ and passes through (3,11)</p> <p>Gradient of the line: $m = -1/3$ Sub in (3,11) into the equation: $11 = -1/3(3) + c$ $11 = -1 + c$ $c = 12$</p>  <p>Find the equation of the line perpendicular to the line $y = 1/3x - 2$ and passes through the points (-4,4)</p> <p>Gradient of the line: $m = -2$ Sub in (-4,4) into the equation: $4 = -2(-4) + c$ $4 = 8 + c$ $c = -4$</p>	
Gradient of the line	Gradient of the perpendicular line																
3	-1/3																
-2	1/2																
-1/4	4																
4/5	-5/4																

Linked Knowledge Maps	Functions / Non-Linear Graphs quadratic and cubic / Non-Linear Graphs other / Solving Linear Equations / Inequalities / Simultaneous equations / Sequences / Transformations / Linear Graphs/ Axes and Coordinates
------------------------------	--

LINEAR GRAPHS

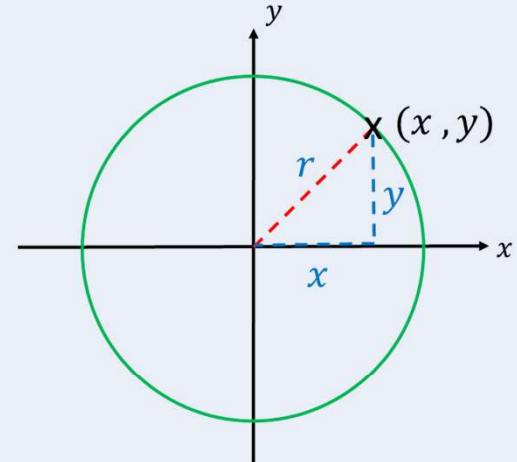
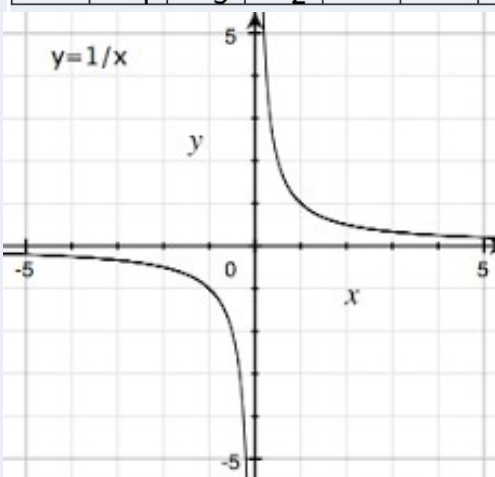
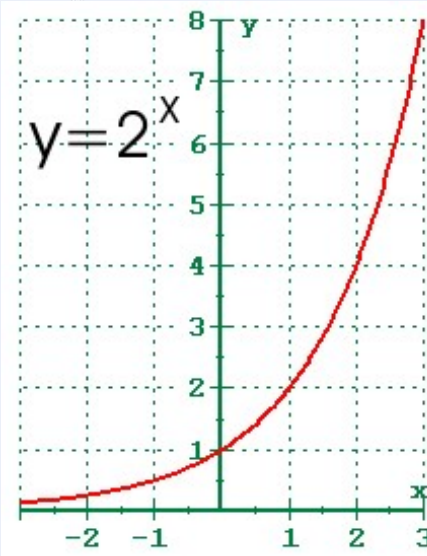
Keywords:	Axis / Co-ordinate / Parallel / perpendicular / Gradient / Linear Graph / Reciprocal							
Definition / Description:	Axis: the axes are the reference lines that form the coordinate plane	Co-ordinates: 2 numbers that locate a specific point on a coordinate plane	Parallel: lines that never meet.	Perpendicular: Two lines at right angles to one another	Gradient: The steepness of a line	Linear graph: A visual representation of a straight line.	Reciprocal: What you multiply a number by to make 1	
Knowledge points:	Gradient (slope)	Gradient: The gradient is simply for every 1 we go along the x-axis how much do we go up/down in the y-axis	Finding gradient from 2 point The gradient is the change in y compared to the change in x	Intercepts These are the points at which the line meets/crosses an axes	The equation of a line $y = mx + c$ M = gradient c = y-intercept	Finding the equation of a line from 2 points To begin find the gradient. Next substitute one co-ordinate into the equation to find the y-intercept	Finding the equation of the line which passes through (3, 6) and (2, 2) Step 1 Calculating the gradient $\frac{\text{Diff in } y}{\text{Diff in } x} = \frac{6-2}{3-2} = \frac{4}{1} = 4$ Step 2 Form the equation $y = 4x + c$ Step 3 Find the y-intercept Substitute one of the co-ordinates into the equation (3,6) $6 = 4(3) + c$ $c = -6$ Step 4 Complete the equation $y = 4x - 6$	
Knowledge point examples:	 <p>an upwards slope</p> <p>Positive gradient</p>		<p>the gradient = $\frac{\text{change in } y}{\text{change in } x}$</p>  <p>the gradient = $\frac{y_2 - y_1}{x_2 - x_1}$</p>		<p>$y = mx + c$</p> <p>the gradient</p> <p>the intercept</p>	<p>Find the equation of the line which passes through (3, 6) and (2, 2)</p> <p>Step 1 Calculating the gradient</p> $\frac{\text{Diff in } y}{\text{Diff in } x} = \frac{6-2}{3-2} = \frac{4}{1} = 4$ <p>Step 2 Form the equation</p> $y = 4x + c$ <p>Step 3 Find the y-intercept</p> <p>Substitute one of the co-ordinates into the equation (3,6)</p> $6 = 4(3) + c$ $c = -6$ <p>Step 4 Complete the equation</p> $y = 4x - 6$		
 <p>a downwards slope</p> <p>Negative gradient</p>		 <p>Diff in $y = 32 - 12 = 20$</p> <p>Diff in $x = 17 - 7 = 10$</p>						
 <p>a horizontal line</p> <p>Zero gradient</p>		 <p>Diff in $y = 6 - (-2) = 8$</p> <p>Diff in $x = 4 - 2 = 2$</p>						

