AVIATION HIGH SCHOOL

Mathematics B

Senior Syllabus 2008

Approved Work Program

Mathematics B
Senior Syllabus 2008
Work Program (Approved)

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RATIONALE

- Mathematics B studies mathematical functions, differential and integral calculus, and applied statistical analysis.
  The subject develops skills in:
  "Knowledge and Procedures", "Modelling and Problem-Solving", "Communication and Justification".

- Mathematics B develops the following key competencies within mathematical contexts:
  Collecting, analysing, organising information; Communicating ideas and information;
  Planning and organising activities; Working with others; Using mathematical ideas and techniques;
  Solving problems; Using technology.

- Mathematics B aims to provide the opportunity for students to participate more fully in lifelong learning.
  It is recommended for students pursuing further study where Mathematics B is useful or a required pre-requisite.

- Mathematics B at Aviation High will incorporate aviation/aerospace applications in order to:
  -Increase exposure to and familiarity with a wide variety of aviation/aerospace settings;
  -Generate interest in aviation/aerospace and satellite industries for future employment;
  -Integrate with the mathematical skill requirements of
  i)Aviation High's Aeroskills and Aerospace subjects;
  ii)Aviation Mathematics modules within Aviation Australia courses;
  iii)Aviation/aerospace related subjects at university or TAFE level, including engineering courses;
  -Support the mathematical skill needs of aerospace-related work placements and apprenticeships;
  -Respond to the requests and advice from aviation/aerospace industry partners.
  -Achieve improved mathematics results through motivation that results from high-interest applications.

COURSE ORGANISATION OVERVIEW:

TIME ALLOCATION: 55 hours per semester; 220 hours over 2 years. Topic hours as per syllabus.

SEQUENCING: Sequencing should include--A spiralling and integrated approach;
--Relevant prerequisite material coverage;
--Provision of mathematics to meet student needs:
-co-development of Year 11 Mathematics A and B,
-co-development of Mathematics B and Mathematics C;
--Linkage of subject matter across topics;
--Physical resources consideration;
--Maintenance of quantitative concepts and skills (QCS).

TECHNOLOGY: Technology should include--Regular and frequent use without complete dependence;
--General purpose computer software such as spreadsheets;
--Specialist mathematical graphing/geometry software;
--Calculator technologies.

COURSE SUMMARY: Time in hours

TOPIC	SEM 1	SEM 2	SEM 3	SEM 4	TOTAL
INTRODUCTION TO FUNCTIONS	16	2	7	10	**35**
RATES OF CHANGE	13	12	8	2	**35**
PERIODIC FUNCTIONS	14	6	3	7	**30**
EXPONENTIAL/LOGARITHMIC FUNCTIONS		15	8	12	**35**
OPTIMISATION			15	15	**30**
INTRODUCTION TO INTEGRATION		9	8	8	**25**
APPLIED STATISTICAL ANALYSIS	10	9	6		**25**
QUANTITATIVE CONCEPTS AND SKILLS (QCS)	2	2		1	**5**
TIME ALLOCATION	**55**	**55**	**55**	**55**	**220**

ASSESSMENT:

ASSESSMENT PLAN: The assessment plan should--
--Cover all syllabus topics, subject matter and general objectives (KAP, MAPS, CAJ) as continuous assessment in appropriate sequence and balance, avoiding over-assessment;
--Detail a variety of assessment categories to ensure validity and reliability:
Supervised Tests including 'Short items', 'Practical exercises', 'Stimulus response', 'Paragraph response';
Extended Modelling and Problem-Solving Tasks (at least 1 per year); Reports (at least 1 per year);
--Use a variety of implementation conditions for assessment to ensure validity and reliability, with conditions and criteria assessed appropriate to the actual instruments supplied at monitoring and verification;
--Prescribe adequate assessment for each of the three criteria during Semester 4 prior to verification and assessment instruments for completion after verification;
--Allow for assessment items with unique identifiers to be constructed to collect evidence reflecting syllabus standards and exit criteria.

