

KING'S COLLEGE JUNIOR SCHOOL
MATHEMATICS

OUTLINE SCHEME OF WORK FOR UPPER REMOVES

YEAR 2010/2011

AUTUMN TERM

Unit A	Polygons
Unit B	Simultaneous Equations
Unit C	Speed
Unit D	Graphing Relations
Unit E	Prisms
Unit F	Arithmetic Skills

SPRING TERM

Mock Transfer Entrance Exams

Unit G	Algebraic Skills
Unit H	Expressions and Formulae
Unit I	Pi and Pythagoras
Unit J	Probability and Statistics
Unit K	Geometric Skills

SUMMER TERM

Past Papers for Practice and Revision.

Unit A Polygons

Pre-Unit Revision: Names of regular polygons and numbers of sides. Symmetry of regular polygons.

Unit Content: Exterior angles as the angles turned through when walking around a polygon; they always total 360° in both regular and irregular polygons. For regular polygons calculating exterior angles by dividing 360° by the number of sides and interior angles by taking this from 180° . Finding the total of the interior angles by different methods. Angles at the centre of regular polygons are the same as exterior angles, diagonal angles are half this. Working back from interior or exterior angles of regular polygons to find the number of sides of a regular polygon. Angle-chasing problems involving interior and exterior angles.

Mental Skills: Calculating exact whole number exterior and interior angles of regular polygons.

What to know: Exterior angles total 360° . The procedure or formula for calculating exterior, interior angles and the sum of interior angles of polygons, and their use backwards to find the number of sides. The names of polygons.

Unit B Simultaneous Equations

Pre-Unit Revision: Adding algebraic expressions as collecting like terms.

Unit Content: Pairs of values which satisfy one equation e.g. $x + y = 10$ and $x - y = 4$. There are an infinite numbers of pairs satisfying each equation separately, but only one, which satisfies them 'simultaneously'. Solving Simultaneous equations by elimination methods. Adding and subtracting equations algebraically, using like terms. The idea of 'elimination'. Identifying co-efficients in value and sign. One and two step multiplications through equations in order to equalise co-efficients. Forming pairs of simultaneous equations from written information e.g. involving costs. Graphical method to solve simultaneous equations.

Mental Skills: Inspection of a pair of simultaneous equations to prepare a solution plan.

What to know: Whether to add or subtract equations to eliminate terms. What to multiply by in order to make co-efficients equal. How to check solutions by substituting both values back into both equations. How to solve simultaneous equations graphically.

Unit C Speed

Pre-Unit Revision: The multiplication and division of mixed fractions.

Unit Content: Hours and minutes converted to and from mixed fractions of an hour. Converting decimal number of hours into hours and minutes (using calculator steps). Speed/Distance/Time formulae. Problems involving speed, distance and time. Calculating the average speed for journeys of more than one stage as total distance divided by total time. Converting units of speed, e.g. km/h to/from m/s.

Mental Skills: Converting top-heavy to and from mixed fractions. Cancelling fractions to lowest terms. Mental strategies for finding time taken, distance travelled and average speed.

What to know: The speed/distance/time formulae by heart. The calculating units to use are determined by those of the given or required speed. Use fractions of hours rather than minutes. How to solve time, distance and speed problems.

Unit D Graphing Relations

Pre-Unit Revision: Equations of horizontal and vertical straight lines and $y = x$ and $y = -x$.

Unit Content: Finding pairs of values to satisfy equations connecting two unknowns x and y , by substituting (usually) a chosen value of x and obtaining the corresponding value of y . (Also to include examples such as $x + y = 12$ where pairs can be found intuitively). Plotting pairs of values as co-ordinates on graphs. The resulting line as a 'picture' of the algebraic relation. Using a table of values to tabulate values. Linear and Quadratic relations and their corresponding straight line and parabolic graphs. Finding the points of intersection of a curve with a straight line. Conversion Graphs.

Mental Skills: Using mental arithmetic to check if a point will be on a particular line.

What to know: How to make a table of values and substitute in values of the independent variable to get corresponding values of the dependent variable to form the co-ordinates of points. What shape of graph to expect depending on the type of equation: linear, quadratic. Points of intersection. How to draw and interpret Conversion Graphs.

Unit E Prisms

Pre-Unit Revision: Volume of cuboids.

