Mathematics

Mathematics

Years 9 – 13

SĀMOA SECONDARY SCHOOL CURRICULUM

Curriculum Materials and Assessment Division

Ministry of Education, Sports and Culture

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CONTENTS

INTRODUCTION

CURRICULUM PRINCIPLES

This mathematics curriculum is based on the Principles of the Sāmoa Secondary School Curriculum stated in the *Sāmoa Secondary School Curriculum Overview Document*. The Principles are that the curriculum:

- provides a challenge for all students and allows for individual differences;
- fosters and enhances the self-concept of all learners, and encourages them to be self-directed in their learning;
- provides all learners with a broad and balanced general education;
- will be based on what is best in Sāmoan tradition: fa'aSāmoa;
- will be responsive to change so that it is relevant to the needs of the individual learner, to the well-being of the community, and ultimately to national development;
- provides for flexibility taking into account the context in which schools operate and the resources available to them;
- establishes a direction for learning and ensures each learner's school experience progresses in a systematic and coherent way;
- promotes the presentation of essential knowledge by means of a systematic bilingual methodology;
- promotes language learning in all areas of the curriculum;
- encourages the use of good assessment practice; and
- reflects the need to be inclusive.

SCOPE OF THE CURRICULUM STATEMENT

The National Curriculum comprises the *Sāmoa Secondary School Curriculum Overview Document* which outlines the framework of underpinning principles and required learning areas, and a set of subject curriculum statements which define the learning principles and achievement aims and objectives which all Sāmoan secondary schools are required to follow.

This mathematics curriculum is for years 9 – 13. It sets out the progression of skills and knowledge for students in Sāmoan secondary schools. This curriculum statement applies to:

- all secondary schools in Sāmoa;
- all students irrespective of gender, ethnicity, belief, ability, social or cultural background;
- Years 9–13 of secondary schooling.

Each school provides programmes of learning in response to local needs, priorities, and resources. The learning programmes developed by schools must provide the learning experiences and the opportunity for the students to achieve the standards that are included in the National Curriculum.

THE ORGANISATION OF THIS MATHEMATICS CURRICULUM

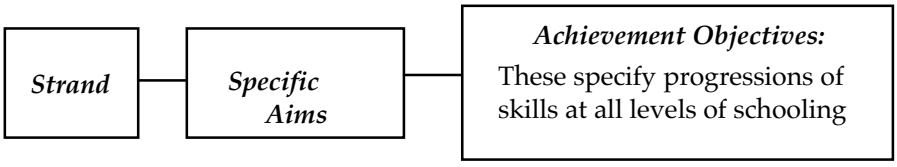
The Curriculum Statement provides information for teachers, students, parents, families and the wider community as to what students are expected to be able to do in each year of secondary schooling in mathematics.

All national subject Curriculum Statements are organised to show:

- the aims of the subject curriculum;
- the organising strands of the curriculum;
- the aims of the strands; and
- the achievement objectives for each year level.

This mathematics curriculum is organised into the topic specific achievement aims or **strands** of *Number, Algebra, Measurement, Trigonometry, Geometry and Probability and Statistics* together with the overarching organisational strand *Using Mathematics*.

Each strand has **specific aims**. These aims group broad progressions of **achievement objectives** at each year level. Most meaningful mathematical problems require a mix of processes and a range of achievement objectives from some or all of the strands will be woven together into learning situations. This integration helps enrich students' experiences and skills in mathematics for both social and academic purposes.



GENERAL AIMS

When considering the content and achievement objectives of the strands, the Mathematics Advisory Committee worked with the following Aim and set of Objectives:

To help students do mathematics so that they can better live in their culture and a world in which mathematics plays an important part.

This basic aim is to be achieved through the following objectives:

1 To provide mathematical experiences which enable students to:

- observe and discover patterns and relationships;
- develop ideas;
- make logical conclusions and generalisations;
- express their thoughts accurately.

2 To encourage an understanding of the principles of mathematics so that students can apply those principles in new and unfamiliar situations.

3 To encourage a spirit of enquiry and a liking for, and lifelong interest in, mathematics.

4 To develop the basic mathematical ability necessary for everyday living.

5 To provide the mathematics background necessary for those who wish to continue the study of mathematics at more advanced levels.

SPECIFIC AIMS AND STRANDS

1. NUMBER

The aims of this strand are to provide students with opportunities to:

- develop an understanding of numbers and the ways that they are represented;
- develop accuracy, efficiency and confidence with calculations;
- develop the ability to estimate, to make approximations and to validate answers for accuracy.

NUMBER STRAND ACHIEVEMENT OBJECTIVES

Year 9 Students will be able to:

- use the four operations with integers, fractions, and decimals;
- calculate percentages;
- convert numbers between the forms: fraction (those in common usage only), decimal and percentage;
- round numbers appropriately in calculations;
- evaluate exponents (both base and exponent natural numbers only);
- find square roots of square numbers;
- apply the order of operations with integers;
- solve simple problems using these skills.

Year 10 Students will be able to:

- use >, <, ≥ and ≤ correctly;
- apply the laws of exponents for multiplication, division and powers of powers;
- evaluate terms with fractional exponents;
- use standard form in naming very large and very small quantities;
- use ideas of ratio and proportion including the allocation of up to three shares;
- apply the order of operations with real numbers;
- solve problems (including VAGST) using these skills.

Year 11 Students will be able to:

- recognise the real numbers as a distinct number set;
- graph specified sets of real numbers and integers on number lines;
- evaluate terms with negative exponents;
- calculate absolute value;
- solve problems involving skills from the number strand objectives at a level appropriate for year 11.

Year 12 Students will be able to:

- perform basic operations with fractions, integers, decimals and percentages;
- express numbers in standard form;
- solve word problems involving ratios, rates and proportions;
- express numbers as powers and roots;
- round numbers appropriately;
- make reasonable estimations;
- apply the orders of operations in calculations;
- calculate with absolute values;
- solve problems and communicate solutions involving skills from the number strand objectives at a level appropriate for year 12.

Year 13 Students will be able to:

- solve problems and communicate solutions involving skills from the number strand objectives at a level appropriate for year 13.

2. ALGEBRA

The aims of this strand are to provide students with the opportunity to:

- recognise mathematical patterns and relationships and be able to generalise from these;
- develop the ability to think in the abstract and use mathematical language and tools to communicate mathematical relationships and ideas;
- use algebraic expressions to solve problems.

ALGEBRA STRAND ACHIEVEMENT OBJECTIVES

Year 9 Students will be able to:

- simplify simple algebraic expressions (4 operations with exponent 1 only);
- expand and factorise expressions with two terms such as $3(x \pm 2)$;
- write simple mathematical expressions for described situations such as three times a number is twelve;
- solve simple linear equations arising from problems;
- plot points on the Cartesian plane;
- use words to describe linear algebraic relations.

Year 10 Students will be able to:

- apply the laws of exponents (multiplication, division and powers of powers with positive exponents);
- simplify algebraic expressions (4 operations with any exponents > 1);
- solve linear equations to include $ax + b = cx + d$, where a, b, c and d are integers;
- solve simple linear inequations with +ve coefficient of x;
- plot linear graphs by calculating coordinates and find the gradient of a line;
- expand products like $(x + a)(x + b)$ and factorise expressions of the form $x^2 + ax + b$ (a,b integers);
- write equations to describe linear algebraic relations.

