

Southend High School for Girls



Assessment Policy for Mathematics

Our assessment policy and procedures are underpinned by three key questions :

1. Where is the learning going?
2. Where is the learner now?
3. How does the learner get there?
(Dylan Wiliam)

Our students should be able to answer these two questions:

1. What am I doing well in the subject?
2. What do I need to do to improve my work in the subject?

At SHSG we see assessment, in all its forms, as an integral part of teaching and learning and as such it is inextricably linked to our curriculum.

We use three broad overarching forms of assessment at Southend High School for Girls:

1. Diagnostic assessment – assessment used to determine what students already know (usually at the start of a lesson / unit)
2. Formative assessment (responsive teaching) – assessment used during the learning process to provide feedback and encourage students to act upon it to make improvements
3. Summative assessment (in-school summative assessment and nationally standardised summative assessment) – used at the end of the learning process as a measure of where students are in their learning.

KS3 National Curriculum Programme of study

By the end of KS3 students should be able to:

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals, fractions, powers and roots
- select and use appropriate calculation strategies to solve increasingly complex problems
- use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships
- substitute values in expressions, rearrange and simplify expressions, and solve equations
- move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs]

- develop algebraic and graphical fluency, including understanding linear and simple quadratic functions
- use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics

Reason mathematically

- extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations
- extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically
- identify variables and express relations between variables algebraically and graphically
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in geometry, number and algebra, including using geometrical constructions
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Subject content

Number

Pupils should be able to:

- understand and use place value for decimals, measures and integers of any size
- order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols $=$, \neq , $<$, $>$, \leq , \geq
- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property
- use the 4 operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative

- use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals
- recognise and use relationships between operations including inverse operations
- use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations
- interpret and compare numbers in standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or 0
- work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)
- define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express 1 quantity as a percentage of another, compare 2 quantities using percentages, and work with percentages greater than 100%
- interpret fractions and percentages as operators
- use standard units of mass, length, time, money and other measures, including with decimal quantities
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures]
- use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- appreciate the infinite nature of the sets of integers, real and rational numbers

Algebra

Pupils should be able to:

- use and interpret algebraic notation, including:
 - 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 $a \times a \times a$; a^2b in place of $a \times a \times b$
 - $\frac{a}{b}$ in place of $a \div b$
 - coefficients written as fractions rather than as decimals
 - brackets
- substitute numerical values into formulae and expressions, including scientific formulae
- understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors
- simplify and manipulate algebraic expressions to maintain equivalence by:
 - collecting like terms
 - multiplying a single term over a bracket
 - taking out common factors
 - expanding products of 2 or more binomials
- understand and use standard mathematical formulae; rearrange formulae to change the subject

- model situations or procedures by translating them into algebraic expressions or formulae and by using graphs
- use algebraic methods to solve linear equations in 1 variable (including all forms that require rearrangement)
- work with coordinates in all 4 quadrants
- recognise, sketch and produce graphs of linear and quadratic functions of 1 variable with appropriate scaling, using equations in x and y and the Cartesian plane
- interpret mathematical relationships both algebraically and graphically
- reduce a given linear equation in 2 variables to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically
- use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations
- find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs
- generate terms of a sequence from either a term-to-term or a position-to-term rule
- recognise arithmetic sequences and find the nth term
- recognise geometric sequences and appreciate other sequences that arise

Ratio, proportion and rates of change

Pupils should be able to:

- change freely between related standard units [for example time, length, area, volume/capacity, mass]
- use scale factors, scale diagrams and maps
- express 1 quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- use ratio notation, including reduction to simplest form
- divide a given quantity into 2 parts in a given part:part or part:whole ratio; express the division of a quantity into 2 parts as a ratio
- understand that a multiplicative relationship between 2 quantities can be expressed as a ratio or a fraction
- relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions
- solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics
- solve problems involving direct and inverse proportion, including graphical and algebraic representations
- use compound units such as speed, unit pricing and density to solve problems

Geometry and measures

Pupils should be able to:

- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)

- calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes
- draw and measure line segments and angles in geometric figures, including interpreting scale drawings
- derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line
- describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric
- use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles
- derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies
- identify properties of, and describe the results of, translations, rotations and reflections applied to given figures
- identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids
- apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles
- understand and use the relationship between parallel lines and alternate and corresponding angles
- derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons
- apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs
- use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles
- use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D
- interpret mathematical relationships both algebraically and geometrically

Probability

Pupils should be able to:

- record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale
- understand that the probabilities of all possible outcomes sum to 1
- enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams

- generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities

Statistics

Pupils should be able to:

- describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)
- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data
- describe simple mathematical relationships between 2 variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs

KS4 National Curriculum Programme of study

By the end of KS4 students should be able to:

(Also, see PLC in Year 11 MSTeams page)

Develop fluency

- consolidate their numerical and mathematical capability from key stage 3 and extend their understanding of the number system to include powers, roots {and fractional indices}
- select and use appropriate calculation strategies to solve increasingly complex problems, including exact calculations involving multiples of π {and surds}, use of standard form and application and interpretation of limits of accuracy
- consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions, {and expressions involving surds and algebraic fractions}
- extend fluency with expressions and equations from key stage 3, to include quadratic equations, simultaneous equations and inequalities
- move freely between different numerical, algebraic, graphical and diagrammatic representations, including of linear, quadratic, reciprocal, {exponential and trigonometric} functions
- use mathematical language and properties precisely
-

Reason mathematically

- extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically
- extend their ability to identify variables and express relations between variables algebraically and graphically

- make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs}
- reason deductively in geometry, number and algebra, including using geometrical constructions
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally
- assess the validity of an argument and the accuracy of a given way of presenting information

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts
- make and use connections between different parts of mathematics to solve problems
- model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem

Subject content

Number

In addition to consolidating subject content from key stage 3, pupils should be able to:

- apply systematic listing strategies, {including use of the product rule for counting}
- {estimate powers and roots of any given positive number}
- calculate with roots, and with integer {and fractional} indices
- calculate exactly with fractions, {surds} and multiples of π {simplify surd expressions involving squares [for example $\sqrt{12} = \sqrt{4 \times 3} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$] and rationalise denominators}
- calculate with numbers in standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer
- {change recurring decimals into their corresponding fractions and vice versa}
- identify and work with fractions in ratio problems
- apply and interpret limits of accuracy when rounding or truncating, {including upper and lower bounds}

Algebra

In addition to consolidating subject content from key stage 3, pupils should be able to:

- simplify and manipulate algebraic expressions (including those involving surds {and algebraic fractions}) by:
 - factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of 2 squares; {factorising quadratic expressions of the form $ax^2 + bx + c$ }
 - simplifying expressions involving sums, products and powers, including the laws of indices
- know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments {and proofs}
- where appropriate, interpret simple expressions as functions with inputs and outputs; {interpret the reverse process as the 'inverse function'; interpret the succession of 2 functions as a 'composite function'}
- use the form $y = mx + c$ to identify parallel {and perpendicular} lines; find the equation of the line through 2 given points, or through 1 point with a given gradient
- identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically {and turning points by completing the square}
- recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$, {the exponential function $y = k^x$ for positive values of k , and the trigonometric functions (with arguments in degrees) $y = \sin x$, $y = \cos x$ and $y = \tan x$ for angles of any size}
- {sketch translations and reflections of the graph of a given function}
- plot and interpret graphs (including reciprocal graphs {and exponential graphs}) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- {calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts}
- {recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point}
- solve quadratic equations {including those that require rearrangement} algebraically by factorising, {by completing the square and by using the quadratic formula}; find approximate solutions using a graph
- solve 2 simultaneous equations in 2 variables (linear/linear {or linear/quadratic}) algebraically; find approximate solutions using a graph
- {find approximate solutions to equations numerically using iteration}
- translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or 2 simultaneous equations), solve the equation(s) and interpret the solution
- solve linear inequalities in 1 {or 2} variable {s}, {and quadratic inequalities in 1 variable}; represent the solution set on a number line, {using set notation and on a graph}
- recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a positive rational number {or a surd}) {and other sequences}

- deduce expressions to calculate the nth term of linear {and quadratic} sequences.
-

Ratio, proportion and rates of change

In addition to consolidating subject content from key stage 3, pupils should be able to:

- compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)
- convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
- understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$; {construct and} interpret equations that describe direct and inverse proportion
- interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion
- {interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of instantaneous and average rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts}
- set up, solve and interpret the answers in growth and decay problems, including compound interest {and work with general iterative processes}

Geometry and measures

In addition to consolidating subject content from key stage 3, pupils should be able to:

- interpret and use fractional {and negative} scale factors for enlargements
- {describe the changes and invariance achieved by combinations of rotations, reflections and translations}
- identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- {apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results}
- construct and interpret plans and elevations of 3D shapes
- interpret and use bearings
- calculate arc lengths, angles and areas of sectors of circles
- calculate surface areas and volumes of spheres, pyramids, cones and composite solids
- apply the concepts of congruence and similarity, including the relationships between lengths, {areas and volumes} in similar figures
- apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {and, where possible, general triangles} in 2 {and 3} dimensional figures