STUDENT PROFILE AND FOLIO: The assessment package (Profile + Folio) should--
--Correspond to the assessment plan with each instrument identified and the criteria indicated in correct sequence, including assessment after verification;
--Record:
-Data from each assessment instrument for feedback purposes;
-Standards awarded for each criterion (KAP, MAPS, CAJ) and proposed levels of achievement based on the whole package rather than the sum of its parts, at Reporting/Monitoring/Verification/Exit;
--Illustrate achievement in all three general objectives (KAP, MAPS, CAJ), with the emphasis on each criterion varying from instrument to instrument;
--Be 'Formative' for Year 11 and 'Summative' for Year 12 due to the spiralling and integrated course structure;
--Inform and validate judgments about standards by matching student responses to the syllabus/exit criteria;
--Allow for 'Fullest and Latest' information and "Selective Updating" to be obtained due to the spiralling and integrated approach, not by an arbitrary weighting of semesters, but by matching to syllabus standards/exit criteria.

--Provide evidence to make decisions regarding interim and exit levels of achievement
which are consistent with the criteria and standards of the syllabus, especially for threshold cases.

COURSE ORGANISATION SEMESTER 1					
SEM	**UNIT: SYLLABUS TOPIC**	**TIME (55h)**	**SUBJECT MATTER**	**ASSESSMENT ITEM**	**TEXT**
SEM 1 A	**1 TRIANGLES:** Periodic Functions (SLEs 1-2) Quantitative Concepts & Skills	8 1	-Trigonometry including the definition and practical applications of the sine, cosine and tangent ratios -Simple practical applications of the sine and cosine rules (the ambiguous case is not essential) -QCS: Metric measurement including measurement of mass, length, area and volume in practical contexts; Calculation and estimation with and without instruments; Basic algebraic manipulations	1 TEST 2 EXT. MAPS	*New QMaths 11B* Chapter 1
SEM 1 A	**2 STATISTICS:** Applied Statistical Analysis (SLEs 1-4;9-15;20) Quantitative Concepts & Skills	10	-Identification of variables and data (continuous and discrete); collection and entry of data -Select and use in context appropriate graphical and tabular displays for different types of data including pie charts, bar charts, tables, histograms, stem-and-leaf and box plots -Use of summary statistics including mean, median, standard deviation, and interquartile distance as appropriate descriptors of features of data in context -Use of graphical displays and summary statistics in describing key features of data, particularly in comparing datasets and exploring possible relationships -QCS: Calculation and estimation with and without instruments; Plotting points using Cartesian coordinates; The summation notation	1 TEST 2 REPORT	*New QMaths 11B* Chapter 2
SEM 1 A/B	**3 LINEAR FUNCTIONS:** Introduction to Functions (SLEs 1-2;3;7) Quantitative Concepts & Skills	8 1	-Concepts of function, domain and range -Ordered pairs, tables, graphs and equations as representations of functions and relations -Graphs as a representation of the points whose coordinates satisfy an equation -Distinction between functions and relations -Distinctions between continuous functions, discontinuous functions and discrete functions -Solutions to simultaneous equations in 2 variables: graphically, using technology, algebraically (linear and quadratic equations only) -QCS: Calculation and estimation with and without instruments; Basic algebraic manipulations; Gradient of a straight line; Equation of a straight line; Plotting points using Cartesian Coordinates	1 TEST 2 REPORT 3 TEST 5 EXT. MAPS	*New QMaths 11B* Chapter 3
SEM 1 B	**4 PERIODIC FUNCTIONS:** Periodic Functions (SLEs 3-5;8;11-13;16-17) Quantitative Concepts & Skills	6	-Definition of a periodic function, the period and amplitude -Applications of periodic functions -QCS: Calculation and estimation with and without instruments; Plotting points using Cartesian coordinates	3 TEST 5 EXT. MAPS	*New QMaths 11B* Chapter 4
SEM 1 B	**5 GRADIENTS:** Rates of Change (SLEs 1-3;5;7-8;10) Quantitative Concepts & Skills	13	-Concept of rate of change -Calculation of average rates of change in both practical and purely mathematical situations -Interpretation of the average rate of change as the gradient of the secant -Understanding of a limit in simple situations -Interpretation of the derivative as the gradient function -Practical application of instantaneous rates of change -QCS: Calculation and estimation with and without instruments; Rates, percentages, ratio and proportion; Gradient of a straight line; Plotting points using Cartesian coordinates	3 TEST 5 EXT. MAPS	*New QMaths 11B* Chapter 5
SEM 1B/2A	**6 PARABOLIC FUNCTIONS:** Introduction to Functions (SLEs 1;4-6;8) Quantitative Concepts & Skills	8/2*****	-Concepts of function, domain and range -Ordered pairs, tables, graphs and equations as representations of functions and relations -Graphs as a representation of the points whose coordinates satisfy an equation -General shapes of functions: polynomials up to degree 4; reciprocal functions; absolute value functions -Practical applications: polynomials up to degree 2; reciprocal functions; absolute value functions -Solutions to simultaneous equations in 2 variables: graphically, using technology; algebraically (linear and quadratic equations only) -QCS: Calculation and estimation with and without instruments; Basic algebraic manipulations; Plotting points using coordinates; Solutions of quadratic equations; Graphs of quadratic functions	3 TEST 4 TEST 5 EXT. MAPS	*New QMaths 11B* Chapter 6