Year 11 Students will be able to:

- list domains and ranges from sets of ordered pairs;
- solve linear equations;
- apply the four operations to algebraic fractions;
- simplify algebraic expressions involving integer exponents;
- find graphical and algebraic solutions to linear simultaneous equations (integer solutions only);
- substitute into linear formulae and change the subject of such formulae;
- sketch linear graphs using gradient/intercept and intercept/intercept;

- investigate and plot quadratic graphs by calculating coordinates;
- evaluate f(x) for linear functions with x an integer;
- solve quadratic equations of the form $x^2 \pm ax \pm b = 0$ by factorisation.

Year 12 Students will be able to:

- form a linear graph using: the 3 points method, the gradient intercept method, and the intercept-intercept method;
- interpret a linear graph where appropriate. E.g. rate of change;
- express linear functions in the forms $y = mx + c$ and $ax + bx + c = 0$;
- solve simultaneous equations using graphical methods;
- sketch quadratic expressions which are capable of being factorised;
- recognize the equations and sketch the graphs of the following functions: exponential, cubic, circle and hyperbole;
- sketch linear inequalities and solve them using graphical methods;
- simplify algebraic expressions using the basic operations (+, -, / and x);
- simplify algebraic expressions involving fractions;
- solve linear equations;
- solve linear inequations and show solutions on a number line;
- solve simultaneous linear equations;
- factorise quadratic expressions;
- use algebra in practical contexts.

Year 13 Students will be able to:

- choose suitable strategies (graphic, numeric, and algebraic) for finding solutions to equations or linear inequations, including those containing brackets and/or fractions, and interpret the results;
- carry out appropriate manipulation and simplification of algebraic expressions (substitution, changing the subject, expanding, factorising, simplifying, factorising, using the laws of logarithms);
- plot and sketch graphs of linear, quadratic and cubic polynomials; circles and rectangular hyperbolae, exponential functions; logarithmic functions, and trigonometric functions;
- find by inspection and interpret the following: domain and range, symmetries of odd and even functions, behaviour for large values of x, axes intercepts and asymptotes;
- recognise the concepts of transforming functions by sketching translations, change of scale and reflection in the x-axis;
- sketch graphs of inverse functions.

3. MEASUREMENT

The aims of this strand are to provide students with the opportunity to:

- develop knowledge of systems of measurement and confidence in their use;
- develop confidence and competence in using instruments and measuring devices;
- develop the ability to use their knowledge to solve problems concerning space.

MEASUREMENT STRAND ACHIEVEMENT OBJECTIVES

Year 9 Students will be able to:

- carry out practical measuring tasks involving length, weight, angle and time, using metric system measures in appropriate units where applicable;
- convert between appropriate metric measures;
- estimate lengths and weights of everyday objects in appropriate units;
- convert between metric and imperial measures in common use;
- find perimeter, area (triangles, rectangles and circles with $\pi = 3$) and volume (cuboids) to solve problems.

Year 10 Students will be able to:

- work appropriately with the perimeter and area of trapeziums, parallelograms, circles with $\pi = 3.14$ and irregular shapes as well as the volume of cylinders;
- calculate and use rates including such ideas as average speeds, flow rates, hourly rates and exchange rates;
- calculate and compare unit costs from measured quantities.

Year 11 Students will be able to:

- calculate the surface area of solid figures using skills from the measurement strand objectives of previous years.

Year 12 Students will be able to:

- determine limits of accuracy;
- perform calculations with time including the 24 hour clock;
- interpret and use information about rates presented in tables;
- use measurement skills in a variety of practical situations (perimeter, area, surface area, volume).

Year 13 Students will be able to:

- use sequences and series to model real problems and interpret their solutions;
- describe and use arithmetic and geometric sequences or series in common situations;
- recognise the relationship between the gradient of a graph and the rate of change;
- find the derivative of a polynomial;
- apply differentiation to find gradients, stationary points, turning points, to assist with sketching graphs of functions and to solve maxima and minima problems;
- find the anti-derivative of a polynomial and evaluate definite integrals;
- find the area under a polynomial curve.

4. TRIGONOMETRY

The aims of this strand are to provide students with the opportunity to:

- gain knowledge of the relationships between sides and angles in triangles and related figures;
- develop awareness of the applicability of a 2–dimensional model to 3–dimensions;
- develop the ability to use trigonometrical models to help solve practical problems of time and space.

TRIGONOMETRY STRAND ACHIEVEMENT OBJECTIVES

Year 9 Students will be able to:

- use Pythagorean triples to solve problems.

Year 10 Students will be able to:

- define and use trigonometric ratios (sine, cosine, tangent) for angles from 0° – 90°;
- solve problems involving finding unknown sides and angles of 2–dimensional right–angled triangles using trigonometry and/or Pythagoras' theorem.

Year 11 Students will be able to:

- extend the objectives of the year 10 trigonometry strand to include angles between 0° – 360°;
- graph trigonometric functions for angles between 0° – 360°.

Year 12 Students will be able to:

- solve practical problems by using Pythagoras' theorem and the trigonometric ratios (find unknown sides and angles of right-angled triangles);
- use the Sine and Cosine Rules to solve problems involving triangles;
- use the formula $A = \frac{1}{2}ab\sin C$ to find the area of triangles;
- find unknown lengths and angles and the names of angles in 3-dimensional figures;
- use the special triangles (equilateral, isosceles, right-angled) to express trigonometric ratios as fractions;
- sketch and recognize the graphs of the trigonometric functions ($y = \sin x$, $y = \cos x$, $y = \tan x$) for the domain $0° \leq x \leq 360°$ (Identify amplitude, periods, asymptotes).

Year 13 Students will be able to:

- use trigonometry to find and interpret measures on context and evaluate results: distances, angles and areas in triangles, arc length, angles and areas of sectors and segments in circles.

5. GEOMETRY

The aims of this strand are to provide students with the opportunity to:

- gain a knowledge of geometrical relations and appreciate their occurrence in the environment;
- develop spatial awareness and the ability to recognise and use the geometrical properties of real objects;
- develop the ability to use geometrical models to help solve practical problems of time and space.

GEOMETRY STRAND ACHIEVEMENT OBJECTIVES

Year 9 Students will be able to explore shapes through:

- studying, modelling and describing two and three dimensional shapes;
- investigating triangles (including interior and exterior angles), quadrilaterals;
- using properties of angles at a point, angles on a line, vertically opposite angles, co-interior, corresponding and alternate angles and parallel lines;
- using the transformations reflection and translation to investigate and create patterns.

Year 10 Students will be able to:

- explore transformations using enlargement with +ve scale factors including unit fractions;
- explore patterns using line and rotational symmetry;
- use bearings to describe direction and plot courses;
- use the interior and exterior angle properties of polygons to solve problems;
- use symmetry and the properties of transformations to solve problems.

Year 11 Students will be able to:

- use bearings to describe direction and plot courses;
- use scale drawings, enlargements with -ve scale factors and similar figures;
- solve simple problems involving the properties:
  - angles at the centre of a circle are twice the size of the angles at the circumference;
  - angles on the same arc are equal in size;
  - angles in semi-circles are right angles;
  - opposite angles of cyclic quadrilaterals sum to 180°;
  - exterior angles of cyclic quadrilaterals are equal in size to the interior and opposite angles.

