Kalamunda Senior High School

An Independent Public School

Mathematics Department

2016 Year 11 Mathematics Specialist (Units 1 & 2) Program

Text: O.T. Lee Mathematics Specialist Year 11 ATAR Course Text book

Course delivery: · This is a Two Unit Course delivered sequentially over three terms and assessed concurrently. **Response type assessments** (40%) include: · Topic Tests (6 @ 6%) · Mini-tests (2 @ 2%) in preparation for Topic Tests and making use of 'past' questions.	**Investigation type assessments** (20%) include: · Investigations related directly and indirectly to the syllabus (4 @ 5%). **Examination type assessments** (40%) include: · Semester I (15%) · Semester II (25%)
The **CASIO ClassPad 400 (or 330)** is a dedicated mathematics computer.	
Additional *Supplementary Material* will be provided for most topics throughout the course.	

TERM 1 WEEK	CONTENT DESCRIPTION	TEXT REFERENCE	ASSESSMENT
1.1	**Topic 1.1: Combinatorics** **Permutations (ordered arrangements)** 1.1.1 solve problems involving permutations 1.1.2 use the multiplication and addition principle 1.1.3 use factorial notation and ^nP_r 1.1.4 solve problems involving permutations involving restrictions with or without repeated objects	**Preliminary work** From Year 10 Reading/review **OT Lee Chapter 1 Combinatronics I** Ex 1.1 Ex 1.2 Ex 1.3	
1.2	**The inclusion-exclusion principle for the union of two sets and three sets** 1.1.5 determine and use the formulas for finding the number of elements in the union of two and the union of three sets **The pigeon-hole principle** 1.1.6 solve problems and prove results using the pigeon-hole principle	**OT Lee Chapter 1 Combinatronics II** Ex 2.1 Ex 2.2 Ex 2.3	
1.3	**Combinations (unordered selections)** 1.1.7 solve problems involving combinations 1.1.8 use the notation $\binom{n}{r}$ or ^nC_r 1.1.9 derive and use associated simple identities associated with Pascal's triangle	**OT Lee Chapter 1 Combinatronics 3** Ex 3.1 Ex 3.2 Ex 3.3 Ex 3.4 Hands on Task	**Investigation 1 (5%)** validation

1.4	<u>**Topic 1.2: Vectors in the plane**</u> **Representing vectors in the plane by directed line segments** 1.2.1 examine examples of vectors, including displacement and velocity 1.2.2 define and use the magnitude and direction of a vector 1.2.3 represent a scalar multiple of a vector 1.2.4 use the triangle and parallelogram rules to find the sum and difference of two vectors	**OT Lee Chapter 4 Introduction to Vectors** Ex 4.1 Ex 4.2	**Mini-Test 1 (2%)**
1.5-1.6	**Algebra of vectors in the plane** 1.2.5 use ordered pair notation and column vector notation to represent a vector 1.2.6 define unit vectors and the perpendicular unit vectors **i** and **j** 1.2.7 express a vector in component form using the unit vectors **i** and **j**	**OT Lee Chapter 4 Vectors in component form** Ex 4.3 Ex 4.4	**Week 6:** **Topic Test 1 (6%)**
1.7	1.2.8 examine and use addition and subtraction of vectors in component form 1.2.9 define and use multiplication of a vector by a scalar in component form	**OT Lee Chapter 5 Position Vectors Ex 5.1** **OT Lee Chapter 7 Vectors Applications I** Ex7.1 Ex7.2 Ex7.3 ?	
1.8 -1.9	1.2.10 define and use scalar (dot) product 1.2.11 apply the scalar product to vectors expressed in component form 1.2.12 examine properties of parallel and perpendicular vectors and determine if two vectors are parallel or perpendicular 1.2.13 define and use projection of vectors 1.2.14 solve problems involving displacement, force and velocity involving the above concepts	**OT Lee Chapter 9 Scalar product** Ex 9.1 Ex 9.2 Ex 9.3 **OT Lee Chapter 10** Vector Applications III Ex10.2	
1.10	Relative Vectors (extension)	**OT Lee Chapter 6 Relative displacement and relative velocity** Ex 6.1 Ex 6.2 **OT Lee Chapter 8** Vector Applications II Ex 8.1	**Topic Test 2 (6%)**

