

**MATHEMATICS DEPARTMENT 2018**

**Year: 11 SPECIALIST MATHEMATICS Course: AEMAS (Unit 1 and Unit 2)**

**Textbook: Maths Specialist Unit 1 & 2 (Sadler) Revision Series: Maths Specialist Unit 1 & 2 (O.T. Lee)**

**SEMESTER 1 (Unit 1)**

**Term 1 2018**

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| **Term****1** | **Week****commencing** | **Syll ref** | **Topic** | **Chapter/Topic** | **Assess- ments** |
| **Topic 1.1: Combinatorics (and parts of Topic 1.3 Geometry)** |
| **The nature of proof & The pigeon-hole Principle** |
| 1 |  29 Jan | 1.1.61.3.11.3.21.3.31.3.41.3.5 | * solve problems and prove results using the pigeon-hole principle
* use implication, converse, equivalence, negation, inverse, contrapositive
* use proof by contradiction
* use the symbols for implication (⇒), equivalence (⇔)
* use the quantifiers ‘for all’ $∀$ and ‘there exists’ $∃$
* use examples and counter-examples
 | **Chapter 1***OTL 4* |  |
| **Permutations (ordered arrangements)** |
| 2 |  5 Feb | 1.1.11.1.21.1.31.1.4 | * solve problems involving permutations
* use the multiplication and addition principle
* use factorial notation and
* solve problems involving permutations involving restrictions with or without repeated objects
 | **Chapter 2***OTL 1, 2, 3* |  |
| **The inclusion-exclusion principle for the union of two & three sets** |
| 3 |  12 Feb | 1.1.5 | * determine and use the formulas for finding the number of elements in the union of two and three sets
 | **Chapter 2***OTL 1, 2, 3* |  |
| **Combinations (unordered selections)** |
| 4 |  19 Feb | 1.1.71.1.81.1.9 | * solve problems involving combinations
* use the notation $\left(\begin{matrix}n\\r\end{matrix}\right)$ or $^{n}C\_{r}$
* derive and use associated simple identities associated with Pascal’s triangle
 | **Chapter 2***OTL 1, 2, 3* | **Test 1 (5%)** |
| **Topic 1.2: Vectors in the plane** |
| **Representing vectors in the plane by directed line segments** |
| 5 |  26 Feb | 1.2.11.2.2 | * examine examples of vectors, including displacement and velocity
* define and use the magnitude and direction of a vector
 | **Chapter 3***OTL 5, 6, 7, 8* |  |
| 6 |  5 MarchMonday Labour Day | 1.2.31.2.4 | * represent a scalar multiple of a vector
* use the triangle and parallelogram rules to find the sum and difference of two vectors
 | **Chapter 3***OTL 5, 6, 7, 8* | **Inv 1 (6%)** |
| **Term****1** | **Week****commencing** | **Syll ref** | **Topic** | **Chapter/Topic** | **Assess- ments** |
| **Algebra of vectors in the plane & Circle properties, including proof and use** |
| 7 |  12 March | 1.2.51.2.61.2.71.2.81.2.9 | * use ordered pair notation and column vector notation to represent a vector
* define unit vectors and the perpendicular unit vectors $i$ and $j$
* express a vector in component form using the unit vectors $i$ and $j$
* examine and use addition and subtraction of vectors in component form
* define and use multiplication of a vector by a scalar in component form
 | **Chapter 4***OTL 5, 6, 7, 8* |  |
| **Topic 1.3: Geometry (and parts of Topic 1.2: Vectors in the plane)** |
| 8 | 19 March | 1.3.61.3.71.3.81.3.91.3.101.3.111.3.12 | * an angle in a semicircle is a right angle
* the size of the angle at the centre subtended by an arc of a circle is twice the size of the angle at the circumference subtended by the same arc
* angles at the circumference of a circle subtended by the same arc are equal
* the opposite angles of a cyclic quadrilateral are supplementary
* chords of equal length subtend equal angles at the centre, and conversely, chords subtending equal angles at the centre of a circle have the same length
* the angle in the alternate segment theorem
* when two chords of a circle intersect, the product of the lengths of the intervals on one chord equals the product of the lengths of the intervals on the other chord
 | **Chapter 5***OTL 16* |  |
| 9 |  26 MarchFridayGood Friday | 1.3.131.3.141.3.15 | * when a secant (meeting the circle at *A* and *B*) and a tangent (meeting the circle at *T)* are drawn to a circle from an external point *M*, the square of length of the tangent equals the product of the lengths to the circle on the secant(*AM* × *BM* = *TM*2)
* suitable converses of some of the above results
* solve problems determining unknown angles and lengths and prove further results using the results listed above
 | **Chapter 5***OTL 16* | **Test 2 (7%)** |
| 10 | 2 AprilMondayEaster Mon  | 1.2.14 | * solve problems involving displacement, force and velocity involving the above concepts
 | **Chapter 6***OTL 9,10,11* |  |
| **Geometric vectors in the plane including proof and use** |
| 11 | 9 April | 1.3.161.3.171.3.18 | * the diagonals of a parallelogram intersect at right angles if, and only if, it is a rhombus,
* the 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
 | **Chapter 7***OTL 15* | **Inv 2****(7%)** |
| **END OF TERM 1** |