Year 12 Students will be able to:

- use the properties of enlargement to find the scale factors of length, area and volume;
- describe the effect of combined transformations (enlargement, translation, reflection, rotation);
- solve problems involving angle properties of lines and polygons and parallel lines;
- solve problems involving angle properties of circles;
- use bearings and grid references to describe direction and plot courses;
- find unknown bearings and distances using scale diagrams;
- use vectors to describe translations;
- use vectors to describe displacement;
- solve problems involving vector addition and subtraction.

Year 13 Students will be able to:

- calculate: the distance between two points; the midpoint of a line segment; the gradient of a line segment; the angle a line segment makes with the x axis;
- find the equation of: a straight line given the gradient and one point on the line; a line given two points on the line;
- express the equation of a line in two forms: $ax + by + c = 0$ and $y = mx + c$;
- determine the gradients of parallel and perpendicular lines.

6. PROBABILITY AND STATISTICS

The aims of this strand are to provide students with the opportunity to:

- recognise the data appropriate to a particular situation and develop the skills to gather, analyse and then organise that data before presenting reports;
- present data in, and interpret data from, tables, charts and graphs;
- develop the ability to calculate or estimate probabilities and use these for predictions.

PROBABILITY AND STATISTICS STRAND

ACHIEVEMENT OBJECTIVES

Year 9 Students will be able to:

- explore chance events through:
  - experimenting with dice, card packs, coins, bags of coloured beads etc;
  - developing the language of probability (sample space, possible and favourable outcomes).
- explore data through:
  - collecting and displaying data (using tally marks, frequency tables, bar graphs, pie graphs (simple divisors of 360° only) and pictographs) to communicate information;
  - carrying out investigations into, and reporting on, situations relevant to the students' lives.

Year 10 Students will be able to:

- calculate theoretical probability from sample spaces that can be listed for simple events;
- calculate expected values for simple events;
- estimate probability from experiments;
- display data on line graphs;
- display data on stem and leaf plots (including back to back);
- calculate mean, median and range of ungrouped data and use them appropriately in reports;
- write simple reports to summarise statistical findings.

Year 11 Students will be able to:

- distinguish data as discrete or continuous, grouped or ungrouped;
- calculate the mean and median of grouped data and use the information in reports;
- construct and read frequency tables and frequency histograms;
- construct and read cumulative frequency tables and plot appropriate graphs;
- draw diagrams and probability trees and use their sample spaces to solve problems involving sequences of events;
- calculate theoretical probabilities of combined events;
- write reports at a level appropriate for year 11 about the results of statistical research.

Year 12 Students will be able to:

- calculate and interpret measures of central tendency (mean, median, mode, range, quartiles);
- present data in grouped and ungrouped frequency tables and analyse associated measures (mean, median, mode, range, quartiles);
- represent data with an appropriate graphical method (Pie graph, bar graph, histogram, linear graph, pictograph, box and whisker diagram, stem and leaf diagram, cumulative frequency graph);
- determine the probabilities of events based on observations of long-run relative frequency;
- determine the theoretical probabilities of the outcomes of events (rolling a die, drawing a card from a deck);
- predict the outcome of a simple probability experiment, test it, and explain the results;
- construct and use tree diagrams to determine the probability of a given sequence of events.

Year 13 Students will be able to:

- list all possible outcomes of an event and calculate probabilities;
- predict outcomes from; tree diagrams; tables of frequencies;
- calculate long run relative frequencies, the expected value of a number of trials, the mean and standard deviation of a data set;
- recognise situations where the normal distribution is a suitable mathematical model and use this model to solve problems;
- recognise and differentiate between continuous and non-continuous data;
- select and use an appropriate method to collect a sample of data using random numbers from a normally distributed population;
- analyse a sample using an appropriate statistical method;
- interpret and display the results of an analysis of a sample;
- present a written report of a statistical survey.

7. USING MATHEMATICS

The aims of this strand are to provide students with the opportunity to:

- develop creativity in applying mathematical techniques to unfamiliar problems;
- develop the skills of logical and systematic argument and apply these in a variety of contexts;
- develop the skills to critically evaluate an argument;
- develop the skills to communicate information in a clear and logical sequence.

9
10
11
12
13

The Achievement Objectives for the Using Mathematics Strand are the same at every year level:

Students will be able to:

- interpret information which involves mathematics;
- collect information necessary to solve problems;
- decide on the necessary techniques to solve problems;
- develop reasoned arguments;
- communicate the results of mathematical reasoning at a level appropriate for their year.

APPROACHES TO TEACHING AND LEARNING

The national curriculum is aimed at enabling students to learn. Learning is a process by which new understandings are constructed. Students learn best when they take action themselves to generate and create meaning, and to apply the new knowledge in meaningful situations. Teaching practices must aim for effective learning. Students are more likely to be involved in effective learning if teachers use activities such as discussion, investigation and reflection, problem solving, and peer work. These types of activities help students to think deeply about the content they are studying.

LANGUAGE AND LEARNING

The language associated with learning in subject areas is often abstract and demanding for any learner. For students who must learn through the medium of their second language, English, learning is even more complex. Such students are required to develop English language for school learning at the same time as attending to the requirements of content learning.

They are expected to use English to:

- reason through to conclusions;
- read and understand expository texts;
- develop arguments;
- analyse, synthesise and evaluate ideas.

Furthermore they are assessed in English on how well they express themselves either orally or in writing. English as second language learners may take at least 5 to 7 years to develop English language skills for academic learning compared to those students for whom English is the first language.

All students must develop the language associated with learning in mathematics. In practice it requires mathematics programmes to have specific English language objectives.

The language that students need in order to:

- understand;
- talk about mathematics content; and
- participate effectively in learning activities;

should be identified and taught together with the appropriate subject matter. In this way language is developed in relevant and meaningful contexts. The development of English language skills for learning needs to be supported in all areas of the curriculum.

Mathematics programmes therefore should:

- include planned integration of content and language learning in interesting contexts;
- provide students with the opportunity to use language for both social and academic purposes;
- develop understanding of meaning through a range of activities which includes listening and reading, speaking and writing, viewing and presenting;
- provide focused instruction on language structures from word forms and meanings to sentence patterns and whole texts;
- provide opportunities for students to interact with each other in the learning process in both Sāmoan and English;
- provide frequent opportunities for meaningful interaction between teachers and students, with teachers providing good models of language use and a balanced use of either language separately.

GENDER ISSUES

The ***Sāmoa Secondary School Curriculum Overview Document*** requires education to be gender–inclusive. This means that students should not be excluded from developing good self–esteem, or from participating fully and successfully in learning, because of narrow gender stereotypes.

Consequently, materials used with this curriculum must give learners the opportunities to understand how men and women, girls and boys can have a wide range of occupations, tasks and responsibilities. The materials should use gender-neutral language where possible.

School programmes and classroom learning tasks should reflect the diversity of roles available to men and women, girls and boys. Teachers need to ensure that gender is not an obstacle to learning, success, or individual value.

