Year 11 Mathematics Method Program 2016

Kalamunda Senior High School
an Independent Public School
Mathematics Department

The full syllabus documents can be viewed at: http://wace1516.scsa.wa.edu.au/mathematics/

Students will be provided with opportunities to:

- plan and carry through tasks:
  - identify and organise information
  - develop systematic approaches
  - choose and use mathematical methods
  - choose methods of processing—mental, written, with a calculator.
- interpret solutions:
  - check answers fit specifications
  - link solutions to contexts and reach conclusions
  - generalise results.
- communicate methods, reasoning and results.

The number formats for the unit are real number forms that facilitate problem-solving including surds and scientific notation.

Time		Year 11 Mathematics Method Topic/syllabus entry	Assessment
		Semester 1 (Unit 1)	
Term 1 Week 1 (3 hours)	**Topic 1 Functions and graphs**	**Linear and linear relationship** **Lines and linear relationships** 1.1.1 determine the coordinates of the mid-point between two points 1.1.2 determine an end-point given the other end-point and the mid-point 1.1.3 examine examples of direct proportion and linearly related variables 1.1.4 recognise features of the graph of $y = mx + c$, including its linear nature, its intercepts and its slope or gradient 1.1.5 determine the equation of a straight line given sufficient information; including parallel and perpendicular lines 1.1.6 solve linear equations, including those with algebraic fractions and variables on both sides	OT Lee Chapt 1 Nelson Chap 1 AJ. Chap 4
Week 2-3 (5 hours)	**Topic 1 Functions and graphs**	**Quadratic relationship** 1.1.7 examine examples of quadratically related variables 1.1.8 recognise features of the graphs of $y = x^2$, $y = a(x-b)^2 + c$, and $y = a(x-b)(x-c)$, including their parabolic nature, turning points, axes of symmetry and intercepts	**Investigation 1**

		1.1.9 solve quadratic equations, including the use of quadratic formula and completing the square 1.1.10 determine the equation of a quadratic given sufficient information 1.1.11 determine turning points and zeros of quadratics and understand the role of the discriminant 1.1.12 recognise features of the graph of the general quadratic $y = ax^2 + bx + c$	OT Lee Chapt 2 Nelson Chap 1 AJ. Chap 5-6
Week 3-4 (7 hours)	**Topic 1 Functions and graphs**	**Inverse proportion** 1.1.13 examine examples of inverse proportion 1.1.14 recognise features and determine equations of the graphs of $y = \frac{1}{x}$ and $y = \frac{a}{x-b}$, including their hyperbolic shapes and their asymptotes. **Powers and polynomials** 1.1.15 recognise features of the graphs of $y = x^n$ for $n \in \boldsymbol{N}, n = -1$ and $n = ½$, including shape, and behaviour as $x \to \infty$ and $x \to -\infty$ 1.1.16 identify the coefficients and the degree of a polynomial 1.1.17 expand quadratic and cubic polynomials from factors 1.1.18 recognise features and determine equations of the graphs of $y = x^3$, $y = a(x-b)^3 + c$ and $y = k(x-a)(x-b)(x-c)$, including shape, intercepts and behaviour as $x \to \infty$ and $x \to -\infty$ 1.1.19 factorise cubic polynomials in cases where a linear factor is easily obtained 1.1.20 solve cubic equations using technology, and algebraically in cases where a linear factor is easily obtained	OT Lee Chapt 4 **Test 1** OT Lee Chapt 3 OT Lee Chapt 5 Nelson Chap 1 AJ. Chap 3
Week 5-7 (8 hours)	**Topic 1 Functions and graphs**	**Graphs of relations** 1.1.21 recognise features and determine equations of the graphs of $x^2 + y^2 = r^2$ and $(x-a)^2 + (y-b)^2 = r^2$, including their circular shapes, their centres and their radii 1.1.22 recognise features of the graph of $y^2 = x$, including its parabolic shape and its axis of symmetry **Functions** 1.1.23 understand the concept of a function as a mapping between sets and as a rule or a formula that defines one variable quantity in terms of another	**Test 2** OT Lee Chapt 5

