Eastlea COMMUNITY SCHOOL

Grade Descriptors for (Mathematics)

Assessment Outcomes Covered in the GCSE:

Strand	Number	Algebra	Geometry & Measures	Ratio, proportion & rates of change	Probability	Statistics
Grade	**In order to be awarded this grade a student must demonstrate that they can...**					
To gain a Grade 9		Solve quadratic equations arising from algebraic fractions, Use iteration with simple converging sequences. Find f(x) + g(x), 2f(x), f(3x) etc. algebraically, Interpret the succession of two functions as a 'composite function' e.g for f(x) and g(x) find gf(x). Estimate area under a quadratic graph by dividing it into trapezium. Interpret the gradient of linear or non-linear graphs, and estimate the gradient of a quadratic or non-linear graph at a given point by sketching the tangent and finding its gradient. Find the equation of a tangent to a circle at a given point Plot graphs of the exponential function $y = ab^x$ for integer values of x and simple positive values of a and b.	Solve problems involving more complex shapes and solids, including segments of circles and frustums of cones. Solve problems for areas and volumes of similar shapes and solids. Find the angle between a line and a plane (but not the angle between two planes or between two skew lines). Use the sine and cosine rules to solve 2-D and 3-D problems. Apply vector methods for simple geometrical proofs Find the area of a segment of a circle given the radius and length of the chord. Use the trigonometric ratios to solve 3-D problems	Calculate the new volume of a shape after enlargement		

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To gain a Grade 8	Calculate the upper and lower bounds of 2-D measurements e.g. area. Calculate the upper and lower bounds of other compound measurements e.g. density. Write $(3 - \sqrt{3})^2$ in the form $a + b\sqrt{3}$. Rationalise a denominator	Interpret transformations of graphs & write the functions algebraically, e.g. write the equation of f(x)+a or f(x - a) Apply to the graph of y = f(x) the transformations, y = -f(x), y = f(-x), y = -f(-x), y = f(x) + a, y = f(ax), y = f(x + a), y = af(x) for linear, quadratic, cubic, sine and cosine functions f(x). Find the inverse of a linear function. Plot graphs of the exponential function $y = k^x$ for integer values of x and simple positive values of k. Recognise, sketch and interpret graphs of trigonometric functions (in degrees) for sin, cos and tan within the range -360° to +360°. Construct the graphs of simple loci including the circle $x^2 + y^2 = r^2$ for a circle of radius r centred at the origin of the coordinate plane. Find the gradient of the radius that meets the circle at a given point. Find the nth term of a quadratic sequence of the form n^2 ,an^2, $an^2 \pm b$, $an^2 \pm bn \pm c$. Solve exactly, by elimination of an unknown, linear/$x^2 + y^2 = r^2$ simultaneous equations	Use the formulae for length of arcs and area of sectors of circles to solve problems. Give reasons for angle sizes using mathematical language. Give reasons for angle and length calculations involving the use of tangent theorems. Understand and use the fact that tangents from an external point are equal in length. know and apply the cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$ to find unknown angles. Know and apply Area = 1/2 ab sin C to calculate the sides or angles of any triangle. Prove lines are parallel/collinear	Recognise sketch and interpret graphs of exponential functions y = kx for positive values of k and integer values of x. Find points that divide a line in a given ratio, using the properties of similar triangles		Use and understand frequency density Construct and interpret histograms from class intervals with unequal width From a histogram complete a grouped frequency table From a histogram understand and define frequency density Estimate the median (or other information) from a histogram with unequal class width