ASSESSMENT AND EVALUATION

Assessment is the process of gathering meaningful information which is used to make judgements on aspects of the learning cycle such as learners' performance against the achievement objectives, and the quality and effectiveness of learning programmes. Assessment and evaluation of mathematics teaching and learning must reflect the principles in the ***Sāmoa Secondary School Curriculum Overview Document.***

The National Curriculum recognises the relationship between the principles and purposes of the curriculum and methods of assessment. Assessment methods are an important factor in influencing and constraining teaching methods. The things that are assessed are seen as important. The way assessment is conducted emphasises the need to gain the skills that are assessed. Written examinations focus on the narrow range of knowledge and skills that can be assessed in written forms. The domination of assessment by pen and paper examinations legitimises the focus on a narrow range of skills and as a result confirms a narrow range of teaching methods.

It is important therefore that:

- a range of assessment procedures is used to provide useful information on students' progress against the achievement objectives stated in the curriculum;
- skills and knowledge such as independent inquiry, oral language, and many practical skills need to be assessed. These are not easily assessed by examination and need assessment through school–based activities;
- assessment and evaluation is ongoing and help improve the ways in which mathematics programmes are meeting the students' needs;
- where appropriate, families and communities be involved as participants in the assessment and evaluation process;
- students be involved in the assessment of their own progress in learning mathematics.

Effective Assessment in Mathematics seeks to:

- be valid, reliable and authentic;
- help students and teachers focus better on learning;
- involve students in worthwhile activities;
- be rewarding in terms of offering guidance about progress and skills;
- give feedback.

Teachers evaluating their programmes or units can use information from assessment. Evaluation is used to measure the success or otherwise of programmes or units. Evaluation requires a teacher to judge what worked well, how well the teaching improved students' learning and the things that need changing to improve the programme or unit for the future. Teachers should involve colleagues and students in the process of evaluation. Students should be asked for their feedback on how well the teaching programme or unit met their learning needs.

FEATURES OF THE MATHEMATICS CURRICULUM

The achievement objectives at each year level are minimal requirements for all students. From their knowledge of their classes, individual teachers may wish to broaden the learning experiences at any year level for some or all of their students.

The Mathematics Advisory Committee gave lengthy consideration to the use of calculators in secondary schools before deciding to recommend that the use of calculators be encouraged in the achievement of appropriate objectives in this curriculum document. The time freed from routine calculation would be able to be used in solving a greater variety of meaningful problems.

Consideration was also given to the approximate time in weeks that a lower quartile student might require in order to achieve the objectives, given the variety of backgrounds that the students may bring with them to year 9.

	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13
Number	6	5	4	3	-
Algebra	8	5	6	7	7
Measurement	5	4	4	3	4
Trigonometry	1	6	5	4	4
Geometry	5	5	6	4	5
Probability and Statistics	6	5	5	7	7
Using Mathematics					
Total Weeks	31	30	30	28	27

The Committee felt that the table above could be used as a rough working guide allowing for individual variation. There was no time allocated to the *Using Mathematics* strand because it was thought that the objectives of this strand would be integrated into the teaching programme throughout the year. The above allocation would also allow time for revision and assessment.

The idea of coherent progression is central throughout the Mathematics curriculum achievement objectives. Students are expected to achieve at a particular level before progressing to more complex objectives at higher levels. Because the students are achieving at each level there should only be a need for minimal revision when topics resume at the subsequent level.

In the future, new examination prescriptions will be required to be written and publicised to reflect the achievement objectives of the Mathematics Curriculum.

STRANDS, AIMS AND ACHIEVEMENT OBJECTIVES

NUMBER

AIM: The aims of this strand are to provide students with opportunities to:

- develop an understanding of numbers and the ways that they are represented;
- develop accuracy, efficiency and confidence with calculations;
- develop the ability to estimate, to make approximations and to validate answers for accuracy.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• use the four operations with integers, fractions, and decimals; • calculate percentages; • convert numbers between the forms: fraction (those in common usage only), decimal and percentage; • round numbers appropriately in calculations; • evaluate exponents (both base and exponent natural numbers only); • find square roots of square numbers; • apply the order of operations with integers; • solve simple problems using these skills.	• use $>$, $<$, $\leq$ and $\leq$ correctly; • apply the laws of exponents for multiplication, division and powers of powers; • evaluate terms with fractional exponents; • use standard form in naming very large and very small quantities; • use ideas of ratio and proportion including the allocation of up to three shares; • apply the order of operations with real numbers; • solve problems (including VAGST) using these skills.	• recognise the real numbers as a distinct number set; • graph specified sets of real numbers and integers on number lines; • evaluate terms with negative exponents; • calculate absolute value; • solve problems involving skills from the number strand objectives at a level appropriate for year 11; • solve problems and communicate solutions involving skills from the number strand objectives at a level appropriate for year 11.

NUMBER

Year 12	Year 13
ACHIEVEMENT OBJECTIVES: Students should be able to	
• perform basic operations with fractions, integers, decimals and percentages; • express numbers in standard form; • solve word problems involving ratios, rates and proportions; • express numbers as powers and roots; • round numbers appropriately; • make reasonable estimations; • apply the orders of operations in calculations; • calculate with absolute values; • solve problems and communicate solutions involving skills from the number strand objectives at a level appropriate for year 12.	• solve problems and communicate solutions involving skills from the number strand objectives at a level appropriate for year 13.

ALGEBRA

AIM: The aims of this strand are to provide students with opportunities to:

- recognise mathematical patterns and relationships and be able to generalise from these;
- develop the ability to think in the abstract and use mathematical language and tools to communicate mathematical relationships and ideas;
- use algebraic expressions to solve problems.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• simplify simple algebraic expressions (4 operations with exponent 1 only); • expand and factorise expressions with two terms such as $3(x \pm 2)$; • write simple mathematical expressions for described situations such as three times a number is twelve; • solve simple linear equations arising from problems; • plot points on the Cartesian plane; • use words to describe linear algebraic relations.	• apply the laws of exponents (multiplication, division and powers of powers with positive exponents); • simplify algebraic expressions (4 operations with exponent > 1); • solve linear equations to include $ax + b = cx + d$, where a, b, c and d are integers; • solve simple linear inequations with +ve coefficient of x; • plot linear graphs by calculating coordinates and find the gradient of a line; • expand products like $(x \pm a)(x \pm b)$ and factorise expressions of the form $x^2 \pm ax \pm b$ (a,b integers); • write equations to describe linear algebraic relations.	• list domains and ranges from sets of ordered pairs; • solve linear equations; • apply the four operations to algebraic fractions; • simplify algebraic expressions involving integer exponents; • find graphical and algebraic solutions to linear simultaneous equations (integer solutions only); • substitute into linear formulae and change the subject of such formulae; • sketch linear graphs using gradient/intercept and intercept/intercept; • investigate and plot quadratic graphs by calculating coordinates; • evaluate f(x) for linear functions with x an integer; • solve quadratic equations of the form $x^2 \pm ax \pm b = 0$ by factorisation.

