**STAGE 1 MATHEMATICS**

**PROGRAM 3 – SEMESTER 1**

This program is for a cohort of students intending to continue to Mathematical Methods at Stage 2. The following program describes the first semester of learning.

**SEMESTER ONE – 18 WEEKS INCLUDING EXAM WEEK**

* Topic 1 – Functions and Graphs Subtopics 1.1, 1.3 and 1.4 (4 weeks)
* Topic 11 – Matrices Subtopic 11.1 (3 weeks)
* Topic 2 – Polynomials Subtopic 2.1 (4 weeks)
* Topic 3 – Trigonometry Subtopic 3.1 (3 weeks)
* Topic 4 – Counting and Statistics Subtopics 4.2, 4.3 and 4.4 (3 weeks)

**Topic 1 – Functions and Graphs Subtopics 1.1, 1.3 and 1.4 (4 weeks)**

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| **Term****week** | **Subtopic** | **Concepts and Content**Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 1-1 | 1.1Lines and Linear Relationships | The equation of a straight line* Given two points
* Given the slope and a point
* Parallel to a line through a given point
* Perpendicular to a line through a given point

Features of the graph of a linear function of the form $y=mx+c$* Slope (*m*) as a rate of growth
* Y-intercept *(c*)

Determine the formula for a linear relationship given data or description of situation* Various problems are addressed from everyday situations such as simple interest and conversion graphs. Slope as a rate of growth and interpretation of intercepts are considered in context.

Calculation of points of intersection* Solve simultaneous equations algebraically and graphically
* Consideration given to situations involving coincident, perpendicular and parallel lines
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| 1-2 | 1.3Relations | Definition of a relation as a set of ordered pairs* Discuss various examples

Exploration of the circle as a relation * Development of the equation of a circle in centre radius form
* Development of the circle in expanded (general) form, demonstrate the use of completing the square to convert from general to centre radius form
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| 1-3 | 1.4Functions | Definition of a function as a set of ordered pairs whereby no two have the same $x$ value (it defines one variable in terms of one other)* The graph of a function
* Domain and range
* Function notation
* Dependent and independent variables
* Use of vertical line test to establish a function

Understanding the distinction between functions and relations |  |
| 1-4 |  | **Revision and consolidation**  |  |

**Topic 11 – Matrices Subtopic 11.1 (3 weeks)**

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| **Term Week** | **Subtopic** | **Concepts and Content**Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 1-5 | 11.1Matrix Arithmetic | Definition of a Matrix* Order of matrices
* Elements of matrices

Matrix operations - initially algebraically then introduction of technology* Addition and subtraction
* Scalar multiplication
* Matrix multiplication

Identity matrix (2x2)* Definition and properties

Inverse of matrices* Determinant and its significance
* Calculation of inverses provided inverse exists
* Finding unique solutions to matrix equations of the form $AX=B $or $XA=B$ if it exists
 |  |
| 1-6 |  |
| 1-7 |  | **Revision and SAT 1**  | **SAT 1**Subtopics 1.1, 1.3, 1.4, 11.1Calculator permitted |

**Topic 2 – Polynomials Subtopic 2.1 (4 weeks)**

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| **Term****Week** | **Subtopic** | **Concepts and Content**Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 1-8 | 2.1Quadratic Relationships | Discussion on quadratic relationships with reference to real life scenarios e.g. throwing a ball straight up.Features of the graph $y=x^{2}$* Shape
* Axial intercepts
* Turning points
* Equation of axis of symmetry

Quadratics in each of the following forms are explored * General $y=ax^{2}+bx+c, a\ne 0$
* Factored $y=a\left(x-α\right)\left(x-β\right), a\ne 0$
* Vertex $y=a\left(x-b\right)^{2}+c, a\ne 0$

Students work on the above forms to identify as appropriate axial intercepts, turning points (vertex) and equation of axis of symmetryDetermining the zeros of a quadratic* Factorisation of quadratics from general to factored form
* Use of the quadratic formula (incorporate the meaning of non-real zeros)

Complete the square to determine turning point of a quadratic |  |
| **EASTER** |
| 1-9 |  | Investigate the discriminant, $∆, $of a function and its significance for the number and nature of the zeros of the graph of the function.* If $∆<0$, two non-real distinct zeros, distinction between rational and irrational zeros
* If $∆ =0$, real repeated zero
* If $∆>0$, two real distinct zeros, distinction between rational and irrational zeros

Relationship between the leading coefficient of a quadratic and its discriminant for positive definite and negative definite quadraticsThe sum and product of real zeros* Revision of surds

Determining quadratic functions from given zeros and a point on the quadraticQuadratic modelling* Determining variables such as height or time from a quadratic
* Optimisation problems such as perimeter dimensions for maximum area
 |  |
| 1-10 |
| 1-11 |  | **Revision and SAT 2**  | **SAT 2 Part 1**Sketching graphs, factorising to solve, use of quadratic formula to obtain exact answersNo calculator **SAT 2 Part 2** $∆$, determining quadratics, sum and product, modellingCalculator permitted |

**Topic 3 – Trigonometry Subtopic 3.1 (3 weeks)**

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| Termweek | **Subtopic** | **Concepts and Content**Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 2-1 | 3.1Cosine and Sine Rules | Right-angled trigonometry* Pythagoras’ theorem
* Trigonometric ratios: sin$θ$, cos$θ$ and tan$θ$

Non-right angled triangle* Cosine rule
	+ Finding the length when given two sides and the included angle
	+ Finding an angle given all sides
 |  |
| 2-2 | * Sine rule
	+ Finding the length of a side when given two angles and one side
	+ Finding the angle given two sides and the non-included angle
* Area of non-right angled triangle

Students complete an assortment of problems involving non-right angled triangles using cosine, sine and area rules | **INVESTIGATION**Packaging of Christmas Balls |
| 2-3 | Word problems including three dimensional problems |  |

**Topic 4 – Counting and Statistics Subtopics 4.2, 4.3 and 4.4 (3 weeks)**

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| **Term Week** | **Subtopic** | **Concepts and Content**Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 2-4 | 4.2Discrete and Continuous Random Data | Definitions of and differences between discrete and continuous variables* Examples considered and students identify discrete and continuous data. Consideration given to continuous variables that may appear to be recorded as discrete.
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| 4.3Samples and Statistical Measures | Describing the centre of data: mean, mode and median* Students develop an understanding of the differences from calculations for each measure of centre. Consideration is given to strength and weakness of each e.g. how extreme value(s) may distort the mean.

Describing the spread of data: range, interquartile range and standard deviation* Students are aware of the standard deviation formula $s=\sqrt{\frac{1}{N-1}Σ(x-\overbar{x})^{2}}$

The use of electronic technology to determine the above is implemented once the concepts are understood. |  |
| 2-5 | 4.4Normal Distributions | Normal distributions occur when the quantity is the combined effect of a number of random errorsFeatures of normal distributions* Bell-shaped
* Position of mean
* Symmetry about mean
* Characteristic spread
* Positions of one, two and three standard deviations from the mean. Technology for other values and inverse calculations if time permits. Use of the 68-95-99.7 rule.

Students use examples to understand the concepts and their implication in real life scenarios. |  |
| 2-6 |  | **Revision and SAT 3** | **SAT 3**Subtopics 4.2, 4.3 and 4.4Calculator permitted |
| 2-7 |  | **EXAMINATION REVISION** |  |
| 2-8 |  | **YEAR 11 EXAMS** |  |