To gain a Grade 7	Use the product rule for counting (i.e. if there are m ways of doing one task and for each of these, there are n ways of doing another task, then the total number of ways the two tasks can be done is m × n ways). Convert a recurring decimal to a fraction in simple cases. Understand a recurring decimal to fraction proof. Find the value of calculations using indices including fractional and negative indices. Understand that the inverse operation of raising a positive number to a power n is raising the result of this operation to the power 1/n. Simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = 2\sqrt{3}$). Use fractions, surds and pi in exact calculations, without a calculator	Solve simple quadratic equations by using the quadratic formula, Expand two or more brackets. factorise quadratic expressions of the form $ax^2 + bx + c$, including the difference of two squares. Use function notation, Deduce turning points by completing the square. Sketch a graph of a quadratic by factorising, identifying roots and y-intercept , turning point. Find the equation of the line through two given points, Find the equation of the line through two given points. Know that a line perpendicular to the line $y = mx + c$, will have a gradient of $-1/m$. Write down the equation of a line perpendicular to a given line. Interpret and analyse a straight line graph and generate equations of lines parallel and perpendicular to the given line. Solve quadratic inequalities in one variable, by factorising and sketching the graph to find critical values. Simplify and manipulate algebraic expressions involving surds and algebraic fractions. Solve exactly, by elimination of an unknown, linear/quadratic simultaneous equations	Solve problems including examples of solids in everyday use. Prove and use the alternate segment theorem. Use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations. Calculate the length of a diagonal of a cuboid. Enlarge 2D shapes, given a negative, fractional scale factor. Know and apply the sine rule $a/\sin A = b/\sin B = c/\sin C$ to find unknown lengths and angles. Calculate the area of a triangle given the length of two sides and the included angle. Work out the magnitude of a vector. Calculate, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector. Solve geometrical problems in 2-D using vector methods	Solve problems involving inverse proportion using graphs by plotting and reading values from graphs. Solve problems involving inverse proportionality, including problems where y is inversely proportional to the square of x. Calculate an unknown quantity from quantities that vary in direct or inverse proportion. Set up and use equations to solve word and other problems involving direct or inverse proportion. Calculate the new area of a shape after enlargement.	Use a two-way table to calculate conditional probability. Use a tree diagram to calculate conditional probability. Use Venn diagrams to calculate conditional probability. Understand conditional probabilities and decide if two events are independent. Understand selection with or without replacement. Use a tree diagram to calculate conditional probability	Know the appropriate use of Histograms. Compare the mean, median, mode and range as appropriate of two distributions Compare distributions and make inferences, using the shapes of distributions and measures of average and spread, including median and quartiles. From a cumulative frequency graph estimate frequency greater/less than a given value. Estimate the mean from a histogram

To gain a Grade 6	Use inequality notation to specify simple error intervals due to truncation or rounding. Estimate powers and roots of any given positive number Recall that n0 = 1 and n-1 = 1/n for positive integers n as well as n1/2 = √n and n1/3 = ∛n for any positive number n	Solve linear equations in one unknown with fractional coefficients, Solve quadratic equations by completing the square. Expand double brackets (ax ± b)(cx ± d), Find the coordinates of the midpoint of a line from coordinates using a formula. Change the subject of a complex formula that involves fractions, e.g. make u or v the subject of the formula 1/v + 1/u =1/t Identify and interpret gradient from an equation ax+by=c. Solve linear inequalities in two variables graphically, Solve two simultaneous inequalities algebraically & show the solution set on a number line. Answer simple proof and 'show that' questions using consecutive integers (n, n+ 1), squares a^2, b^2, even numbers 2n, and odd numbers 2n + 1. Use finite/infinite and ascending/ descending to describe sequences, Distinguish between arithmetic and geometric sequences, Continue geometric progression and find term to term rule, including negative, fraction and decimal terms. Simplify expressions involving brackets and powers e.g. $x(x^2+x+4)$, 3(a + 2b) − 2(a + b)	Prove and use the fact that the angle in a semicircle is a right angle, same segment are equal, opposite angles of a cyclic quadrilateral sum to 180°, angle subtended at the centre and at the circumference. Use the sine, cosine and tangent ratios to find the lengths of unknown sides in a right-angled triangle, using more complex algebraic manipulation, e.g. the hypotenuse (using cosine or sine), or adjacent (using the tangent ratio). Use the appropriate ratio to find a length, or angle, and hence solve a two-dimensional problem. Find angles of elevation and angles of depression. Know that the tangent at any point on a circle is perpendicular to the radius at that point. Know that the perpendicular from the centre to the chord bisects the chord. Complete a formal geometric proof of similarity of two given triangles	Use expressions of the form y α x^2 Identify direct proportion from a table of values by comparing ratios of values		Interpret and analyse information in a range of linear graphs - to describe how one variable changes in relation to another Construct cumulative frequency graphs Interpret cumulative frequency graphs Find the median, quartiles and interquartile range for large data sets with grouped data Compare the measures of spread between a pair of box plots/cumulative frequency graphs