		1.1.24 use function notation; determine domain and range; recognise independent and dependent variables 1.1.25 understand the concept of the graph of a function 1.1.26 examine translations and the graphs of $y = f(x) + a$ and $y = f(x - b)$ 1.1.27 examine dilations and the graphs of $y = cf(x)$ and $y = f(dx)$ 1.1.28 recognise the distinction between functions and relations and apply the vertical line test	Nelson Chap 4 AJ. Chap 7
Week 7-8 (5 hours)	**Topic 2 Trigonometric Functions**	**Cosine and sine rules** 1.2.1 review sine, cosine and tangent as ratios of side lengths in right-angled triangles 1.2.2 understand the unit circle definition of $\cos\theta$, $\sin\theta$ and $\tan\theta$ and periodicity using degrees 1.2.3 examine the relationship between the angle of inclination of a line and the gradient of that line 1.2.4 establish and use the cosine and sine rules, including consideration of the ambiguous case and the formula $Area = \frac{1}{2}bc\,sin\,A$ for the area of a triangle **Circular measure and radian measure** 1.2.5 define and use radian measure and understand its relationship with degree measure 1.2.6 calculate lengths of arcs and areas of sectors and segments in circles	OT Lee Chapt 6 OT Lee Chapt 7 OT Lee Chapt 8 OT Lee Chapt 9 Nelson Chap 3 AJ. Chap 1
Week 8-11 (10 hours)	**Topic 2 Trigonometric Functions**	**Trigonometric functions** 1.2.7 understand the unit circle definition of $\sin\theta$, $\cos\theta$ and $\tan\theta$ and periodicity using radians 1.2.8 recognise the exact values of $\sin\theta$, $\cos\theta$ and $\tan\theta$ at integer multiples of $\frac{\pi}{6}$ and $\frac{\pi}{4}$ 1.2.9 recognise the graphs of $y = \sin x, y = \cos x$, and $y = \tan x$ on extended domains 1.2.10 examine amplitude changes and the graphs of $y = a\sin x$ and $y = a\cos x$ 1.2.11 examine period changes and the graphs of $y = \sin bx$, $y = \cos bx$ and $y = \tan\ bx$ 1.2.12 examine phase changes and the graphs of $y = \sin(x - c)$, $y = \cos(x - c)$ and $y = \tan(x - c)$	**Test 3** OT Lee Chapt 10 OT Lee Chapt 11 OT Lee Chapt 12 Nelson Chap 6 AJ. Chap 2 & 8

		1.2.13 examine the relationships $\sin\left(x+\frac{\pi}{2}\right)=\cos x$ and $\cos\left(x-\frac{\pi}{2}\right)=\sin x$ 1.2.14 prove and apply the angle sum and difference identities 1.2.15 identify contexts suitable for modelling by trigonometric functions and use them to solve practical problems 1.2.16 solve equations involving trigonometric functions using technology, and algebraically in simple cases	
Week 11-12 (4 hours)	**Topic 3 Counting and probability**	**Combinations** 1.3.1 understand the notion of a combination as a set of r objects taken from a set of n distinct objects 1.3.2 use the notation $\binom{n}{r}$ and the formula $\binom{n}{r}=\frac{n!}{r!(n-r)!}$ for the number of combinations of r objects taken from a set of n distinct objects 1.3.3 expand $(x+y)^n$ for small positive integers n 1.3.4 recognise the numbers $\binom{n}{r}$ as binomial coefficients (as coefficients in the expansion of $(x+y)^n$) 1.3.5 use Pascal's triangle and its properties	OT Lee Chapt 14 Nelson Chap 2 AJ. Chap 9
Week 12-14 (4 hours)	**Topic 3 Counting and probability**	**Language of events and sets** 1.3.6 review the concepts and language of outcomes, sample spaces, and events, as sets of outcomes 1.3.7 use set language and notation for events, including: a. $\bar{A}$ (or A') for the complement of an event A b. $A\cap B$ and $A\cup B$ for the intersection and union of events A and B respectively c. $A\cap B\cap C$ and $A\cup B\cup C$ for the intersection and union of the three events A, B and C respectively d. recognise mutually exclusive events. 1.3.8 use everyday occurrences to illustrate set descriptions and representations of events and set operations	**Investigation 2** OT Lee Chapt 13 Nelson Chap 2 AJ. Chap 9
Week 14-15		**Finalising and consolidation**	
Week 16 - 17		**Semester 1 Examinations**	12%

Term 2 **Week 8** **Week 18** **(4 hours)**	**Topic 3** **Counting and probability**	**Review of the fundamentals of probability** 1.3.9 review probability as a measure of 'the likelihood of occurrence' of an event 1.3.10 review the probability scale: $0 \leq P(A) \leq 1$ for each event A, with $P(A) = 0$ if A is an impossibility and $P(A) = 1$ if A is a certainty 1.3.11 review the rules: $P(\overline{A}) = 1 - P(A)$ and $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ 1.3.12 use relative frequencies obtained from data as estimates of probabilities	Nelson Chap 5 AJ. Chap 9 OT Lee Chapt 15
Week 19-20 **(6 hours)**	**Topic 3** **Counting and probability**	**Conditional probability and independence** 1.3.13 understand the notion of a conditional probability and recognise and use language that indicates conditionality 1.3.14 use the notation $P(A\|B)$ and the formula $P(A \cap B) = P(A\|B)P(B)$ 1.3.15 understand the notion of independence of an event A from an event B, as defined by $P(A\|B) = P(A)$ 1.3.16 establish and use the formula $P(A \cap B) = P(A)P(B)$ for independent events A and B, and recognise the symmetry of independence 1.3.17 use relative frequencies obtained from data as estimates of conditional probabilities and as indications of possible independence of events	**Test 4** Nelson Chap 5 AJ. Chap 9 OT Lee Chapt 15
Week 20		**End of Unit 1 assessment**	