Unit Content: The definition of a prism, uniform cross-section and perpendicular edge. Naming different prisms. Nets of prisms and finding their surface area (the cross section faces becoming 'wings' attached to a large rectangle formed by the other faces flattened). The volume of prisms as Area of uniform cross section times perpendicular length (height). The cylinder as circular prism. Using a given volume to find an unknown cross-sectional area or an unknown perpendicular edge. Specific application to finding the height of water surface level when a known volume of water is poured into a prism tank with cross-section base. Other water and tank problems. Conversion between litres and cubic cm and m.

Mental Skills: Visual imagery. Mental rotation of 3D shapes, identifying the uniform cross-sections.

What to know: How to draw the nets of prisms. How to find the surface area of a prism. That the volume of a prism is the area of the uniform cross-section times the length of the perpendicular length and how to apply this. Using it to form an equation for height of water in a tank. How to convert between litres and cubic cm and m.

Unit F Arithmetic Skills

Pre-Unit Revision: This is mainly a revision unit.

Unit Content: A revision of fraction and decimal arithmetic, four operations, but particularly techniques for division. Estimating the value of complex numerical expressions. Order of operations: BODMAS. Directed Numbers: addition, subtraction, multiplication and division of negative and positive numbers. Rounding to a given number of decimal places and significant figures. The use of calculator in evaluating complex numerical expressions. Percentage calculations including finding the percentage of an amount, finding one number as a percentage of another, percentage increases and decreases, using the two-step method (and scale factors). Percentage profit and loss. Converting between fractions, decimals and percentages. Fractions of amounts. Calculations using ratio. Prime factorisation.

Mental Skills: Mental strategies for percentage calculations, including VAT at $17\frac{1}{2}\%$ and percentage increases and decreases. Finding the fraction of an amount. Using a given ratio to find a missing value.

What to know: How to answer questions involving fraction and decimal arithmetic. How to estimate the value of numerical expressions. Understand and use BODMAS. The rules for directed numbers. How to use a calculator efficiently and use it to solve numerical problems. How to find a given percentage of an amount. How to find one number as a percentage of another. How to solve questions involving percentage increase and decrease. How to solve ratio problems. How to prime factorise a whole number.

Unit G Algebraic Skills

Pre-Unit Revision: This is mainly a revision unit.

Unit Content: Revision of expanding brackets and factorising, including dealing with signs: $x - 3(2y - x)$. Collecting like terms. Simplifying algebraic fractions by cancelling common factors, the use of factorising as a step in simplifying fractions. Multiplying algebraic terms. Revision of solving equations especially those with unknowns terms on both sides and with brackets. Solving fractional equations by finding common denominator. Substitution. Inequalities: 'Greater than or equal to' and 'Less than or equal to' signs and ideas. Number lines, boundary points included or excluded. Solving linear inequalities. Listing sets of integer values which satisfy a pair of inequalities. Greatest or least possible values.

Mental Skills: Mentally solving 'I think of a number' problems by working backwards. Substituting values into algebraic terms.

What to know: How to expand brackets by multiplying. How to avoid traps with negative signs. How to factorise expressions. How to collect like terms. How to multiply and divide algebraic terms. That operations must be applied equally to both sides when solving an equation. When converting fractions both the numerator and denominator must be multiplied by the same number. When multiplying through an equation by a number each separate term must be multiplied. How to solve equations with unknowns on both sides, with brackets and with fractions. How to substitute values to evaluate expressions, working out each term separately. Inequalities: How to recognise and read all four inequality signs. How to use mental imagery of number line to find greatest and least possible integer values. That solving inequalities is like solving equations EXPECT that when multiplying and dividing both sides by a negative, the inequality sign is reversed; alternative strategies to avoid this situation. How to represent solutions on a number line.

Unit H Expressions and Formulae

Pre-Unit Revision: How to write algebraic expressions. Known number sequences

Unit Content: Expressing relations algebraically: e.g. twice x , 3 less than x . Using algebraic expressions in terms of a single variable to represent; for example lengths, angles, area, heights and other quantities. Forming equations with these expressions using given information and context. Substituting numerical values into formulae. Changing the subject of formulae using algebraic steps. Sequences: different types of sequences e.g. Fibonacci, triangular, Linear Sequences. Generating rules. Find and describe in words the rule for the next term. The use of an n -number to represent the 'position' of a term in a sequence. Finding the n th term rule for linear sequences, arising from an analysis of the first difference. Substituting into an n th term rule to find particular values. Solving equations to find the value of n to match a given term of the sequence e.g. the first term greater than a given limit.

