**STAGE 1 MATHEMATICS**

**PROGRAM 1 – 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 WEEKS**

* Topic 1 – Functions and Graphs (5 weeks)
* Topic 2 – Polynomials (5 weeks)
* Topic 3 – Trigonometry (6 weeks)

**Topic 1 – Functions And Graphs (5 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 | 1.1  Lines 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   * 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 |  |
| 1-2 | 1.2  Inverse Relationships | Exploring the mathematical relationship where one variable decreases as the other increases  Consider the graph of the basic hyperbola   * Define asymptote, both horizontal and vertical   Consider translations of the basic hyperbola i.e.  The use of technology is incorporated in the graphs above |  |
| 1-3 | 1.3  Relations | 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 |  |
| 1-4 | 1.4  Functions | Definition of a function as a set of ordered pairs whereby no two have the same 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 |  |
| 1-5 |  | **Revision and SAT 1** | **SAT 1**  Entire topic  Calculator permitted |

**Topic 2 – Polynomials (5 weeks)**

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| **Term**  **Week** | **Subtopic** | **Concepts and Content**  Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 1-6 | 2.1  Quadratic Relationships | Discussion on quadratic relationships with reference to real life scenarios e.g. throwing a ball straight up.  Features of the graph   * Shape * Axial intercepts * Turning points * Equation of axis of symmetry   Quadratics in each of the following forms are explored   * General * Factored * Vertex   Students work on the above forms to identify as appropriate axial intercepts, turning points (vertex) and equation of axis of symmetry  Determining 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 |  |
| 1-7 | Investigate the discriminant, of a function and its significance for the number and nature of the zeros of the graph of the function.   * If , two non-real distinct zeros, distinction between rational and irrational zeros * If , real repeated zero * If , 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 quadratics  The sum and product of real zeros   * Revision of surds   Determining quadratic functions from given zeros and a point on the quadratic  Quadratic modelling   * Determining variables such as height or time from a quadratic * Optimisation problems such as perimeter dimensions for maximum area | **INVESTIGATION**  Features of Polynomials |
| 1-8 |
| **EASTER** | | | |
| 1-9 | 2.2  Cubic and Quartic Polynomials | Definition of a cubic  Terminology, degree and forms   * General * Point of Inflection * Factored   Features   * Shape reference to leading coefficient * Behaviour as * Nature and number of zeros of the graph of a cubic   Explore features of cubics written as a product of:   * A linear factor and a quadratic (both real and non-real zeros) * Three linear factors   Determining cubic functions from given zeros and one other piece of data  Definition of a quartic  Terminology, degree and forms as an extension of the work on cubics  Cubic and quartic modelling (using technology)  Determining unknown variables  Optimisation such as dimensions for maximum volume |  |
| 1-10 |  | **Revision and SAT 2**  **Investigation work and submission** | **SAT 2 Part 1** – No calculator  Sketching graphs, factorising to solve, use of quadratic formula to obtain exact answers  **SAT 2 Part 2** - Calculator permitted  , determining quadratics, sum and product, modelling |

**Topic 3 – Trigonometry (6 weeks)**

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| Term  week | **Subtopic** | **Concepts and Content**  Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 1-11 | 3.1  Cosine and Sine Rules | Right-angled trigonometry   * Pythagoras’ theorem * Trigonometric ratios: sin, cos and tan   Non-right angled triangle   * Cosine rule   + Finding the length when given two sides and the included angle   + Finding an angle given all sides |  |
| 2-1 | * 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 |  |
| 2-2 | 3.2  Circular Measure and Radian Measure | Introduction to the unit circle and its properties  How the unit circle is linked to graphs of and   * The link between the unit circle and , and in degrees * The unit circle definition of , and and periodicity using degrees   Definition of radian measure   * Conversion between radian and degree measure   Calculation of the lengths of arcs and areas of sectors of circle |  |
| 2-3 | 3.3  Trigonometric Functions | Connection between unit circle and , and in radians  Determine the exact value of cosine and sine from multiples of and using unit circle or graphs  Making the connection that the functions and best describe the horizontal and vertical positions around a circle  Explore the features of and   * Amplitude and * Period and * Phase and   Solve practical problems in a range of different contexts |  |
| 2-4 | Solve trigonometric equations both algebraically and graphically   * Only consider cases such as and   Special relationships observed of sine and cosine functions      Tangent function   * Consider the relationship between the angle of inclination and the gradient of a line * The relationship * Graphs of the functions |  |
| 2-5 |  | **Revision and SAT 3** | **SAT 3**  1 hour  Entire topic  Calculator permitted |
| 2-6 |  | **EXAMINATION REVISION** |  |
| 2-7  2-8 |  | **YEAR 11 EXAMS** | End Semester One |