**STAGE 1 MATHEMATICS**

**PROGRAM 4 – SEMESTER 3**

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

**SEMESTER THREE - 17 WEEKS INCLUDING EXAM WEEK**

It is assumed this component will be taught after students have completed Program 1 – Semester 1 covering Topics 1, 2 and 3.

* Topic 9 – Vectors in the Plane Subtopics 9.1, 9.2, 9.3 and 9.4 (7 Weeks)
* Topic 12 – Real and Complex Numbers Subtopics 12.2, 12.3, 12.4, 12.5 (5 Weeks)
* Topic 10 – Further Trigonometry Subtopics 10.1 (part), 10.2 (4 Weeks)

**Topic 9 – Vectors in the Plane (7 weeks) Start Term 2 week 9**

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| **Week** | **Subtopic** | **Concepts and Content**  Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 2-9 | 9.1  Vector Operations | Representation of vectors in the plane by directed line segments  Vector operations including:   * Addition and subtraction * Scalar multiples * Applications of scalar multiples: parallel vectors and ratio of division |  |
| 2-10 | 9.2  Component and Unit Vector form | Vectors in the Cartesian Plane   * ordered pair notation * column vector notation * combination of vectors * unit vectors * position vector   Determination of length and direction of a vector from its components | **Investigation**  **Bezier curves** |
| 3-1 | 9.3  Projections | Projection of one vector onto another   * The dot (scalar) product * The angle between two vectors * Perpendicular vectors * Parallel vectors |  |
| 3-2 |
| 3-3 | 9.4  Geometric proof using Vectors | Geometric Proofs using Vectors in the plane  Various selections of proofs involving parallelism and perpendicularity that makes use of dot product and scalar multiples  Examples include:   * The diagonals of a parallelogram meet at right angles if and only if it is a rhombus * Midpoints of the sides of a quadrilateral join to form a parallelogram * The sum of the squares of the lengths of the diagonals of a parallelogram is equal to the sum of the squares of the lengths of the sides |  |
| 3-4 |
| 3-5 |  | **Revision and SAT 1** | **SAT 1 Part 1**  Subtopics 9.1, 9.2, 9.3  Calculator permitted  **SAT 1 Part 2**  Subtopic 9.4  No calculator |

**Topic 12 – Real and Complex Numbers Subtopics 12.2, 12.3, 12.4, 12.5 (5 weeks)**

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| **Week** | **Subtopic** | **Concepts and Content**  Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 3-6 | 12.2  Introduction to Mathematical Induction | Ladder/Dominoes example   * Initial statement, inductive step * Prove results for simple sums, such as 1 + 4 + 9 … + n2 = for any positive integer n * Prove results for arithmetic and geometric series |  |
| 3-7 | 12.3  Complex Numbers | Introduction to the imaginary number , and its definition as . Exemplify its use in solutions to equations such as  Introduction to complex numbers: and defining the real and imaginary components  Operations with complex numbers, including the use of   * Addition, subtraction, multiplication and division * Complex conjugates * Readdress the quadratic formula in the context of complex number solutions |
| 3-8 | 12.4  The Complex Plane (Argand) | Cartesian form on an Argand diagram  Vector addition in the complex plane  Complex conjugates in the complex plane  Modulus |
| 3-9 | 12.5  Roots of Equations | Factorise quadratics into linear factors  Use of quadratic formula involving *i.* |  |
| 3-10 |  | **Revision and SAT 2** | **SAT 2**  Subtopics 12.2, 12.3, 12.4, 12.5  Calculator permitted |

**Topic 10 – Further Trigonometry Subtopic 10.1 (part), 10.2 (4 weeks)**

*The content of this topic assumes Topic 3 - Trigonometry has been completed*

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| **Week** | **Subtopic** | **Concepts and Content**  Technology is incorporated into all aspects of this topic as appropriate | **Assessment Task** |
| 4-1 | 10.1  Further Trigonometric Functions (part) | Solve trigonometric equations of the form y=AsinB(x – C)+D (including cosine and tan versions) finding all solutions. |  |
| 4-2 | 10.2  Trigonometric Identities | Consider the sine and cosine functions and their behaviour in the unit circle. Hence develop the following trigonometric relationships:   * (this is a review from subtopic 3.3) * and * and |  |
| 4-3 | Derive and find expressions for  Consider the reciprocal trigonometric functions:  Sketch graphs and complete simple transformations for each of these |  |
| 4-4 |  | **Revision and SAT 3** | **SAT 3**  Subtopic 10.1 (part), 10.2  Calculator permitted |
| 4-5/6 |  | **EXAMINATION REVISION / EXAMS** |  |