**Term 2 2018**

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| **Term****2** | **Week****commencing** |  | **Topic** | **Reference:****Chapter/Topic** | **Assess-ment** |
| **Algebra of vectors in the plane** |
| 1 | 30 April | 1.2.101.2.11 | * define and use scalar (dot) product
* apply the scalar product to vectors expressed in component form
 | **Chapter 8***OTL 12, 13, 14* |  |
| 2 |  7 May | 1.2.121.2.13 | * examine properties of parallel and perpendicular vectors and determine if two vectors are parallel or perpendicular
* define and use projection of vectors
 | **Chapter 8***OTL 12, 13, 14* |  |
| 3 | 14 May |  | Revision |  | **Test 3 (7%)** |
| 4 | 21 May  |  | Revision |  |  |
| 5 |  28 May |  | **SEMESTER ONE EXAMINATION** |  |  |
| 6 |  4 June |  |  |  |

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| **SEMESTER 2 (Unit 2)** |
| **Topic 2.1: Trigonometry** |
| **MODULE 1: Compound angles & Compound angles & The basic trigonometric functions** |
| 7 |  11 June | 2.1.52.1.3 | * prove and apply the Pythagorean identities
* prove and apply the angle sum, difference, and double angle
 | **Chapter 9***OTL 17-24* | Mon West Australia Day |
| **MODULE 2: Trigonometric identities & The reciprocal functions, secant, cosecant and cotangent** |
| 8 |  18 June | 2.1.72.1.42.1.62.1.8 | * convert sums *a*cos *x +b*sin*x* to *R*cos*(x±α)* or *R*sin*(x±α)* and apply these to sketch graphs; solve equations of the form *a*cos*x +b*sin*x=c*
* define the reciprocal trigonometric functions; sketch their graphs and graph simple transformations of them
* prove and apply the identities for products of sines and cosines expressed as sums and differences
* prove and apply other trigonometric identities
 | **Chapter 9***OTL 17-24* |  |
|  **The basic trigonometric functions & Applications of trigonometric functions to model periodic phenomena** |
| 9 | 25 June | 2.1.12.1.22.1.9 | * determine all solutions of *f(a(x−b))=c* where *f* is one of sine, cosine or tangent
* graph functions with rules of the form *y=f(a(x−b))*+c where *f* is one of sine, cosine, or tangent
* model periodic motion using sine and cosine functions and understand the relevance of the period and amplitude of these functions in the model
 | **Chapter 9***OTL 17-24* | **Inv 3****(7%)** |