Linked Knowledge Maps	Functions / Non-Linear Graphs quadratic and cubic / Non-Linear Graphs other / Solving Linear Equations / Inequalities / Simultaneous equations / Sequences / Transformations Linear Graphs – parallel and perpendicular lines / Axes and Coordinates
------------------------------	--

Non linear graphs

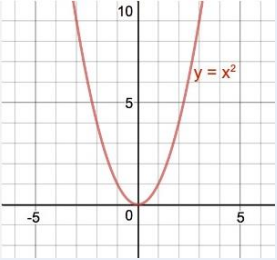
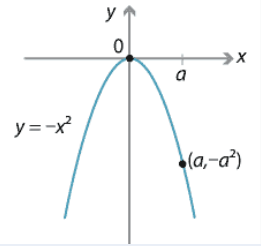
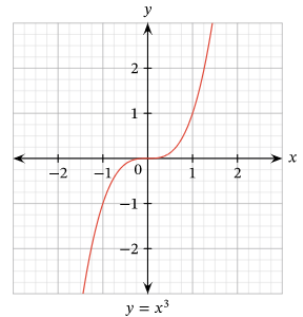
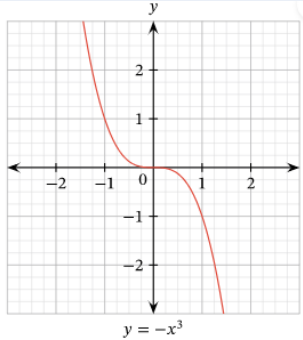
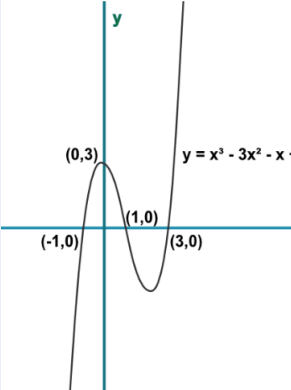
Keywords:	Reciprocal / Asymptote / Exponential / Growth and decay / Radius / Non-Linear					
Definition / Description:	Reciprocal: The inverse of any number except 0	Asymptote: the distance between a curve and a line which approaches but never touches zero	Exponential: a function, where we use repeated multiplication on an initial value to get the output	Growth and decay: an example of exponential increase (growth) and decrease (decay)	Radius: The distance between the centre of a circle and it's circumference	Non-Linear: A graph which does not have a consistent gradient

Knowledge points:	Reciprocal graph: remember the asymptote to the curve as we cannot divide by 0	Exponential Graph: An exponential graph in the form $y = a^x$ will cross the y axis at the point (0,1)	Equation of a circle: The equation of a circle with the centre (0,0) is expressed in the form: $x^2 + y^2 = r^2$
--------------------------	--	--	--