- know the exact values of $\sin \theta$ and $\cos \theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90° ; know the exact value of $\tan \theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$
- {know and apply the sine rule, $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, and cosine rule, $a^2 = b^2 + c^2 - 2bc \cos A$, to find unknown lengths and angles}
- {know and apply Area = $\frac{1}{2} ab \sin C$ to calculate the area, sides or angles of any triangle}
- describe translations as 2D vectors
- apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; {use vectors to construct geometric arguments and proofs}

Probability

In addition to consolidating subject content from key stage 3, pupils should be able to:

- apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to 1
- use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size
- calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions
- {calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams}

Statistics

In addition to consolidating subject content from key stage 3, pupils should be able to:

- infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- interpret and construct tables and line graphs for time series data
- {construct and interpret diagrams for grouped discrete data and continuous data, ie, histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use}
- interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
 - appropriate graphical representation involving discrete, continuous and grouped data, {including box plots}
 - appropriate measures of central tendency (including modal class) and spread {including quartiles and inter-quartile range}
- apply statistics to describe a population

- use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.

KS5

By the end of KS5 students should be able to meet all AOs as outlined in the specification:

Please see link to the specification

[A level Mathematics \(pearson.com\)](https://www.pearson.com)

Diagnostic assessment methods

- Starter challenges, retrieval tasks ... last lesson/last week/ last topic (mainly at KS3 & KS4)
- Starter challenges for KS5 is usually an exam question on current or previous topics
- Detailed questioning to encourage student participation, students given thinking time, then cold calling.
- Mini-whiteboards to monitor participation and understanding
- Self/Peer marking
- In task intervention; teachers walk around and check classwork is completed and give verbal feedback to individuals
- Mini Quizzes
- Exit questions

Formative assessment methods

- Baseline tests in year 7, 10, 12 & 13 to establish any significant issues at the start of the year
- Unit tests for all key stages
- Diagnostic/revision
- Written and verbal feedback given after every test
- Re-tests if necessary for students identified as 'working towards'

Summative assessment

- Pre-public examinations
- End of year tests for all key stages
- Applications and Mastery tests every term for KS3 & 4

Marking and Feedback

For all Key Stages:

- Classwork is self/peer marked (books/folders are checked during QA process to ensure work is being completed to the high standards that we expect)
- Unit tests are marked by teachers and feedback and targets given on back page of the tests

- Feed forward tasks are given to students based on teacher target; use of Mathswatch videos or work posted on teams to support with reviewing topic.
- Feed forward tasks are to be completed in exercise books and highlighted in yellow for teachers to check and sign off.
- HW is completed on Mathswatch, the work is marked and a percentage given.
- Year 11 students complete GCSE papers on Mathswatch, students work is marked and a grade given

At key stage 5:

- As above, except HW is standardised and all classes get 1 worksheet to complete each week which is marked by the teacher and verbal feedback given
- Remaining HW time is given to completing exercises from textbook or flip learning where students copy the examples in advance so that they can fully focus on explanations during the lesson

Marking and Feedback Codes

When providing written feedback in exercise books to ensure consistency across the school particularly for literacy the following codes should be used above the relevant word /section:

- ✓ good point
- X incorrect or wrong point
- SP spelling error which needs correction
- P punctuation error which needs correction
- GR grammatical error which needs correction
- / start a new sentence
- // start a new paragraph
- ?? the point is not clear
- WW wrong word
- ^ missing word
- [] this part needs rewording
- +1 AP academic achievement point
- P1 good presentation at A level Maths

Presentation

- All work should have a date on the right hand side, written in full and underlined with a ruler (e.g. 12th September 2023). MFL require students to write the date in the relevant target language
- All work will have a title / heading which is underlined with a ruler
- All work should have CW/HW written in the top left-hand margin (MFL require students to write these in the target language)
- Only black or blue ink should be used for writing with the exception of student responses to feedback (as indicated by individual department policies)

- Feedback tasks to be highlighted in yellow
- All diagrams / graphs should be done in pencil.
- All work should be set out neatly.

Recording and Monitoring of Assessment

- Test marks are recorded in individual teacher planners
- These marks are to be transferred to SIMS topic tracker marksheets (once SIMS has time to update/complete the column headings) for all year groups
- Year 11 is the only one currently as an excel spreadsheet on Sharepoint
- HW checked on Mathswatch and recorded there
- Re-tests to be recorded in individual teacher planners
- DOF to record names of any students who have been set targets (Red on RAG rating or ATL 3 or 4) and monitor in future QA sessions