**Term 3 2018**

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| **Term 3** | **Week****commencing** |  | **Topic** | **Reference:****Chapter/Topic** | **Assess-ment** |
| **Topic 2.2: Matrices** |
| **Matrix arithmetic** |
| 1 |  16 July  | 2.2.12.2.22.2.3 | * apply matrix definition and notation
* define and use addition and subtraction of matrices, scalar multiplication, matrix multiplication, multiplicative identity, and inverse
* calculate the determinant and inverse of 2 × 2 matrices and solve matrix equations of the form *AX* = *B*, where *A* is a 2 × 2 matrix and *X* and *B* are column vectors
 | **Chapter 10***OTL 25* | **Test 4 (7%)** |
| **Systems of linear equations** |
| 2 |  23 July | 2.2.11 | * interpret the matrix form of a system of linear equations in two variables and use matrix algebra to solve a system of linear equations
 | **Chapter 10***OTL 26, 27* |  |
| **Transformations in the plane** |
| 3 | 30 July | 2.2.42.2.52.2.62.2.7 | * examine translations and their representation as column vectors
* define and use basic linear transformations: dilations of the form *(x,y) ->(λ1 x, λ2 y*), rotations about the origin and reflection in a line that passes through the origin and the representations of these transformations by 2 × 2 matrices
* apply these transformations to points in the plane and geometric objects
* define and use composition of linear transformations and the corresponding matrix products
 | **Chapter 11***OTL 28* |  |
| 4 |  6 Aug | 2.2.82.2.92.2.10 | * define and use inverses of linear transformations and the relationship with the matrix inverse
* examine the relationship between the determinant and the effect of a linear transformation on area
* establish geometric results by matrix multiplications; for example: show that the combined effect of 2 reflections is a rotation
 | **Chapter 11** *OTL 28* |  |
| **Topic 2.3: Real and complex numbers** |
| **Proofs involving numbers & Rational and irrational numbers** |
| 5 |  13 Aug  | 2.3.12.3.22.3.3 | * prove simple results involving numbers
* express rational numbers as terminating or eventually recurring decimals and vice versa
* prove irrationality by contradiction for numbers such as
 | **Chapter 12***OTL 30* | **Test 5 (7%)** |
| **An introduction to proof by mathematical induction** |
| 6 | 20 Aug | 2.3.42.3.52.3.6 | * develop the nature of inductive proof, including the ‘initial statement’ and inductive step
* prove results for sums, such as  for any positive integer *n*
* prove divisibility results, such as  is divisible by 5 for any positive integer *n*
 | **Chapter 12***OTL 30* |  |
| **Complex numbers** |
| 7 |  27 Aug  | 2.3.72.3.82.3.92.3.10 | * define the imaginary number *i* as a root of the equation x2=-1
* represent complex numbers in the rectangular form; *a* + *bi* where *a* and *b* are the real and imaginary parts
* determine and use complex conjugates
* perform complex number arithmetic: addition, subtraction, multiplication and division
 | **Chapter 13***OTL 29* |  |
| **The complex plane** |
| 8 |  3 Sep  | 2.3.112.3.122.3.13 | * consider complex numbers as points in a plane, with real and imaginary parts, as Cartesian coordinates
* examine addition of complex numbers as vector addition in the complex plane
* develop and use the concept of complex conjugates and their location in the complex plane
 | **Chapter 13***OTL 29* |  |
| **Roots of equations** |
| 9 |  10 Sept  | 2.3.142.3.152.3.16 | * use the general solution of real quadratic equations
* determine complex conjugate solutions of real quadratic equations
* determine linear factors of real quadratic polynomials
 | **Chapter 13***OTL 29* |  |
| 10 | 17 Sept |  | Revision |  | **Test 6(7%)** |
| **Term 4** | **Week****commencing** |  | **Topic** | **Reference:****Chapter/Topic** | **Assess-ment** |
| 1 | 8 Oct |  | Revision |  |  |
| 2 | 15 Oct |  | **SEMESTER TWO EXAMINATIONS** |  |  |
| 3 | 22 Oct |  | **SEMESTER TWO EXAMINATIONS** |  |  |
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**Mathematics Specialist: Assessment Outline: Year 11, 2018**

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| **Item** | **Type** | **Topic** | **Year weighting** | **Approximate timing** |
| Test 1 | Response | Combinatronics & Geometry1.3.1-1.3.5, 1.1.1-1.1.9 | 5% | Term 1, Week 4 |
| Investigation 1 | Investigation | Combinatonics  | 6% | Term 1, Week 6 |
| Test 2 | Response  | Vectors & Geometry1.2.1-1.2.9, 1.3.6-1.3.15 | 7% | Term 1, Week 9 |
| Investigation 2 | Investigation | Vectors/Geometry | 7% | Term 1, Week 11 |
| Test 3 | Response | Geometry & Vectors1.2.10-1.2.14, 1.3.16-1.3.18 | 7% | Term 2, Week 3 |
| Semester 1 Examination | Examination | Unit 1 | 16% | Term 2, Week 5/6 |
|  |  | **Totals** | **48%** |  |
| Investigation 3 | Investigation | Trigonometry | 7% | Term 2, Week 9 |
| Test 4 | Response | Trigonometry2.1.1-2.1.9 | 7% | Term 3, Week 1 |
| Test 5 | Response | Matrices2.2.1-2.2.10 | 7% | Term 3, Week 5 |
| Test 6 | Response | Real and Complex numbers2.3.1-2.3.16 | 7% | Term 3, Week 10 |
| Semester 2 Examination | Examination | Unit 1 & 2 | 24% | Term 4, Week 2/3 |
|  |  | **Totals** | **52%** |  |

**Types: Relative to time allocation**

Response 40% 1. Combinatorics 10% 4.Trigonometry 15%

Investigation 20% 2. Vectors 20% 5. Matrices 17%

Examination 40% 3. Geometry 20% 6. Real and Complex nos. 18%