***NOTE:** In unit 6, 2 hours are carried over to semester 2.

COURSE ORGANISATION SEMESTER 2					
SEM	**UNIT: SYLLABUS TOPIC**	**TIME (55h)**	**SUBJECT MATTER**	**ASSESSMENT ITEM**	**TEXT**
SEM 2A	**7 DIFFERENTIAL CALCULUS:** Rates of Change (SLEs 1-6;8-12) Quantitative Concepts & Skills	12	-Concept of rate of change -Understanding of a limit in simple situations -Definition of the derivative of a function at a point -Derivative of simple algebraic functions from first principles -Evaluation of the derivative of a function at a point -Interpretation of instantaneous rate of change at a point as the gradient of a tangent and as the derivative at that point -Rules for differentiation including product and chain rules -Practical applications of instantaneous rates of change -QCS: Basic algebraic manipulations; Gradient of a straight line; Equation of a straight line; Plotting points using Cartesian coordinates	4 TEST 5 EXT. MAPS	*New QMaths 11B* Chapter 7
SEM 2A	**8 TRIGONOMETRIC FUNCTIONS :** Periodic Functions & Applications (SLEs 3;5-8;10-11;13;15-16;18) Quantitative Concepts & Skills	6 1	-Definition of a radian and its relationship with degrees -Definition of the trigonometric functions sin, cos and tan of any angle in degrees and in radians -Graphs of y=sin x, y=cos x, and y=tan x for any angle in degrees and radians -Significance of the constants A, B, C, D on the graphs of $y=A\sin B(x+C)+D$, $y=A\cos B(x+C)+D$ -Applications of periodic functions -QCS: Calculation and estimation with and without instruments; Basic algebraic manipulations; Plotting points using Cartesian coordinates	4 TEST 5 EXT. MAPS	*New Qmaths 11B* Chapter 8
SEM 2B	**9 GROWTH AND DECAY:** Exponential /Logarithmic Functions (SLEs 1-2;7;9;11) Quantitative Concepts & Skills	15	-Index laws and definitions -Definitions of a^x and $\log_a x$, for $a>1$ -Logarithmic laws and definitions -Solution of equations involving indices -Use of logarithms to solve equations involving indices -Development of algebraic models from appropriate datasets using logarithms and/or exponents -QCS: Calculation and estimation with and without instruments; Basic algebraic manipulations; Identities; Linear equations and inequalities	6 TEST	*New Qmaths 11B* Chapter 9
SEM 2B	**10 PROBABILITY:** Applied Statistical Analysis (SLEs 5-7) Quantitative Concepts & Skills	9 1	-Use of relative frequencies to estimate probabilities; -The notion of probabilities of individual values for discrete and intervals for continuous variables -Identification of the binomial situation and use of tables or technology for binomial probabilities -QCS: Tree diagrams as a tool for defining sample spaces and estimating probabilities; The summation notation	6 TEST	*New Qmaths 11B* Chapter 10
SEM 2B	**11 INTEGRALS:** Introduction to Integration (SLEs 3-5) Quantitative Concepts & Skills	9	-Definition of the indefinite integral -Indefinite integrals of simple polynomial functions, simple exponential functions, sin, cos, and $\frac{1}{ax+b}$ -Practical applications of the integral -QCS: Calculation and estimation with and without instruments; Basic algebraic manipulations	6 TEST	*New Qmaths 11B* Chapter 11

NOTE: 2 hours are carried over from Semester 1.

