

» Mathematics Program Summary | Year 9 Course

» TOPIC 1: ALGEBRA REVISION	
Remove grouping symbols	
Expand and simplify binomial products	
Generalise an arithmetic statement	
Substitute into formulae	
Construct formulae	
Solve linear equations up to those involving parentheses & fractions	
Change the subject of a formula	
Factorise: common factors	
difference of squares	
by grouping pairs	
trinomials (i.e. quadratics)	
Solve miscellaneous exercises	
Solve simple quadratic equations	
State laws for positive integer indices	
Simplify algebraic expressions involving simplification of indices	
Write down the meaning of a^0 ($a \neq 0$)	
» TOPIC 2: PRODUCTS & FACTORS	
Factor the sum & difference of 2 cubes	
Factor trinomials whose co-efficient of x^2 is not unity (i.e. non-monic)	
Simplify algebraic fractions	
Multiply & divide algebraic fractions	
Add & subtract algebraic fractions	
» TOPIC 3: IRRATIONAL NUM. & SURDS	
Construct lines of length $\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$.	
Plot $\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$ on a number line.	
Discuss uneven spacing of $\sqrt{2}$, $\sqrt{3}$ & $\sqrt{5}$.	
Define \sqrt{a} .	
Use result $\sqrt{a^2b} = a\sqrt{b}$ to simplify surds	
Express $a\sqrt{b}$ in the form \sqrt{A}	
Add and subtract surds	
Multiply and divide surds	
Expand and simplify surds	
Rationalise surd denominators	
Rationalise binomial denominators by using the conjugate surd	
Equate expressions involving surds	
Solve simple surd equations	
Calculate lengths in 3D figures	
Use surds in calculating volumes & SA	
Prove that $\sqrt{2}$ is irrational	
» TOPIC 4: GEOMETRY REVISION	
List angle properties associated with straight lines, parallel lines & triangles	
Use such properties in deductive proofs	
Test for congruent triangles	
Summarise properties of quadrilaterals	
State Pythagoras' Theorem & its converse; use it to calculate side lengths	
Test for similar triangles	
Prove that an interval joining the midpoints of two sides of a triangle is parallel to & half the length of the third side; also prove converse	
Prove that a line parallel to one side of a triangle divides the other two sides in the same ratio; also prove converse	
Prove that intercepts made by parallel lines on a set of transversals are in the same ratio (NOT converse)	
Use theorems in numerical exercises	

» TOPIC 5: PROBABILITY	
Define <i>random experiment</i> , <i>sample space</i> , and <i>probability of an event</i>	
Construct sample space by making:	
> Lists of elements	
> Dot diagrams in case of 2 outcomes	
> Tree diagrams in case of 3+ outcomes	
Use Venn diagrams to enumerate sample spaces and favourable events in probability problems	
Use dot and tree diagrams to solve problems w/ conditional probability	
Construct a probability tree diagram; use the product & addition rules	
Describe (in)/dependent events	
Describe complementary events	
Solve probability problems involving the concept of areas	
» TOPIC 6: GEOMETRY of a CIRCLE	
Define the parts of a circle: radius, diameter, circumference, arc, chord, sector, segment	
List the chord properties of a circle (see Year 8 program) and use these in numerical exercises	
Prove the common angle properties of a circle as a sequence of results:	
> The angle at the centre is twice the angle at the circumf. on the same arc	
> The angle at the circumference in a semicircle is a right angle	
> Angles at the circumference in the same segment of a circle are equal, OR Angles at the circumference standing on the same arc are equal	
> Angles at the circumference standing on equal arcs are equal (+ converse)	
> Opposite angles in a cyclic quadrilateral are supplementary	
> Exterior angle of a cyclic quadrilateral is equal to the opposite interior angle	
Solve simple exercises using these properties	
» TOPIC 7: INDICES	
Explain the meaning of a negative index	
Evaluate numerical expressions containing negative indices	
Simplify algebraic expressions containing negative indices	
Evaluate expressions after substituting into algebraic expressions involving negative indices	
Explain fractional indices	
Evaluate numerical expressions containing fractional indices	
Graph exponential functions	
Solve indicial equations	
Solve simultaneous indicial equations	
Simplify algebraic expressions involving indices & factorisation	
» TOPIC 8: SUFFICIENCY CONDITIONS for QUADRILATERALS	
State sufficiency conditions for quadrilaterals	
> Parallelogram	
> Rectangle	
> Rhombus	
> Square	
> Kite	
Apply sufficiency conditions in the solution of geometrical problems	

» TOPIC 9: CO-ORDINATE GEOMETRY	
Write down formulae for distance, midpoint and gradient	
Use these formulae to identify particular types of triangle or quadrilateral	
Graph the equation of a line given in general form	
Identify the gradient of a line when written in general form	
State the condition for lines to be:	
> Parallel	
> Perpendicular	
Use these conditions to identify the type of quadrilateral bounded by a certain set of four lines (given equations)	
Recognise the various forms of the equations of a line:	
> X-axis	
> Y-axis	
> Line parallel to X-axis	
> Line parallel to Y-axis	
> Slope-intercept form	
> Point-gradient form	
Prove that a point lies on a line	
Write down the form of a line parallel to $ax + by = c$, and use it to find the equation of a line parallel to a given line passing through a given point	
Write down the form of a line perpendicular to $ax + by = c$, and use it to find the equation of a line perpendicular to a given line passing through a given point	
Sketch the half-plane corresponding to a linear inequality	
Sketch a region completely determined by a set of inequalities	
Describe regions by writing down a set of inequalities which exactly determine a region enclosed by a set of lines	
» TOPIC 10: SIMULTANEOUS EQUATIONS	
Sketch graphs of lines in point-gradient & general form by (a) plotting general points and (b) intercepts	
Sketch the special cases $x = a$ and $y = b$	
Solve simultaneous linear equations:	
> By graphical means	
> By the elimination method	
> By the substitution method	
> That require algebraic simplification	
Use the above techniques in problem situations involving:	
> Relationships between two unknown numbers	
> Unknown angles and sides in triangles and quadrilaterals	
> Unknown numbers of currency	
> Attendance and takings at concerts & sporting events	
> Ages of people	
> Place values of number	
Solve equations simultaneously to find the point of intersection of two lines	
Solve problems requiring use of a variety of these formulae and techniques in their solution	