Mental Skills: Calculating differences in sequences.

What to know: How to write algebraic expressions using letters to represent the relationship between variables. How to use algebraic expressions to form equations and formulae, to match given situations. How to substitute numerical values into formulae. How to change the subject of formulae. Sequences: Basic number patterns off by heart: square, cube, triangular, Fibonacci. How to use the method of differences (1^{st} and 2^{nd}) to find the next term in the sequence. How to use notation in terms of a sequence. How to find the n th term rule for linear sequences. How to substitute into n th term formula to find value of higher terms. How to reverse this process. How to solve equations to find the value of n .

Unit I Pi and Pythagoras

Pre-Unit Revision: Definition and value of Pi. Circle Vocabulary. Circumference and Area formulae for circles. Area of Annulus.

Unit Content: Applications of Pi in basic formulae for circumference and area of circle. Lengths of arcs and areas of sectors as a fraction of these, determined by the angle as that number of 360-degrees. Wheel problems (a wheel in one rotation moves forwards a distance equal to its own circumference). Finding the radius given the circumference. Giving all answers to 3 s.f. Surface area and volume of cylinders (curved surface area unrolled to make a rectangle). Pythagoras theorem for finding the hypotenuse or a perpendicular side in right-angled triangles. Pythagorean triples. Problems involving Pythagoras. Calculate the distance between two points given their 2D co-ordinates.

Mental Skills: Cancelling fractions of 360° to their lowest terms. Rough estimates of answers to questions involving Pi, using value of 3. Squaring mentally.

What to know: The formulae for area and circumference of circle, surface area and volume of cylinder. The values of Pi, when to use $22/7$. Common fractions of 360° . How to find lengths of arcs and areas of sectors. How to find the radius given the circumference. Remember sequence of steps required in applying Pythagoras for finding hypotenuse and perpendicular sides. How to mentally image a diagram of a 3D object from different points of view and identify right-angled triangles in different planes.

Unit J Probability and Statistics

Pre-Unit Revision: Drawing and interpreting Bar Charts and Pie charts. Scatter diagrams
Probability of simple events. Conversion graphs.

Unit Content: Probability of combined events. Using combination tables. The idea of conditional probability, i.e. if A has occurred what is the probability of B?
Collected and grouped data. Using frequency tables to calculate means and find medians and modes. Finding these also from Bar Charts. Average problems: working back from the mean to find the total for numerical data and hence individual items.

Mental Skills: Fraction calculations required in Probability: taking away from 1. Finding the mean of a set of numbers.

What to know: How to find the probability of combined and conditional events. How to use $p(E') = 1 - p(E)$. How to find the Mean, Median, Mode and Range of a set of numerical data and of a set of grouped data. How to find the total given the Mean and number of items and use this to find particular items.

Unit K Geometric Skills

Pre-Unit Revision: This is mainly a revision unit.

Unit Content: A revision of angle properties of parallel lines: alternate, corresponding and allied angles. Situations in which the sum of the angles add up to 180° and 360° . Angle properties of regular polygons: interior, exterior and central angles. Angle-sum of polygons. Angle-chasing.
Using letters to represent variable angles: expressions for other angles in terms of the variable.
Bearings: Scale drawing. Measuring and drawing angles to the nearest 1 degree using a protractor.
Calculating back bearings using alternate, corresponding and allied angles. Drawing multiple stage journeys.
Properties (including symbols) and construction of triangles and quadrilaterals.
Area of triangle, parallelogram, rhombus, kite and trapezium.
Combining Transformations: Reflection, Rotation, Translation and Enlargement.

Mental Skills: Taking angles from 180° and 360° . Recalling the bearings of each of eight compass points. Lines of symmetry and order of rotational symmetry of 2D shapes. Estimating distances.

What to know: How to use knowledge of angle properties to find the size of missing angles. How to express angles as algebraic expressions in terms of given angle x , according to their relations to x . How to draw a scale diagram of a multiple stage journey given written description of bearings and distances. Learn the bearings for the eight-point compass by heart. How to use back-bearings to improve accuracy. The properties of all types of triangle, quadrilateral and regular polygons. Which properties also apply to irregular polygons. How to construct triangles and quadrilaterals. How to use compasses accurately. How to find the area and perimeter of triangles and quadrilaterals. How to reflect, rotate and translate a shape on a grid. How to enlarge a shape on a grid and find the area of the enlarged shape.