ALGEBRA

Year 12	Year 13
• form a linear graph using: the 3 points method; the gradient intercept method; and the intercept-intercept method; • interpret a linear graph where appropriate e.g. rate of change; • express linear functions in the forms $y = mx + c$ and $ax + bx + c = 0$; • solve simultaneous equations using graphical methods; • sketch quadratic expressions which are capable of being factorised; • recognize the equations and sketch the graphs of the following functions: exponential, cubic, circle and hyperbole; • sketch linear inequalities and solve them using graphical methods; • simplify algebraic expressions using the basic operations (+, -, / and x); • simplify algebraic expressions involving fractions; • solve linear equations; • solve linear inequations and show solutions on a number line; • solve simultaneous linear equations; • factorise quadratic expressions; • use algebra in practical contexts.	• choose suitable strategies (graphic, numeric, and algebraic) for finding solutions to equations or linear inequations, including those containing brackets and/or fractions, and interpret the results; • carry out appropriate manipulation and simplification of algebraic expressions (substitution, changing the subject, expanding, factorising, simplifying, factorising, using the laws of logarithms); • plot and sketch graphs of linear, quadratic and cubic polynomials, circles and rectangular hyperbolae, exponential functions, logarithmic functions, and trigonometric functions; • find by inspection and interpret the following: domain and range, symmetries of odd and even functions, behaviour for large values of x, axes intercepts and asymptotes; • recognise the concepts of transforming functions by sketching translations, change of scale and reflection in the x-axis; • sketch graphs of inverse functions.

MEASUREMENT

AIM: The aims of this strand are to provide students with the opportunity to:

- develop knowledge of systems of measurement and confidence in their use;
- develop confidence and competence in using instruments and measuring devices;
- develop the ability to use their knowledge to solve problems concerning space.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• carry out practical measuring tasks involving length, weight, angle and time, using metric system measures in appropriate units where applicable; • convert between appropriate metric measures; • estimate lengths and weights of everyday objects in appropriate units; • convert between metric and imperial measures in common use; • find perimeter, area (triangles, rectangles and circles with $\pi = 3$) and volume (cuboids) to solve problems.	• work appropriately with the perimeter and area of trapeziums, parallelograms, circles with $\pi = 3.14$ and irregular shapes as well as the volume of cylinders; • calculate and use rates including such ideas as average speeds, flow rates, hourly rates and exchange rates; • calculate and compare unit costs from measured quantities.	• calculate the surface area of solid figures using skills from the measurement strand objectives of previous years.

MEASUREMENT

Year 12	Year 13
ACHIEVEMENT OBJECTIVES: Students should be able to	
• determine limits of accuracy; • perform calculations with time including the 24 hour clock; • interpret and use information about rates presented in tables; • use measurement skills in a variety of practical situations. (perimeter, area, surface area, volume).	• use sequences and series to model real problems and interpret their solutions; • describe and use arithmetic and geometric sequences or series in common situations; • recognise the relationship between the gradient of a graph and the rate of change; • find the derivative of a polynomial; • apply differentiation to find gradients, stationary points, turning points, to assist with sketching graphs of functions and to solve maxima and minima problems; • find the anti-derivative of a polynomial and evaluate definite integrals; • find the area under a polynomial curve.

TRIGONOMETRY

AIM: The aims of this strand are to provide students with the opportunity to:

- gain knowledge of the relationships between sides and angles in triangles and related figures;
- develop awareness of the applicability of a 2–dimensional model to 3–dimensions;
- develop the ability to use trigonometrical models to help solve practical problems of time and space.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• use Pythagorean triples to solve problems.	• define and use trigonometric ratios (sine, cosine, tangent) for angles from 0°– 90°; • solve problems involving finding unknown sides and angles of 2–dimensional right–angled triangles using trigonometry and/or Pythagoras' theorem.	• extend the objectives of the year 10 trigonometry strand to include angles between 0°– 360°; • graph trigonometric functions for angles between 0°– 360°.

TRIGONOMETRY

Year 12	Year 13

ACHIEVEMENT OBJECTIVES: Students should be able to

- solve practical problems by using Pythagoras' theorem and the trigonometric ratios (find unknown sides and angles of right-angled triangles);
- use the Sine and Cosine Rules to solve problems involving triangles;
- use the formula $A = \frac{1}{2}ab\sin C$ to find the area of triangles;
- find unknown lengths and angles and the names of angles in 3-dimensional figures;
- use the special triangles (equilateral, isosceles, right-angled) to express trigonometric ratios as fractions;
- sketch and recognize the graphs of the trigonometric functions ($y = \sin x$, $y = \cos x$, $y = \tan x$) for the domain $0° \leq x \leq 360°$ (Identify amplitude, periods, asymptotes).

- use trigonometry to find and interpret measures on context and evaluate results: distances, angles and areas in triangles; arc length, angles and areas of sectors and segments in circles.

GEOMETRY

AIM: The aims of this strand are to provide students with the opportunity to:

- gain a knowledge of geometrical relations and appreciate their occurrence in the environment;
- develop spatial awareness and the ability to recognise and use the geometrical properties of real objects;
- develop the ability to use geometrical models to help solve practical problems of time and space.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• explore shapes through: - studying, modelling and describing two and three dimensional shapes; - investigating triangles (including interior and exterior angles), quadrilaterals; - using properties of angles at a point, angles on a line, vertically opposite angles, co–interior, corresponding and alternate angles and parallel lines; - using the ransformations reflection and translation to investigate and create patterns.	• explore transformations using enlargement with +ve scale factors including unit fractions; • explore patterns using line and rotational symmetry; • use bearings to describe direction and plot courses; • use the interior and exterior angle properties of polygons to solve problems; • use symmetry and the properties of transformations to solve problems.	• use bearings to describe direction and plot courses; • use scale drawings, enlargements with –ve scale factors and similar figures; • solve simple problems involving the properties: - angles at the centre of a circle are twice the size of the angles at the circumference; - angles on the same arc are equal in size; - angles in semicircles are right angles; - opposite angles of cyclic quadrilaterals sum to 180°; - exterior angles of cyclic quadrilaterals are equal in size to the interior and opposite angles.

GEOMETRY

Year 12	Year 13

ACHIEVEMENT OBJECTIVES: Students should be able to

- use transformational geometry processes (enlargement, translation, reflection, rotation and symmetry) to solve practical problems;
- use the properties of enlargement to find the scale factors of length, area and volume;
- describe the effect of combined transformations (enlargement, translation, reflection, rotation);
- solve problems involving angle properties of lines and polygons and parallel lines;
- solve problems involving angle properties of circles;
- use bearings and grid references to describe direction and plot courses;
- find unknown bearings and distances using scale diagrams;
- use vectors to describe translations;
- use vectors to describe displacement;
- solve problems involving vector addition and subtraction.

- calculate: the distance between two points, the midpoint of a line segment, the gradient of a line segment, the angle a line segment makes with the x axis;
- find the equation of: a straight line given the gradient and one point on the line, a line given two points on the line;
- express the equation of a line in two forms: $ax + by + c = 0$ and $y = mx + c$;
- determine the gradients of parallel and perpendicular lines.