TERM 2 WEEK	CONTENT DESCRIPTION	TEXT REFERENCE	ASSESSMENT
2.1	**<u>Topic 1.3: Geometry</u>** **The nature of proof** 1.3.1 use implication, converse, equivalence, negation, inverse, contrapositive 1.3.2 use proof by contradiction 1.3.3 use the symbols for implication (⇒), equivalence (⇔) 1.3.4 use the quantifiers 'for all' ∀ and 'there exists' ∃. 1.3.5 use examples and counter-examples	**OT Lee Chapter 21 Methods of Proof** Ex 21.1 Ex 21.2 Ex 21.3 Ex 11.1 & 11.2	**Investigation 2 (5%) handed out**
2.2	**Circle properties, including proof and use** 1.3.6 an angle in a semicircle is a right angle 1.3.7 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 1.3.8 angles at the circumference of a circle subtended by the same arc are equal 1.3.9 the opposite angles of a cyclic quadrilateral are supplementary 1.3.10 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	**OT Lee Chapter 11 Geometric proofs & Circle Properties** Ex 11.1	**Investigation 2 (5%) Validation**
2.3	1.3.11 the angle in the alternate segment theorem 1.3.12 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 1.3.13 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 ($AM \times BM = TM^2$) 1.3.14 suitable converses of some of the above results 1.3.15 solve problems determining unknown angles and lengths and prove further results using the results listed above	**OT Lee Chapter 11 Geometric proofs & Circle Properties** Ex 11.2	

2.4	**Geometric vectors in the plane, including proof and use** 1.3.16 the diagonals of a parallelogram intersect at right angles if, and only if, it is a rhombus 1.3.17 the midpoints of the sides of a quadrilateral join to form a parallelogram 1.3.18 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	**OT Lee Chapter 12 Geometric Proofs using vectors** Ex 12.1 Ex 12.2	**Topic Test 3 (6%)**
2.5	**Revision**		
2.6-2.7	**Semester I Examination Unit 1**		**Semester I Exam Unit 1 (15%)**
2.8	**Topic 2.1: Trigonometry** **The basic trigonometric functions** 2.1.1 determine all solutions of $f(a(x-b))=c$ where f is one of sine, cosine or tangent 2.1.2 graph functions with rules of the form $y=f(a(x-b))+c$ where f is one of sine, cosine, or tangent	**Preliminary work** From Year 10 and *Mathematics Methods* Reading/review **OT Lee Chapter 13 Trigonometric Equations** Ex 13.1	
2.8	**The reciprocal trigonometric functions, secant, cosecant and cotangent** 2.1.4 define the reciprocal trigonometric functions; sketch their graphs and graph simple transformations of them	**OT Lee Chapter 13 Trigonometric Equations** Ex 13.2 **OT Lee Chapter 14 Trigonometric Graphs** Ex 14.1 Ex 14.2	
2.9	**Trigonometric identities** 2.1.5 prove and apply the Pythagorean identities 2.1.6 prove and apply the identities for products of sines and cosines expressed as sums and differences **Compound angles** 2.1.3 prove and apply the angle sum, difference, and double angle identities	**OT Lee Chapter 15 Trigonometric Identities** Ex 15.1 Ex 15.2 Ex 15.5 Ex 15.3 Ex 15.4	**Mini test 2 (2%)**
2.10	2.1.7 convert sums $a \cos x + b \sin x$ to $R \cos(x \pm \alpha)$ or $R \sin(x \pm \alpha)$ and apply these to sketch graphs; solve equations of the form $a \cos x + b \sin x = c$ 2.1.8 prove and apply other trigonometric identities such as $\cos 3x = 4\cos^3 x - 3\cos x$ **Applications of trigonometric functions to model periodic phenomena** 2.1.9 model periodic motion using sine and cosine functions and understand the relevance of the period and amplitude of these functions in the model	**OT Lee Chapter 15 Trigonometric Identities** Ex 15.6 ?	