Knowledge point examples:	Use the table to plot the graph $y = 1/x$	Use the table to plot the graph $y = 2^x$	 <p>The following circles all have centre (0,0) Write down the equations of the circles.</p> <p>Radius = 5 Radius = $\frac{1}{8}$ $x^2 + y^2 = 25$ $x^2 + y^2 = \frac{1}{64}$</p>																																
	<table border="1" data-bbox="246 766 940 893"> <tr><td>x</td><td>-4</td><td>-3</td><td>-2</td><td>-1</td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>y</td><td>$-\frac{1}{4}$</td><td>$-\frac{1}{3}$</td><td>$-\frac{1}{2}$</td><td>-1</td><td>1</td><td>$\frac{1}{2}$</td><td>$\frac{1}{3}$</td><td>$\frac{1}{4}$</td></tr> </table> 	x		-4	-3	-2	-1	1	2	3	4	y	$-\frac{1}{4}$	$-\frac{1}{3}$	$-\frac{1}{2}$	-1	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	 <table border="1" data-bbox="940 1324 1590 1420"> <tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr> <tr><td>y</td><td>0.125</td><td>0.25</td><td>0.5</td><td>1</td><td>2</td><td>4</td><td>8</td></tr> </table>	x	-3	-2	-1	0	1	2	3	y	0.125	0.25	0.5	1	2
x	-4	-3	-2	-1	1	2	3	4																											
y	$-\frac{1}{4}$	$-\frac{1}{3}$	$-\frac{1}{2}$	-1	1	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$																											
x	-3	-2	-1	0	1	2	3																												
y	0.125	0.25	0.5	1	2	4	8																												

Linked Knowledge Maps	Non-Linear Graphs quadratic and cubic / Linear Graphs / Functions /
------------------------------	---

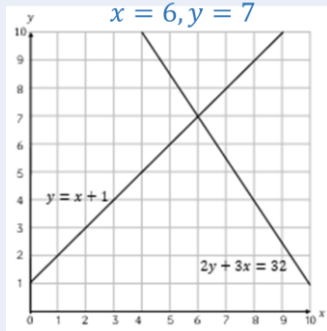
Non-linear Graphs – quadratic and cubic

Keywords:	Quadratic / Parabola / Substitute / Cubic / Root / Solution				
Definition / Description:	Quadratic expression contains terms up to and including x^2	A Parabola is a curved graph formed from a quadratic equation. A parabola has a line of symmetry	Cubic expression contains terms up to and including x^3	Substitute: Exchange or replace variables with amounts	Roots or solutions: of graphs are the values of x-coordinates of the points where the graph crosses the x-axis
Knowledge points:	Plotting graphs: <ol style="list-style-type: none"> 1. Complete a table of values for a graph, substituting different values of x to find the y coordinate 2. Join the points with a smooth line to create a curve 3. Label the graph 				
Knowledge point examples:	Positive Quadratic in the form $y = x^2$ 	Negative quadratic in the form $y = -x^2$ 	Positive cubic graph $y = x^3$ 	Negative cubic graph $y = -x^3$ 	Complex cubic graph 
Linked Knowledge Maps	Linear Graphs Non-linear graphs – reciprocal, exponential and circle Solving Quadratic equations				

Solving Quadratic Equations

Keywords:	Quadratic Equation / Solution / Formula / Factorise / Discriminant				
Definition / Description:	Quadratic Equation: An equation where the maximum power is two	Solution: The answer to a quadratic equation	Formula: An equation to find quantities when given certain values	Factorise: To break up or to separate into factors	Discriminant: the part of the quadratic formula underneath the square root symbol
Knowledge points:	Solving by factorising – Use the product and sum	Solving when not equal to zero	Solving by completing the square	Solve using the quadratic formula – Use the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	Finding the amount of solutions a quadratic equation has. The value of the discriminant shows the amount of solutions a quadratic equation has
Knowledge point examples:	<p>Factorise and solve $g^2 + 11g + 24 = 0$</p> <p>Factors of 24</p> <p>1 and 24 2 and 12 3 and 8 4 and 6</p> <p>$g^2 + 11g + 24 \equiv (g + 3)(g + 8)$ $(g + 3)(g + 8) = 0$ $g = -3$ and $g = -8$</p>	<p>A quadratic equation can only be solved when equal to zero</p> <p>Factorise and solve:</p> <p>$x^2 + 6x + 10 = 2$ $x^2 + 6x + 8 = 0$ $(x+4)(x+2) = 0$ $x = -4$ or -2</p>	<p>Use $\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$</p> <p>To complete the square before solving:</p> <p>$x^2 + 8x + 6 = 0$ $(x + 4)^2 - 10 = 0$ $(x + 4)^2 = 10$ $(x + 4) = \pm\sqrt{10}$ $x = \pm\sqrt{10} - 4$</p>	<p>Solve $3x^2 + 8x - 5 = 0$ using the quadratic formula To 3 S.F. $a = 3$ $b = 8$ $c = (-5)$</p> <p>$x = \frac{-8 \pm \sqrt{(64 - 4 \times 3 \times -5)}}{2 \times 3}$ $x = \frac{-8 \pm \sqrt{124}}{6}$ $x = 0.523$ or $x = -3.19$</p>	<p>$b^2 - 4ac > 0$ 2 solutions $3x^2 - 4x - 3 = 0$ $b^2 - 4ac = (-4)^2 - 4 \times 3 \times (-3) = 52$ <u>Two Solutions</u> $b^2 - 4ac = 0$ 1 solution $16x^2 + 16x + 4 = 0$ $b^2 - 4ac = 16^2 - 4 \times 16 \times 4 = 0$ <u>One solution</u> $b^2 - 4ac < 0$ No real solutions $4x^2 + 3x + 2$ $b^2 - 4ac = 3^2 - 4 \times 4 \times 2 = -23$ <u>No real solutions</u></p>
Linked Knowledge Maps	Multiples, Primes, Factors / Notation and manipulation / Non-Linear Graphs quadratic and cubic / Solving Linear Equations / Inequalities / Sequences / Simultaneous equations				