Time		Year 11 Mathematics Method Topic/syllabus entry	Assessment
		Semester 2 (Unit 2)	
Week 20-23 (10 hours)	**Topic 1 Exponential functions**	**Indices and the index laws** 2.1.1 review indices (including fractional and negative indices) and the index laws 2.1.2 use radicals and convert to and from fractional indices 2.1.3 understand and use scientific notation and significant figures **Exponential functions** 2.1.4 establish and use the algebraic properties of exponential functions 2.1.5 recognise the qualitative features of the graph of $y = a^x \ (a > 0)$, including asymptotes, and of its translations ($y = a^x + b$ and $y = a^{x-c}$) 2.1.6 identify contexts suitable for modelling by exponential functions and use them to solve practical problems 2.1.7 solve equations involving exponential functions using technology, and algebraically in simple cases	Nelson Chap 11 AJ. Chap 1 & 2 OT Lee 16 & 17
Week 23-24 (6 hours)	**Topic 2 Arithmetic and Geometric series**	**Arithmetic sequences** 2.2.1 recognise and use the recursive definition of an arithmetic sequence: $t_{n+1} = t_n + d$ 2.2.2 develop and use the formula $t_n = t_1 + (n-1)d$ for the general term of an arithmetic sequence and recognise its linear nature 2.2.3 use arithmetic sequences in contexts involving discrete linear growth or decay, such as simple interest 2.2.4 establish and use the formula for the sum of the first n terms of an arithmetic sequence	**Investigation 3** Nelson Chap 8 AJ. Chap 3 OT Lee Chapt 18

Week 25-26 (6 hours)	**Topic 2 Arithmetic and Geometric series**	**Geometric sequences** 2.2.5 recognise and use the recursive definition of a geometric sequence: $t_{n+1} = t_n r$ 2.2.6 develop and use the formula $t_n = t_1 r^{n-1}$ for the general term of a geometric sequence and recognise its exponential nature 2.2.7 understand the limiting behaviour as $n \to \infty$ of the terms t_n in a geometric sequence and its dependence on the value of the common ratio r 2.2.8 establish and use the formula $S_n = t_1 \frac{r^n - 1}{r - 1}$ for the sum of the first n terms of a geometric sequence 2.2.9 use geometric sequences in contexts involving geometric growth or decay, such as compound interest	**Test 5** Nelson Chap 8 AJ. Chap 4 OT Lee Chapt 18
Week 26-28 (9 hours)	**Topic 3 Introduction to differential calculus**	**Rates of change** 2.3.1 interpret the difference quotient $\frac{f(x+h)-f(x)}{h}$ as the average rate of change of a function f 2.3.2 use the Leibniz notation δx and δy for changes or increments in the variables x and y 2.3.3 use the notation $\frac{\delta y}{\delta x}$ for the difference quotient $\frac{f(x+h)-f(x)}{h}$ where $y = f(x)$ 2.3.4 interpret the ratios $\frac{f(x+h)-f(x)}{h}$ and $\frac{\delta y}{\delta x}$ as the slope or gradient of a chord or secant of the graph of $y = f(x)$ **The concept of the derivative** 2.3.5 examine the behaviour of the difference quotient $\frac{f(x+h)-f(x)}{h}$ as $h \to 0$ as an informal introduction to the concept of a limit 2.3.6 define the derivative $f'(x)$ as $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$ 2.3.7 use the Leibniz notation for the derivative: $\frac{dy}{dx} = \lim_{\delta x \to 0} \frac{\delta y}{\delta x}$ and the correspondence $\frac{dy}{dx} = f'(x)$ where $y = f(x)$ 2.3.8 interpret the derivative as the instantaneous rate of change 2.3.9 interpret the derivative as the slope or gradient of a tangent line of the graph of $y = f(x)$	OT Lee Chapt 19 Nelson Chap 7 & 9 AJ. Chap 5