To gain a Grade 5	Multiply and divide simple fractions (mixed) - positive and negative. Calculate with roots (surds - exact values) Write numbers less than 10 in standard index form. Order numbers written in standard index form. Convert between large and small numbers into standard form and vice-versa. Add and subtract in standard form Multiply and divide numbers in standard form	Solve quadratic equations algebraically by factorising. In simple cases, change the subject of the formula, e.g. make c the subject of the formula from y = mx + c, Change the subject of a formula including where the subject is on both sides. Plot and draw graphs of straight lines WITHOUT using a table of values (use intercept and gradient). Solve more complex linear inequalities in one variable & represent the solution on a number line e.g. -6 < 2n+4 or -9 < 2n + 3 < 7. Generate arithmetic sequences of numbers , squared integers and sequences derived from diagrams Solve exactly, by elimination of an unknown, linear/linear simultaneous equations, including where both need multiplying, Solve linear/linear simultaneous equations graphically, Write simultaneous equations to represent a situation, Solve simultaneous equations representing a real-life situation graphically and interpret the solution in the context of the question	Find the surface area of simple shapes (prisms) using the formulae for triangles and rectangles, and other shapes. Use simple examples of the relationship between enlargement and areas and volumes of simple shapes and solids. Know the formula for Pythagoras' theorem and use it to find a shorter side and longer side and solve problems. Use the sine, cosine and tangent ratios to find the lengths of unknown sides in a right-angled triangle, using straight-forward algebraic manipulation, e.g. calculate the adjacent (using cosine), or the opposite (using sine or tangent ratios). Transform 2-D shapes by simple combinations of rotations, reflections and translations, using ICT (e.g. repeated reflection, rotation or translation, reflections in the x and y axes, rotations about (0, 0)). Transform 2D shapes by a more complex combination of rotations, reflections and translations, e.g. a reflection, followed by a rotation etc. Add and Subtract vectors	Write a ratio as a linear function. Extend to simple conversions of compound measures (e.g. convert 2 m/s to km/hr). Convert imperial units to imperial units. Convert between metric and imperial measures. Use graphs to calculate measures including unit price, average speed, distance, time, acceleration. Use percentages in real-life situations: compound interest, depreciation, percentage profit and loss. Calculate repeated proportional change. Find the original amount given the final amount after a percentage change (reverse percentages). Use calculators for reverse percentage calculations by doing an appropriate division. Understand that the ratio of any two sides is constant in similar right-angled triangles. Understand the implications of enlargement for perimeter. Identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments. Enlarge 2-D shapes and recognise the similarity of resulting shapes	Find a missing probability from a list or two-way table including algebraic terms Use tree diagrams to calculate the probability of two dependent events	Know the appropriate use of a cumulative frequency diagram Construct cumulative frequency tables Interpret box plots to find median, quartiles, range and interquartile range and draw conclusions Produce box plots from raw data and identify outliers when given quartiles and median

To gain a Grade 4	Find HCF and LCM using Prime Factors. Use prime factorisation to represent a number as a product of its primes using index notation. Add and subtract fractions (mixed) - positive and negative. Use the laws of indices to multiply and divide numbers written in index notation. Estimate answers to calculations by rounding numbers to 1 sig. fig. Write numbers greater than 10 in standard index form. Understand that each of the headings in the place value system, to the left of the units column, can be written as a power of ten. Find the reciprocal of simple numbers/fractions mentally, e.g. 10 and 1/10, 1/3 and 3 etc.	Solve equations of the form (ax +/- b)/c =(dx +/- e)/f [one of c or f should be 1]. Construct and solve equations that involve multiplying out brackets by a negative number (e.g. 4(2a - 1) = 32 - 3(2a - 2)). Multiply out brackets involving positive terms such as (a + b)(c + d) and collect like terms. Factorise to one bracket by taking out the highest common factors for all terms e.g. $2x^2y + 6xy^2 = 2xy(x + 3y)$ Recognise that linear functions can be rearranged to give y explicitly in terms of x e.g. rearrange y + 3x - 2 = 0 in the form y = 2 - 3x Simplify simple expressions involving index notation	Mark on a diagram the position of point B given its bearing from point A, Use accurate drawing to solve bearings problems. Use the sum of the interior angles of an n-sided polygon. Calculate the interior angles of polygons. Find the size of each interior angle or the size of each exterior angle or the number of sides of a regular polygon. Calculate the volume and surface area of right prisms. Calculate the lengths, areas and volumes in cylinders. Use the formulae for the circumference and area of a circle, given the circumference or area, to calculate the radius or diameter. Find the perimeters and areas of semicircles and quarter circles. Use the information given about the length of sides and sizes of angles to determine whether triangles are congruent, or similar. Draw the locus equidistant between 2 points or from a point. Use vector notation for translations. Use 2D Vector notation for translation. Enlarge 2D shapes, given a fractional scale factor. Find the centre of rotation. Describe a transformation. Describe reflections on a coordinate grid. Recognise whether a reflection is correct. Express points as position vectors. Understand and use vector notation	Interpret and write ratios to describe a situation. Understand and use compound measures (density, speed, pressure). Solve problems using constant rates and related formulae. Solve problems involving compound measures. Write lengths, areas and volumes of two shapes as ratios in simplest form. Estimate conversions. Use algebraic methods to solve problems involving variables in direct proportion. Use expressions of the form $y \propto 1/x$. Interpret the gradient of a straight line graph as a rate of change. Use compound interest. Represent repeated proportional change using a multiplier raised to a power. Know that enlargements of 2D shapes produce similar shapes. Express a multiplicative relationship between two quantities as a ratio or a fraction. Use the unitary method for an inverse operation, e.g. If I know an item was 80% of the original cost in a sale, find the original price. Use and interpret scale drawings, where scales use mixed units, and drawings aren't done	Record outcomes of events in a Venn Diagram Use theoretical models to include outcomes using spinners, dice, coins etc.	Use more complex two way tables Find the median, mode and range from a stem and leaf diagram Estimate the mean of grouped data using the mid-interval value Criticise questions from a questionnaire Distinguish between positive, negative and zero correlation using lines of best fit Interpret scatter graphs in terms of the relationship between two variables Interpret correlation in terms of the problem