PROBABILITY AND STATISTICS

AIM: The aims of this strand are to provide students with the opportunity to:

- recognise the data appropriate to a particular situation and develop the skills to gather, analyse and then organise that data before presenting reports;
- present data in, and interpret data from, tables, charts and graphs;
- develop the ability to calculate or estimate probabilities and use these for predictions.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• explore chance events through: - experimenting with dice, card packs, coins, bags of coloured beads etc; - developing the language of probability (sample space, possible and favourable outcomes); • explore data through: - collecting and displaying data (using tally marks, frequency tables, bar graphs, pie graphs (simple divisors of 360° only) and pictographs) to communicate information; - carrying out investigations into, and reporting on, situations relevant to the students' lives.	• calculate theoretical probability from sample spaces that can be listed for simple events; • calculate expected values for simple events; • estimate probability from experiments; • display data on line graphs; • display data on stem and leaf plots (including back to back); • calculate mean, median and range of ungrouped data and use them appropriately in reports; • write simple reports to summarise statistical findings.	• distinguish data as discrete or continuous, grouped or ungrouped; • calculate the mean and median of grouped data and use the information in reports; • construct and read frequency tables and frequency histograms; • construct and read cumulative frequency tables and plot appropriate graphs; • draw diagrams and probability trees and use their sample spaces to solve problems involving sequences of events; • calculate theoretical probabilities of combined events; • write reports at a level appropriate for year 11 about the results of statistical research.

PROBABILITY AND STATISTICS

Year 12	Year 13

ACHIEVEMENT OBJECTIVES: Students should be able to

- calculate and interpret measures of central tendency (mean, median, mode, range, quartiles);
- present data in grouped and ungrouped frequency tables and analyse associated measures (mean, median, mode, range, quartiles);
- represent data with an appropriate graphical method (Pie graph, bar graph, histogram, linear graph, pictograph, box and whisker diagram, stem and leaf diagram, cumulative frequency graph);
- determine the probabilities of events based on observations of long-run relative frequency;
- determine the theoretical probabilities of the outcomes of events (rolling a die, drawing a card from a deck);
- predict the outcome of a simple probability experiment, test it, and explain the results;
- construct and use tree diagrams to determine the probability of a given sequence of events.
- list all possible outcomes of an event and calculate probabilities;
- predict outcomes from; tree diagrams; tables of frequencies;
- calculate; long run relative frequencies; the expected value of a number of trials; the mean and standard deviation of a data set;
- recognise situations where the normal distribution is a suitable mathematical model and use this model to solve problems;
- recognise and differentiate between continuous and non-continuous data;
- select and use an appropriate method to collect a sample of data using random numbers from a normally distributed population;
- analyse a sample using an appropriate statistical method;
- interpret and display the results of an analysis of a sample;
- present a written report of a statistical survey.

USING MATHEMATICS

AIM: The aims of this strand are to provide students with the opportunity to:

- develop creativity in applying mathematical techniques to unfamiliar problems;
- develop the skills of logical and systematic argument and apply these in a variety of contexts;
- develop the skills to critically evaluate an argument;
- develop the skills to communicate information in a clear and logical sequence.

Year 9	Year 10	Year 11
ACHIEVEMENT OBJECTIVES: Students should be able to		
• interpret information which involves mathematics; • collect information necessary to solve problems; • decide on the necessary techniques to solve problems; • develop reasoned arguments; • communicate the results of mathematical reasoning at a level appropriate for year 9.	• interpret information which involves mathematics; • collect information necessary to solve problems; • decide on the necessary techniques to solve problems; • develop reasoned arguments; • communicate the results of mathematical reasoning at a level appropriate for year 10.	• interpret information which involves mathematics; • collect information necessary to solve problems; • decide on the necessary techniques to solve problems; • develop reasoned arguments; • communicate the results of mathematical reasoning at a level appropriate for year 11.

USING MATHEMATICS

Year 12	Year 13
ACHIEVEMENT OBJECTIVES: Students should be able to	
• interpret information which involves mathematics; • collect information necessary to solve problems; • decide on the necessary techniques to solve problems; • develop reasoned arguments; • communicate the results of mathematical reasoning at a level appropriate for Year 12.	• interpret information which involves mathematics; • collect information necessary to solve problems; • decide on the necessary techniques to solve problems; • develop reasoned arguments; • communicate the results of mathematical reasoning at a level appropriate for year 13.

MATHEMATICS ACHIEVEMENT OBJECTIVES BY YEAR LEVEL

YEAR 9

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 9 students will be able to:

NUMBER (6 WEEKS)

- use the four operations with integers, fractions, and decimals;
- calculate percentages;
- convert numbers between the forms: fraction (those in common usage only), decimal and percentage;
- round numbers appropriately in calculations;
- evaluate exponents (both base and exponent natural numbers only);
- find square roots of square numbers;
- apply the order of operations with integers;
- solve simple problems using these skills.

ALGEBRA (8 WEEKS)

- simplify simple algebraic expressions (4 operations with exponent 1 only);
- expand and factorise expressions with two terms such as $3(x \pm 2)$;
- write simple mathematical expressions for described situations such as three times a number is twelve;
- solve simple linear equations arising from problems;
- plot points on the Cartesian plane;
- use words to describe linear algebraic relations.

MEASUREMENT (5 WEEKS)

- carry out practical measuring tasks involving length, weight, angle and time, using metric system measures in appropriate units where applicable;
- convert between appropriate metric measures;
- estimate lengths and weights of everyday objects in appropriate units;
- convert between metric and imperial measures in common use;
- find perimeter, area (triangles, rectangles and circles with $\pi = 3$) and volume (cuboids) to solve problems.

YEAR 9

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 9 students will be able to:

TRIGONOMETRY (1 WEEK)

- use Pythagorean triples to solve problems.

GEOMETRY (5 WEEKS)

- Explore shapes through:
  - studying, modelling and describing two and three dimensional shapes;
  - investigating triangles (including interior and exterior angles), quadrilaterals;
  - using properties of angles at a point, angles on a line, vertically opposite angles, co-interior, corresponding and alternate angles and parallel lines;
  - using the transformations reflection and translation to investigate and create patterns.

PROBABILITY AND STATISTICS (6 WEEKS)

- Explore chance events through:
  - experimenting with dice, card packs, coins, bags of coloured beads etc;
  - developing the language of probability (sample space, possible and favourable outcomes).

- Explore data through:
  - collecting and displaying data (using tally marks, frequency tables, bar graphs, pie graphs (simple divisors of 360° only) and pictographs to communicate information;
  - carrying out investigations into, and reporting on, situations relevant to the students' lives.

YEAR 10

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 10 students will be able to:

NUMBER (5 WEEKS)

- use >, <, ≤ and ≤and correctly;
- apply the laws of exponents for multiplication, division and powers of powers;
- evaluate terms with fractional exponents;
- use standard form in naming very large and very small quantities;
- use ideas of ratio and proportion including the allocation of up to three shares;
- apply the order of operations with real numbers;
- solve problems (including VAGST) using these skills.

ALGEBRA (5 WEEKS)

- apply the laws of exponents (multiplication, division and powers of powers with positive exponents);
- simplify algebraic expressions (4 operations with any exponents > 1);
- solve linear equations to include $ax + b = cx + d$, where a, b, c and d are integers;
- solve simple linear inequations with +ve coefficient of x;
- plot linear graphs by calculating coordinates and find the gradient of a line;
- expand products like $(x \pm a)(x \pm b)$ and factorise expressions of the form $x^2 \pm ax \pm b$ (a,b integers);
- write equations to describe linear algebraic relations.

MEASUREMENT (4 WEEKS)

- work appropriately with the perimeter and area of trapeziums, parallelograms, circles with $\pi = 3.14$ and irregular shapes as well as the volume of cylinders;
- calculate and use rates including such ideas as average speeds, flow rates, hourly rates and exchange rates;
- calculate and compare unit costs from measured quantities.