SIMULTANEOUS EQUATIONS

Keywords:	Simultaneous / Eliminate / Non-linear / Linear / Substitute				
Definition / Description:	Simultaneous: 2 values satisfying more than one equation at the same time	Eliminate: To remove	Non-Linear: An expression or equation where there is a power than is not 1	Linear: An expression or equation where the only power than 1	Substitute: To exchange or replace a value
Knowledge points:	Solving using Elimination (2 Linear) <ol style="list-style-type: none"> Label equations Look to see if the coefficients of either variable are equal Multiply one or both equations to make the coefficients of one variable the same Look at sign in front of those variables Same Signs Subtract Different Signs Add Solve equation to find first variable Substitute into original equation to find second variable Check both solutions in other equation 	Solving using Substitution (1 linear and 1 quadratic) <ol style="list-style-type: none"> Rearrange one equation to make a variable as subject Substitute into second equation Solve as linear equation Substitute into original equation to find other variable Check both solutions in the other equation 	Simultaneous Equations Graphically <ol style="list-style-type: none"> Plot both graphs The solution to the simultaneous equation is found at the intersection of the two graphs 	Setting up and solving: David and Jen are attending a football match with their families Jen buys 2 Adult tickets and 2 Kids tickets for £90 David buys 1 Adult ticket and 3 Kids tickets for £75 Use Simultaneous Equations to work out the price of 1 Adult and 1 Kids Ticket.	Solving using Substitution (1 linear and 1 quadratic) <ol style="list-style-type: none"> Rearrange linear to make variable as subject Substitute into quadratic Solve quadratic (2 solutions) Substitute both solutions in the linear equation to find other variable
Knowledge point examples:	$\begin{aligned} 7x + 6y &= 46 \quad (1) \\ 2x + 3y &= 17 \quad (2) \end{aligned}$ $(2) \times 2 \quad 4x + 6y = 34 \quad (3)$ $\text{SSS } (1)-(3) \quad 3x = 12$ $x = 4$ $\text{Sub in } (1) \quad 7(4) + 6y = 46$ $28 + 6y = 46$ $6y = 18$ $y = 3$ $\text{Check in } (2) \quad 2(4) + 3(3) = 17$	$\begin{aligned} 3x + 2y &= 21 \\ y &= x + 3 \end{aligned}$ $3x + 2(x + 3) = 21$ $3x + 2x + 6 = 21$ $5x + 6 = 21$ $5x = 15$ $x = 3$ $y = 3 + 3$ $y = 6$ $3(3) + 2(6) = 21$		$\begin{aligned} 2a + 2k &= 90 \quad (1) \\ a + 3k &= 75 \quad (2) \end{aligned}$ $(2) \times 2 \quad 2a + 6k = 150 \quad (3)$ $\text{SSS } (3) - (1) \quad 4k = 60$ $k = 15$ $a + 3(15) = 75$ $a = 30$ $\text{Adults} = \text{£}30$ $\text{Kids} = \text{£}15$	$\begin{aligned} x^2 - y^2 &= 7 \\ 2y &= 2 + x \end{aligned}$ $x = 2y - 2$ $(2y - 2)^2 - y^2 = 7$ $4y^2 - 8y + 4 - y^2 = 7$ $3y^2 - 8y - 3 = 0$ $(3y+1)(y-3) = 0$ $y = \frac{1}{3} \text{ or } 3$ $x = 2\left(\frac{1}{3}\right) - 2 \text{ or } x = 2(3) - 2$ $= -2\frac{2}{3} \quad = 4$

Linked Knowledge Maps	Solving Linear Equations / Non-Linear Graphs quadratic and cubic / Solving Quadratic Equations / Linear Graphs
------------------------------	--