				on squared paper, but have measurements marked on them.		
To gain a Grade 3	Add and subtract up to 3 fractions mixing both addition and subtraction into the calculation, with denominators less than or equal to 12 and using the LCM. Be able to estimate answers to calculations involving 2 or more operations and BIDMAS Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 or 3/8) Use standard form display and know how to enter numbers in standard form. Use numbers of any size rounded to 1 significant figure to make standardized estimates for calculations with one step. Use halving and doubling strategies on fractions to find decimal equivalents of other fractions, e.g. 1/4 = 0.25 so 1/8 is half of 0.25 etc. Original fact is given	Solve simple two-step linear equations with integer coefficients, of the form ax ± b = c, e.g. 3x + 7 = 25. Substitute positive and negative integers into simple formulae, Write expressions to solve problems representing a situation. Understand the difference between 2n and n^2 Use the distributive law to take out numerical common factors, e.g. 6a + 8b = 2(3a + 4b). Recognise that equations of the form y = mx + c correspond to straight-line graphs in the coordinate plane. Begin to use formal algebra to describe the nth term in an arithmetic sequence.	Identify alternate and corresponding angles on parallel lines and their values. Solve harder problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons - by looking at several shapes together. Find the area of triangles by counting i.e. adding full and partial squares. Know the formulae for the volume of a cube and a cuboid. Use a formula to calculate the area of parallelograms, triangles, Calculate areas of compound shapes made from rectangles and triangles. Know and understand the term 'congruent'. Know that triangles given SSS, SAS, ASA or RHS are unique, but that triangles given SSA or AAA are not. Draw a circle given the radius or diameter. Identify co-interior angles and their values. Use the sum of the exterior angles of any polygon is 360°. Calculate the interior angles of regular polygons. Use a formula to calculate the area of trapezium. Deduce and use formulas for the area of a trapezium. Use the formula for the circumference of a circle. Use the formulae for area of a circle, given the radius or diameter	Use the unitary method to solve simple word problems involving ratio and direct proportion. Divide a quantity into more than two parts in a given ratio. Convert one metric unit to another, including decimals (e.g. 3250 grams to 3.25 kilograms, or 3.25kg to 3250g). Use fraction notation to express a smaller whole number as a fraction of a larger one. Use a ratio to find one quantity when the other is known. Use proportional reasoning to solve a problem. Use strategies for finding equivalent fractions, decimals and percentages involving decimal percentages and decimals greater than 0. Find the outcome of a given percentage increase/decrease. Use and interpret maps, using proper map scales (1 : 25 000). Simplify a ratio expressed in fractions or decimals. Write ratios in the form 1: m or m: 1. Set up equations to show direct proportion. Use expressions of the form	Know that if the probability of an event is p, the probability of it not occurring is 1-p Identify different mutually exclusive outcomes and know that the sum of probabilities of all outcomes is 1 Estimate the number of times an event will occur, given the probability and the number of trials Identify all mutually exclusive outcomes for two successive events with three outcomes in each event Work out probabilities from frequency tables	Use simple two way tables Design a question for a questionnaire, Calculate the mean and range from a frequency table for discrete data Produce ordered back-to-back stem and leaf diagrams Draw scatter graphs, Interpret a scatter graph Construct and use frequency polygons to compare sets of data