YEAR 10

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 10 students will be able to:

TRIGONOMETRY (6 WEEKS)

- define and use trigonometric ratios (sine, cosine, tangent) for angles from 0°– 90°;
- solve problems involving finding unknown sides and angles of 2-dimensional right-angled triangles using trigonometry and/or Pythagoras' theorem.

GEOMETRY (5 WEEKS)

- explore transformations using enlargement with +ve scale factors including unit fractions;
- explore patterns using line and rotational symmetry;
- use bearings to describe direction and plot courses;
- use the interior and exterior angle properties of polygons to solve problems;
- use symmetry and the properties of transformations to solve problems.

PROBABILITY AND STATISTICS (5 WEEKS)

- calculate theoretical probability from sample spaces that can be listed for simple events;
- calculate expected values for simple events;
- estimate probability from experiments;
- display data on line graphs;
- display data on stem and leaf plots (including back to back);
- calculate mean, median and range of ungrouped data and use them appropriately in reports;
- write simple reports to summarise statistical findings.

YEAR 11

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 11 students will be able to:

NUMBER (4 WEEKS)

- recognise the real numbers as a distinct number set;
- graph specified sets of real numbers and integers on number lines;
- evaluate terms with negative exponents;
- calculate absolute value;
- solve problems involving skills from the number strand objectives at a level appropriate for year 11.

ALGEBRA (6 WEEKS)

- list domains and ranges from sets of ordered pairs;
- solve linear equations;
- apply the four operations to algebraic fractions;
- simplify algebraic expressions involving integer exponents;
- find graphical and algebraic solutions to linear simultaneous equations (integer solutions only);
- substitute into linear formulae and change the subject of such formulae;
- sketch linear graphs using gradient/intercept and intercept/intercept;
- investigate and plot quadratic graphs by calculating coordinates;
- evaluate f(x) for linear functions with x an integer;
- solve quadratic equations of the form $x^2 \pm ax \pm b = 0$ by factorisation.

MEASUREMENT (4 WEEKS)

- calculate the surface area of solid figures using skills from the measurement strand objectives of previous years.

YEAR 11

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 11 students will be able to:

TRIGONOMETRY (5 WEEKS)

- extend the objectives of the year 10 trigonometry strand to include angles between 0°–360°;
- graph trigonometric functions for angles between 0°–360°.

GEOMETRY (6 WEEKS)

- use bearings to describe direction and plot courses;
- use scale drawings, enlargements with –ve scale factors and similar figures;
- solve simple problems involving the properties:
  - angles at the centre of a circle are twice the size of the angles at the circumference;
  - angles on the same arc are equal in size;
  - angles in semi-circles are right angles;
  - opposite angles of cyclic quadrilaterals sum to 180°;
  - exterior angles of cyclic quadrilaterals are equal in size to the interior and opposite angles.

PROBABILITY AND STATISTICS (5 WEEKS)

- distinguish data as discrete or continuous, grouped or ungrouped;
- calculate the mean and median of grouped data and use the information in reports;
- construct and read frequency tables and frequency histograms;
- construct and read cumulative frequency tables and plot appropriate graphs;
- draw diagrams and probability trees and use their sample spaces to solve problems involving sequences of events;
- calculate theoretical probabilities of combined events;
- write reports at a level appropriate for year 11 about the results of statistical research.

YEAR 12

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 12 students will be able to:

NUMBER (3 WEEKS)

- perform basic operations with fractions, integers, decimals and percentages;
- express numbers in standard form;
- solve word problems involving ratios, rates and proportions;
- express numbers as powers and roots;
- round numbers appropriately;
- make reasonable estimations;
- apply the orders of operations in calculations;
- calculate with absolute values.

ALGEBRA (7 WEEKS)

- form a linear graph using: the 3 points method; the gradient intercept method; and the intercept-intercept method;
- interpret a linear graph where appropriate e.g. rate of change;
- express linear functions in the forms $y = mx + c$ and $ax + bx + c = 0$;
- solve simultaneous equations using graphical methods;
- sketch quadratic expressions which are capable of being factorised;
- recognize the equations and sketch the graphs of the following functions: exponential, cubic, circle and hyperbole;
- sketch linear inequalities and solve them using graphical methods;
- simplify algebraic expressions using the basic operations (+, -, / and x);
- simplify algebraic expressions involving fractions;
- solve linear equations;
- solve linear inequations and show solutions on a number line;
- solve simultaneous linear equations;
- factorise quadratic expressions;
- use algebra in practical contexts.

YEAR 12

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 12 students will be able to:

MEASUREMENT (3 WEEKS)

- determine limits of accuracy;
- perform calculations with time including the 24 hour clock;
- interpret and use information about rates presented in tables;
- use measurement skills in a variety of practical situations (perimeter, area, surface area, volume).

TRIGONOMETRY (4 WEEKS)

- solve practical problems by using Pythagoras theorem and the trigonometric ratios (find unknown sides and angles of right-angled triangles);
- use the Sine and Cosine Rules to solve problems involving triangles;
- use the area formula $A = \frac{1}{2}ab\sin C$ to find the area of triangles;
- find unknown lengths and angles and the names of angles in 3-dimensional figures;
- use the special triangles (equilateral, isosceles, right-angled) to express trigonometric ratios as fractions;
- sketch and recognize the graphs of the trigonometric functions ($y = \sin x$, $y = \cos x$, $y = \tan x$) for the domain $0° \leq x \leq 360°$ (Identify amplitude, periods, asymptotes).

GEOMETRY (4 WEEKS)

- use transformational geometry processes (enlargement, translation, reflection, rotation and symmetry) to solve practical problems;
- use the properties of enlargement to find the scale factors of length, area and volume;
- describe the effect of combined transformations (enlargement, translation, reflection, rotation).

YEAR 12

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 12 students will be able to:

GEOMETRY (CONT)

- solve problems involving angle properties of lines and polygons and parallel lines;
- solve problems involving angle properties of circles;
- use bearings and grid references to describe direction and plot courses;
- find unknown bearings and distances using scale diagrams;
- use vectors to describe translations;
- use vectors to describe displacement;
- solve problems involving vector addition and subtraction.

PROBABILITY AND STATISTICS AND (7 WEEKS)

- calculate and interpret measures of central tendency (mean, median, mode, range, quartiles);
- present data in grouped and ungrouped frequency tables and analyse associated measures (mean, median, mode, range, quartiles);
- represent data with an appropriate graphical method (Pie graph, bar graph, histogram, linear graph, pictograph, box and whisker diagram, stem and leaf diagram, cumulative frequency graph);
- determine the probabilities of events based on observations of long-run relative frequency;
- determine the theoretical probabilities of the outcomes of events (rolling a die, drawing a card from a deck).

YEAR 13

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 13 students will be able to:

NUMBER

- solve problems and communicate solutions involving skills from the number strand objectives at a level appropriate for year 13.

ALGEBRA (7 WEEKS)

- choose suitable strategies (graphic, numeric, and algebraic) for finding solutions to equations or linear inequations, including those containing brackets and/or fractions, and interpret the results;
- carry out appropriate manipulation and simplification of algebraic expressions (substitution, changing the subject, expanding, factorising, simplifying, factorising, using the laws of logarithms);
- plot and sketch graphs of linear, quadratic and cubic polynomials; circles and rectangular hyperbolae, exponential functions; logarithmic functions, and trigonometric functions;
- find by inspection and interpret the following: domain and range, symmetries of odd and even functions, behaviour for large values of x, axes intercepts and asymptotes;
- recognise the concepts of transforming functions by sketching translations, change of scale and reflection in the x-axis;
- sketch graphs of inverse functions.