TERM 3 WEEK	CONTENT DESCRIPTION	TEXT REFERENCE	ASSESSMENT
3.1& 3.2	**Topic 2.2: Matrices** **Matrix arithmetic** 2.2.1 apply matrix definition and notation 2.2.2 define and use addition and subtraction of matrices, scalar multiplication, matrix multiplication, multiplicative identity, and inverse 2.2.3 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	**OT Lee Chapter 16 Matrix Algebra** Ex 16.1 Ex 16.2 Ex 16.3 Ex 16.4 Ex 16.5 Ex 16.6	**Topic Test 4 (6%)**
3.2	**Systems of linear equations** 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	**OT Lee Chapter 17 Systems of Linear Equations** Ex 17.1 **Chapter 18** Applications Using Matrices Ex 18.1	**Investigation 3 (5%) Home Section**
3.3	**Transformations in the plane** 2.2.4 examine translations and their representation as column vectors 2.2.5 define and use basic linear transformations: dilations of the form $(x,y) \longrightarrow (\lambda_1 x, \lambda_2 y)$, rotations about the origin and reflection in a line that passes through the origin and the representations of these transformations by 2 × 2 matrices 2.2.6 apply these transformations to points in the plane and geometric objects 2.2.7 define and use composition of linear transformations and the corresponding matrix products	**OT Lee Chapter 19 Transformations Matrices** Ex 19.1	**Investigation 3 (5%) Validation**
3.4	2.2.8 define and use inverses of linear transformations and the relationship with the matrix inverse 2.2.9 examine the relationship between the determinant and the effect of a linear transformation on area 2.2.10 establish geometric results by matrix multiplications; for example: show that the	**OT Lee Chapter 19 Transformations Matrices** Ex 19.2	

	combined effect of 2 reflections is a rotation		
3.5	**<u>Topic 2.3: Real and complex numbers</u>** **Proofs involving numbers** 2.3.1 prove simple results involving numbers **Rational and irrational numbers** 2.3.2 express rational numbers as terminating or eventually recurring decimals and vice versa 2.3.3 prove irrationality by contradiction for numbers such as $\sqrt{2}$	**OT Lee Chapter 21 Methods of Proofs** Ex 21.5	**Topic Test 5 (6%)**
3.6	**An introduction to proof by mathematical induction** 2.3.4 develop the nature of inductive proof, including the 'initial statement' and inductive step 2.3.5 prove results for sums, such as $1+4+9...+n^2=\frac{n(n+1)(2n+1)}{6}$ for any positive integer *n* 2.3.6 prove divisibility results, such as $3^{2n+4}-3^{2n}$ is divisible by 5 for any positive integer *n*	**OT Lee Chapter 21 Methods of Proofs** Ex 21.4 Ex 21.6	
3.7	**Complex numbers** 2.3.7 define the imaginary number *i* as a root of the equation $x^2=-1$ 2.3.8 represent complex numbers in the rectangular form; *a* + *bi* where *a* and *b* are the real and imaginary parts 2.3.9 determine and use complex conjugates 2.3.10 perform complex number arithmetic: addition, subtraction, multiplication and division	**OT Lee Chapter 20 Complex numbers** Ex 20.1	
3.8	**The complex plane** 2.3.11 consider complex numbers as points in a plane, with real and imaginary parts, as Cartesian coordinates 2.3.12 examine addition of complex numbers as vector addition in the complex plane 2.3.13 develop and use the concept of complex conjugates and their location in the complex plane	**OT Lee Chapter 20 Complex numbers** Ex 20.2	
3.9	**Roots of equations** 2.3.14 use the general solution of real quadratic	**OT Lee Chapter 20 Complex numbers**	**Topic Test 6 (6%)**

	equations 2.3.15 determine complex conjugate solutions of real quadratic equations 2.3.16 determine linear factors of real quadratic polynomials	Ex 20.3	
3.10	**Revision** **Semester II Examination Units 1&2**		**Semester II Exam Units 1&2 (25%)**

TERM 4 WEEK	CONTENT DESCRIPTION	TEXT REFERENCE	ASSESSMENT
4.1 – 4.4	*Commence Year 12 Mathematics Specialist Units 3&4*		Investigation 4 (5%)
4.5 – 4.6	*Balance of Year 11 Semester II Examinations*		