Week 29-30 (9 hours)	**Topic 3 Introduction to differential calculus**	**Computation of derivatives** 2.3.10 estimate numerically the value of a derivative for simple power functions 2.3.11 examine examples of variable rates of change of non-linear functions 2.3.12 establish the formula $\frac{d}{dx}(x^n) = nx^{n-1}$ for non-negative integers n expanding $(x+h)^n$ or by factorising $(x+h)^n - x^n$ **Properties of derivatives** 2.3.13 understand the concept of the derivative as a function 2.3.14 identify and use linearity properties of the derivative 2.3.15 calculate derivatives of polynomials	**Test 6** Nelson Chap 10 AJ. Chap 6
Week 31-33 (12 hours)	**Topic 3 Introduction to differential calculus**	**Applications of derivatives** 2.3.16 determine instantaneous rates of change 2.3.17 determine the slope of a tangent and the equation of the tangent 2.3.18 construct and interpret position-time graphs with velocity as the slope of the tangent 2.3.19 recognise velocity as the first derivative of displacement with respect to time 2.3.20 sketch curves associated with simple polynomials, determine stationary points, and local and global maxima and minima, and examine behaviour as $x \to \infty$ and $x \to -\infty$ 2.3.21 solve optimisation problems arising in a variety of contexts involving polynomials on finite interval domains **Anti-derivatives** 2.3.22 calculate anti-derivatives of polynomial functions	**Investigation 4** OT Lee Chapt 20 & 21 & 23 Nelson Chap 12 AJ. Chap 7 & 8 OT Lee Chapt 22 OT Lee Chapt 23
Week 33-34		**Revision / end of course assessment**	**Test 7**
Week 35		**Semester 2 Exams**	28%

Unit 1

Learning outcomes
By the end of this unit, students:

- understand the concepts and techniques in algebra, functions, graphs, trigonometric functions, counting and probability
- solve problems using algebra, functions, graphs, trigonometric functions, counting and probability
- apply reasoning skills in the context of algebra, functions, graphs, trigonometric functions, counting and probability
- interpret and evaluate mathematical information and ascertain the reasonableness of solutions to problems
- communicate their arguments and strategies when solving problems.

Unit 2

Learning outcomes
By the end of this unit, students:

- understand the concepts and techniques used in algebra, sequences and series, functions, graphs and calculus
- solve problems in algebra, sequences and series, functions, graphs and calculus
- apply reasoning skills in algebra, sequences and series, functions, graphs and calculus
- interpret and evaluate mathematical and statistical information and ascertain the reasonableness of solutions to problems
- communicate arguments and strategies when solving problems.

Assessment outline 2016 Math Method Unit 1 & 2 (Combined)

Assessment weightings	When/due date/start and submission date	Item	Response Item Content	Task weighting	Number and algebra	Space and measurement	Chance and data
Response 80%	Term 1 Week 2	Test 1 (Unit 1)	Functions and graphs – linear relationships, quadratic relationships	3%	P		
	Term 1 Week 6	Test 2 (Unit 1)	Functions and graphs – linear relationships, quadratic relationships, inverse proportion, powers and polynomials	5%	P		
	Term 2 Week 1	Test 3 (Unit 1)	Functions and graphs – Functions, graphs and relations; sine and cosine rules, radian measure, trigonometric functions (plus revision of concepts from previous tasks)	6%	P	P	
	Term 2 Week 9	Test 4 (Unit 1)	Counting and Probability; sets, fundamentals of probability, conditional probability and independence (plus revision of concepts from previous two tasks)	6%	P	P	P
	Term 3 Week 5	Test 5 (Unit 2)	Algebra, equations, trigonometry (plus revision of concepts from previous tasks)	7%	P	P	
	Term 3 Week 9	Test 6 (Unit 2)	Data, patterns and graphs (plus revision on concepts from previous tasks)	6%		P	P
	Term 4 Week 3	Test 7 (Unit 2)	Functions, graphs, probability and populations (plus revision of concepts from previous tasks)	7%	P	P	P
	Term 2 Week 6	Semester 1 Exam (Unit 1 excluding probability)	All of semester 1	12%	P	P	P
	Term 4 Week 5	Semester 2 Exam (50% from each unit)	All of Unit 1 and Unit 2	28%	P	P	P
Investigation 20%	Term 1 Week 2	Investigation 1 (Unit 1) – Graphs and transformations		5%	P	P	
	Term 2 Week 3	Investigation 2 (Unit 1) – Application of trigonometric functions		5%	P	P	
	Term 3 Week 4	Investigation 3 (Unit 2) – Counting systems and games of chance		5%	P		P
	Term 4 Week 1	Investigation 4 (Unit 2) – Logarithmic functions		5%	P	P	