» TOPIC 11: SOLUTION of QUADRATIC EQUATIONS & MAX/MIN PROBLEMS	
Solve equations (monic & non-monic) by use of factors	
Solve equations of form $(ax + b)^2 = c$	
Solve equations by completing the \square	
Develop the quadratic formula	
Use the most appropriate method for solving an equation	
Simplify the square root of a negative number	
Describe complex numbers	
Write solutions of equations with complex solutions	
Solve quadratic equations where initial algebraic simplification is needed	
Solve equations leading to a quadratic equation where restrictions on the pronumerals exist	
Solve problems involving use of quadratic equations	
Solve equations reducible to quadratics	
Graph quadratic functions by means of:	
> Plotting sets of points	
> Finding points of intersection w/ axes	
> Finding equation of axis of symmetry and co-ordinates of vertex	
Use the graph of a quadratic function in the solution of problems	
» TOPIC 12: LINEAR PROGRAMMING	
Sketch linear graphs	
Sketch linear inequalities	
Sketch regions	
Describe regions	
Find the value of linear expressions	
Solve problems involving linear programming	
» TOPIC 13: POLYNOMIALS	
Write down the definition of a polynomial of degree n	
Describe the following terms: co-efficients of a polynomial, degree, terms, leading term, leading co-efficient, monic polynomial, zeros	
Add, subtract & multiply polynomials	
Divide polynomials	
Use the Division Transformation to rewrite a polynomial in terms of its quotient, divisor and remainder	
Use the Remainder Theorem	
Use the Factor Theorem	
Solve polynomial equations	
Sketch polynomial functions	
Use a graph of a polynomial to solve an inequality	
» TOPIC 14: TRIGONOMETRY	
Demonstrate the sine, cosine and tangent of acute angles for whole numbers of degrees by (a) using enlargements and (b) using ratios of sides of similar triangles	
Find the side of a right-angled triangle given:	
> The hypotenuse and an angle	
> An angle and a side	
> Two sides	
Calculate lengths by indirect measurement	
Calculate heights of trees and buildings using angles of elevation & depression	
Fix the position of a ship at sea by use of a vertical sextant angle	
Construct a scale diagram from a problem involving a set of bearings	
Solve simple problems using bearings	
Calculate the lengths of sides and size of angles in geometric figures	

» TOPIC 15: STATISTICS	
Construct bar, column, sector, line and travel graphs	
Interpret all of the above	
Distinguish between discrete and continuous data	
Discuss the differences between a sample and a census	
Discuss approaches to obtaining an unbiased sample	
Collect simple data	
Display simple data	
Calculate measures of central tendency for a small body of data	
Describe the measure of central tendency appropriate to a situation	
Illustrate the disadvantage of relying on only one measure of central tendency to describe simple data	
Construct stem-and-leaf plots	
Use stem-and-leaf plots to find median, upper quartile, lower quartile and interquartile range	
Construct box-and-whisker plots from raw data and from a stem-and-leaf plot	
Compare sets of data using stem-and-leaf plots and box-and-whisker plots.	
Display data by means of a frequency distribution table	
Use a frequency distribution table to construct a relative frequency column	
Calculate measures of central tendency from a frequency distribution table.	
Display data in frequency or cumulative frequency polygon/histogram	
Display grouped data in a frequency distribution table and on a histogram or polygon	
Calculate measures of central tendency (modal class, median class) for grouped data	
Differentiate between data with similar means by using a dispersion measure.	
Explain the significance of the standard deviation of a set of scores.	
Explain the significance of a small or large standard deviation.	
Define the terms positive and negative skew and sketch graphs to demonstrate data with positive or negative skew	
» TOPIC 16: FUNCTIONS, FUNCTION NOTATION & GRAPHS	
Interpret line graphs, step graphs and travel graphs	
Define a relation or function and state the domain and range	
Use vertical line test on a graph to identify a function or a relation	
Write down the domain and range of a function or relation	
Sketch linear, quadratic & exponential functions	
Graph the hyperbola, describe its asymptotes & discuss the family of related graphs	
Discuss the relationship between $y = x^2$ and $y = ax^2 + bx + c$	
Write $y = ax^2 + bx + c$ in the form $y - k = a(x - h)^2$ and state its vertex	
Write down the equation of a circle with centre at the origin & given radius	
Write down the equation of a semi-circle with given centre & radius and axis of symmetry the y -axis	
Write down the equation of a circle with centre not at the origin & given radius	
Find the centre and radius of a circle whose equation is given in general form	
<i>Continued next column »</i>	

» TOPIC 16, continued	
Extension of graphical work to include those done by:	
> Plotting sets of points	
> Drawing in horizontal & vertical asymptotes	
Determine the inverse of a function	
Explain the conditions of a function to have an inverse	
Sketch the graph of $y = f(x) + k$ and $y = f(x - a)$ given $y = f(x)$	

For more details, please see the full mathematics program, available for download on the school intranet.