MEASUREMENT (4 WEEKS)

- use sequences and series to model real problems and interpret their solutions;
- describe and use arithmetic and geometric sequences or series in common situations;
- recognise the relationship between the gradient of a graph and the rate of change;
- find the derivative of a polynomial;
- apply differentiation to find gradients, stationary points, turning points, to assist with sketching graphs of functions and to solve maxima and minima problems;
- find the anti-derivative of a polynomial and evaluate definite integrals;
- find the area under a polynomial curve.

YEAR 13

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, Year 13 students will be able to:

TRIGONOMETRY (4 WEEKS)

- use trigonometry to find and interpret measures on context and evaluate results: distances, angles and areas in triangles; arc length, angles and areas of sectors and segments in circles.

GEOMETRY (5 WEEKS)

- calculate: the distance between two points; the midpoint of a line segment; the gradient of a line segment; the angle a line segment makes with the x axis;
- find the equation of: a straight line given the gradient and one point on the line; a line given two points on the line;
- express the equation of a line in two forms: $ax + by + c = 0$ and $y = mx + c$;
- determine the gradients of parallel and perpendicular lines.

PROBABILITY AND STATISTICS (7 WEEKS)

- list all possible outcomes of an event and calculate probabilities;
- predict outcomes from; tree diagrams; tables of frequencies;
- calculate; long run relative frequencies; the expected value of a number of trials; the mean and standard deviation of a data set;
- recognise situations where the normal distribution is a suitable mathematical model and use this model to solve problems;
- recognise and differentiate between continuous and non-continuous data;
- select and use an appropriate method to collect a sample of data using random numbers from a normally distributed population;
- analyse a sample using an appropriate statistical method;
- interpret and display the results of an analysis of a sample;
- present a written report of a statistical survey.

YEARS 9–13

ACHIEVEMENT OBJECTIVES FOR ALL STRANDS

From their study, mathematics students will be able to:

USING MATHEMATICS

- interpret information which involves mathematics;
- collect information necessary to solve problems;
- decide on the necessary techniques to solve problems;
- develop reasoned arguments;
- communicate the results of mathematical reasoning at a level appropriate for each year level.

GLOSSARY

GLOSSARY OF TERMS

Absolute Value
the value of a number when the size is not considered.

Acute angle
an angle between 0° and 90°.

Angle
the union of two rays with a common end point (the vertex).

Arc
part of a curve.

Area
the size or measure of a surface expressed in square units.

Average of a set of numbers
the sum of all the numbers divided by the number of numbers. It is also the general term for any number used to represent a set of numbers (e.g. mean, median, or mode).

Axis (axes)
the line(s) which form the framework for a graph.

Axis of symmetry
a line which divides a shape in half.

Bar graph
a graph which uses horizontal or vertical bars to present information. The bars should be the same width with the length representing quantity. (A vertical bar graph is also known as a column graph.)

Bearing
direction measured in degrees clockwise from north.

Billion
1000 million.

Bisector
a line or ray the cuts a figure or line segment or angle into two congruent parts.

Bivariate data
data which is classified according to two variables (e.g. heights and weights of students).

Category data
information which can be organised into categories (e.g. food can be categorised as meat, fish, vegetables, fruit etc).

Chord
a line segment with both end points on a curve or circle.

Co-efficient
the number part of a mathematical term (e.g. the term -5x has a co-efficient of -5).

Collinear points

points on the same line.

Complementary angles

two angles which add up to 90°.

Concurrent lines

lines which pass through a common point.

Conditional probability

the probability of an event assuming that another has occurred (e.g. the probability that two rolls of a die give a total of 8 when the first roll was a 5).

Congruent

figures which have the same size and shape.

Continuous data

data which is measured not counted.

Data

a set of facts, numbers, or information.

Diameter

the distance across a circle, through the centre.

Digit

a symbol used to write numerals.

Discrete data

data which is counted not measured.

Empty set

a set with no members (not even 0).

Equation

an open number sentence stating that two quantities are equal.

Equivalent fractions

fractions that represent the same number.

Estimation

an approximate calculation or judgement.

Exponent

the power of a number.

Factor

a number that is multiplied by another to give a product.

Frequency

the number of times an item appears.

Graph

a picture or diagram which shows information.

Hectare

a unit of area equivalent to a square with sides 100m.

Histogram

a bar chart for continuous data in which the area of the bars is proportional to the frequency represented.

Hypotenuse

the longest side of a right-angled triangle.

Index

another name for exponent.

Inequation

a number sentence stating that one quantity is more or less than another.

Integer

a number of the set {...-3, -2, -1, 0, 1, 2, 3...}.

Invariant

remains unchanged.

Isosceles triangle

a triangle with two congruent sides.

Kilo

a prefix meaning 1000.

Kite

a quadrilateral with two pairs of adjacent congruent sides.

Line graph

a graph formed by line segments which join the points representing data.

Linear equation

an equation that has a straight line graph.

Locus

a set of points mapping out a path.

Mean

the mean of a set of scores divided by the number of scores.

Median

the number which comes in the middle of a set of numbers when they are arranged in order.

Mode

the number which appears most often in a set of data.

Natural number

one of the counting numbers {1, 2, 3...}.

Numeral

a name or symbol used for a number.

Obtuse angle

an angle with size between 90° and 180°.

Order of symmetry

the order of rotational symmetry is the number of ways a shape can be rotated to fit on itself. The total order of symmetry is the order of rotational symmetry plus the number of axes of symmetry.

Perimeter

the distance around the boundary of a plane figure.

Plane

a flat surface that extends indefinitely.

Polygon

a plane figure of three or more straight sides.

Power

also known as the exponent or index. In $5^3=5x5x5=125$, the power of 5 is 3.

Prime

a number with just two factors - itself and 1.

Probability

a number that tells how likely it is that an event will happen.

Radius

the distance from the centre of a circle to the circumference.

Range

the difference between the smallest and greatest values in a data set.

Reflex angle

an angle with size between 180° and 360°.

Regular polygon

a polygon with all sides and angles congruent.

Scalene triangle

a triangle in which no sides are congruent.

Scatter diagram

a diagram that shows pairs of variables on a graph.

Sector

part of a circle bounded by an arc and two radii.

Segment

part of a circle bounded by an arc and a chord.

Similar

two figures are similar if they have exactly the same shape.

Standard form

the form in which a number is written as the product of a number between 1 and 10 and a power of 10.

Supplementary angles

two angles which add up to 180°.

Tally chart

a table with three columns headed outcomes, tally, and frequency and used to record data.

Tree diagram

a diagram which systematically represents all outcomes for a sequence of events.

Unit cost

the cost of one unit of a particular item.

Variables

quantities which can take many values (e.g. *the number of people entering a shop each hour*).

Velocity

speed in a particular direction.

Volume

the amount of space occupied by an object. Volume is measured in cubic units.

Whole number

a number from the set {0, 1, 2, 3...}.