COURSE OUTLINE
MATHEMATICS SPECIALIST – ATAR YEAR 11: 2021
UNIT 1 & UNIT 2

Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
1	1	**Combinatorics** The pigeon-hole principle	1.1.6 solve problems and prove results using the pigeon-hole principle	**Sadler Ch 1** **Lee Ch 2.3** **Nelson Ch 3.03**	
1	1-3	**Geometry** 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 1.3.17 the midpoints of the sides of a quadrilateral join to form a parallelogram	**Sadler Ch 1 & 5** **Lee Ch 11** **Nelson Ch 2**	
1	4-5	**Geometry** 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	**Sadler Ch 5** **Lee Ch 11** **Nelson Ch 6**	

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			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 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		
1	6-8	**Combinatorics** Permutations (ordered arrangements) The inclusion-exclusion principle for the inion of two sets and three sets	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	**Sadler Ch 2** **Lee Ch 1-3** **Nelson Ch 3 & 5**	**Test 1** **Week 6**

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Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
		Combinations (unordered selections)	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 1.1.7 solve problems involving combinations 1.1.8 use the notation 1.1.9 derive and use associated simple identities associated with Pascal's triangle		
1	9	**Vectors in the Plane** 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	**Sadler Ch 3** **Lee Ch 4** **Nelson Ch 1**	**Investigation 1** **Week 9**
2	1-4	**Vectors in the Plane** 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**	**Sadler Ch 4, 6-8** **Lee Ch 4-10** **Nelson Ch 1 & 4**	**Test 2** **Week 2**

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Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
			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 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		
2	5-6	**Geometry** 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	**Sadler Ch 5** **Lee Ch 11** **Nelson Ch 2**	**Test 3** **Week 6**
2	7	**Revision**			
2	8-9	**SEMESTER ONE EXAMS**			

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Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
2	10	**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	**Sadler Ch Prelim Work** **Lee Ch 13-14** **Nelson Ch 12**	
2	11	**Trigonometry** Compound angles	2.1.3 prove and apply the angle sum, difference, and double angle identities	**Sadler Ch 9** **Lee Ch 15** **Nelson Ch 9**	
3	1	**Trigonometry** 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	**Sadler Ch 9** **Lee Ch 13** **Nelson Ch 12**	
3	2	**Trigonometry** 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 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 $\cos 3x = 4\cos^3 x - 3\cos x$	**Sadler Ch 9** **Lee Ch 15** **Nelson Ch 9**	
3	4	**Trigonometry** 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	**Sadler Ch 9** **Lee Ch 14** **Nelson Ch 12**	
3	5	**Real and complex numbers** Proofs involving numbers	2.3.1 prove simple results involving numbers	**Sadler Ch 12** **Lee Ch 21**	**Test 4** **Week 5**

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Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
		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 $\sqrt{2}$	**Nelson Ch 7**	
3	6	**Real and complex numbers** 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 $1+4+9\ldots+n^2=\frac{n(n+1)(2n+1)}{6}$ 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*	**Sadler Ch 12** **Lee Ch 21** **Nelson Ch 7**	
3	7-8	**Real and complex numbers** 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	**Sadler Ch 13** **Lee Ch 20** **Nelson Ch 10**	
3	9	**Real and complex numbers** The complex plane	2.3.11 consider complex numbers as points in a plane, with real and imaginary parts, as Cartesian coordinates	**Sadler Ch 13** **Lee Ch 20**	

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Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
			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	**Nelson Ch 10**	
3	10	**Real and complex numbers** Roots of equations	2.3.14 use the general solution of real quadratic equations 2.3.15 determine complex conjugate solutions of real quadratic equations 2.3.16 determine linear factors of real quadratic polynomials	**Sadler Ch 13** **Lee Ch 20** **Nelson Ch 10**	**Test 5** **Week 10**
4	1-2	**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	**Sadler Ch 10** **Lee Ch 16** **Nelson Ch 8**	**Investigation 2** **Week 1**
4	3-4	**Matrices** Transformations in the plane and Systems of linear equations	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	**Sadler Ch 11** **Lee Ch 16 & 17** **Nelson Ch 11**	

Term	Week	Topic and Key Teaching Points	Syllabus Content	Reference	Assessments
			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 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 combined effect of 2 reflections is a rotation 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		
4	5	**Revision**			**Test 6** **Week 4**
4	6-7	**SEMESTER TWO EXAMS**			

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Reference:

Mathematics Specialist Units 1 & 2 by A.J. Sadler (Sadler)
Nelson Senior Maths for the Australian Curriculum Specialist 11by S. Swift, R. Brodie et.al
Mathematics Specialist Year 11 by O.T. Lee