				y α x. Identify direct proportion from a graph		
To gain a Grade 2	Round decimals to the nearest whole number. Understand the vocabulary of prime numbers, factors, multiples, common factors, common multiples. Multiply and divide decimals by 10, 100, 1000, and explain the effect multiply by 0. Recognise that every number can be written as a product of two factors. Be able to order negative decimals with the largest on the left. Decimals should be to 2 or 3 significant figures Use index notation for squares & cubes & for positive integer powers of 10 (e.g. write 27 as 3^3 & 1000 as 10^3)	Substitute positive integers into simple formulae expressed in words, Use function machines to create expressions Simplify simple linear algebraic expressions by collecting like terms (e.g. a + a + a, 3b + 2b), Use distributive law with brackets, with numbers Generate terms of a simple sequence using term to term rules like +3, -2. Find the next term in a sequence, including negative values Construct expressions from worded descriptions, using addition, subtraction and multiplication e.g. 3a, a + b, 2 + a + b + 3 = 5 + a + b, a × b, a × a Begin to multiply a single positive term over a bracket containing linear terms e.g. 4(x+3). Multiply together two simple algebraic expressions, e.g. 2a × 3b	Use a protractor to measure obtuse angles to the nearest degree, Use a protractor to draw acute angles to the nearest degree. Distinguish between acute, obtuse and reflex angles. Use the formula for the area of a rectangle/square. Calculate the surface area of cubes with a net. Calculate perimeter and area of compound shapes made from triangles, rectangles and other shapes. Calculate angles in a triangle. Understand and use the language associated with bearings. Identify interior and exterior angles in a shape. Calculate angles around a point. Use the sum of angles in a triangle to find missing angle values. Use the sum of the interior angle and the exterior angle is 180°. Calculate the surface area of cubes, without a net. Calculate the perimeter and area of shapes made from rectangles. Use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS). Identify regular and irregular polygons. Draw or complete diagrams with a given number of lines of symmetry, order of rotational symmetry. Name all quadrilaterals that have a specific property	Use fraction notation to describe parts of shapes. Recognise the equivalence of percentages, fractions and decimals. Define percentages as the number of parts per hundred. Draw lines and shapes to scale. Use and interpret maps and scale drawings, using a variety of scales and units. Estimate length using a scale diagram. Divide a quantity into two parts in a given ratio, where ratio given in ratio notation. Convert a larger whole number metric unit to a smaller unit (e.g. 3 kilograms to 3000 grams). Convert between simple metric units. Express one number as a fraction of another. Express the division of a quantity into a number of parts as a ratio. Use percentages to compare simple proportions. Recall equivalent fractions, decimals and percentages including for fractions that are greater than 1. Match across all 3 types, and need to be simple fractions (1/2, 1/4, 1/5, 1/10). Find a percentage of a quantity using a	Understand and use experimental and theoretical measures of probability, including relative frequency to include outcomes using dice, spinners, coins etc. Use the vocabulary of probability, Understand and use the probability scale from 0 to 1	Represent data in a table Find mode, modal, median, mean from discrete and grouped discrete data. Produce bar charts including dual bar charts, pie charts Produce pictograms, Interpret simple pie charts Compare two simple distributions using the range Use information provided to complete a two-way

				multiplier. Interpret percentages and percentage change as a fraction or a decimal. Use ratio notation. Reduce a ratio to its simplest form		
To gain a Grade 1	Round positive whole numbers to the nearest 10, 100 or 1000. Add three or more multiples of 10, Find a difference by counting up through the next multiple of 10. Partition to multiply mentally TU × U, Use doubling, Use halving. Know by heart multiplication facts up to 10 × 10, Know square numbers, 1 × 1 to 10 × 10 Understand addition and subtraction as they apply to whole numbers and decimals Use diagrams to compare two or more simple fractions, order positive and negative integers	Find outputs of simple functions in words and symbols Read x and y coordinate in the first quadrant	Know the sum of angles on a straight line. Find the perimeter of a square/rectangle by counting. Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone. Draw sketches of shapes. Recognise properties of squares. Identify all the symmetries of 2-D shapes. Construct diagrams of everyday 2-D situations involving rectangles, triangles, perpendicular and parallel lines. Know the sum of angles in a triangle is 180°. Recognise where a shape will be after translation	Convert a percentage to a number of hundredths or tenths. Read and construct scale drawings		Find range from a set of ordered data Find the range of a small set of data.