COURSE ORGANISATION SEMESTER 3					
SEM	**UNIT: SYLLABUS TOPIC**	**TIME (55h)**	**SUBJECT MATTER**	**ASSESSMENT ITEM**	**TEXT**
SEM 3A	**12 POLYNOMIAL FUNCTIONS:** Introduction to Functions (SLEs 1-5; 10-12;14) Quantitative Concepts & Skills	7	-Concepts of function, domain and range -Ordered pairs, tables, graphs and equations as representations of functions and relations -Graphs as a representation of the points whose coordinates satisfy an equation -Distinction between functions and relations; continuous, discontinuous and discrete functions -General shapes of functions: polynomials up to degree 4; reciprocal and absolute value functions -Practical applications: polynomials up to degree 2; reciprocal functions; -absolute value functions -Composition of two functions; -Concept of the inverse of a function -QCS: Calculation and estimation with and without instruments; Plotting points using coordinates	7 TEST 8 EXT. MAPS	*New QMaths 12B* Chapter 1
SEM 3A	**13 DERIVATIVES OF TRIGONOMETRIC FUNCTIONS:** Rates of Change (SLEs 5,9,12) Intro. to Integration (SLEs 4-5) Periodic Functions (SLEs 8) Quantitative Concepts & Skills	4 1 3	-Definition of the derivative of a function at a point -Interpretation of instantaneous rate of change at a point as the gradient of a tangent and derivative -Rules for differentiation including chain rule and product rule -Definition of the indefinite integral -Practical applications of the integral -Derivatives of functions involving sin x and cos x in life-related situations -QCS: Calculation and estimation with and without instruments	7 TEST 8 EXT. MAPS	*New QMaths 12B* Chapter 2
SEM 3A	**14 DERIVATIVES OF EXPONENTIAL /LOGARITHMIC FUNCTIONS:** Exponential/ Logarithmic Functions (SLEs 2-4;6-10;12-17) Rates of Change (SLEs 5;8;12) Quantitative Concepts & Skills	8 3	-Definition of the exponential function e^x; -Graphs of $y = e^{kx}$ for $k \neq 0$ -Graphs of, and the relationships between, $y = a^x$, $y = \log_a x$ for $a = e$ and other values of a -Use of logarithms to solve equations involving indices -Development of algebraic models from appropriate datasets using logarithms and/or exponents -Rules for differentiation; -Derivatives of exponential and logarithmic functions for base *e* -Applications of exponential and logarithmic functions and the derivatives of exponentials -Interpretation of instantaneous rate of change at a point as the gradient of a tangent and derivative -QCS: Calculation and estimation with and without instruments	7 TEST 8 EXT. MAPS	*New QMaths 12B* Chapter 3
SEM 3B	**15 BINOMIAL AND NORMAL DISTRIBUTIONS:** Applied Statistical Analysis (SLEs 6-8; 10; 15-19) Quantitative Concepts & Skills	6	-Probability distribution and expected value for a discrete variable -Identification of the binomial situation and use of tables or technology for binomial probabilities -Concept of a probability distribution, expected value, and median for a continuous random variable -The normal model and use of standard normal tables or technology -QCS: The summation notation; Calculation and estimation with and without instruments	8 REPORT 9 TEST	*New QMaths 12B* Chapter 5
SEM 3B	**16 INTEGRATION:** Introduction to Integration (SLEs 1-5; 8-11; 15-16) Quantitative Concepts & Skills	7	-Definition of the definite integral and its relation to the area under a curve -The value of the limit of a sum as a definite integral; -Definition of the indefinite integral -Rules for integration, including $\int af(x)dx$, $\int [f(x) \pm g(x)]dx$, $\int f(ax+b)dx$ -Indefinite integrals of polynomial functions, exponential functions, sin, cos, and 1/ (*ax+b*) -Use of integration to find area; -Practical applications of the integral -QCS: Calculation and estimation with and without instruments; The summation notation	9 TEST 10 EXT. MAPS	*New QMaths 12B* Chapter 4
SEM 3B	**17 OPTIMISATION AND GRAPHS:** Optimisation (SLEs 2-4) Rates of Change (5; 8; 12) Quantitative Concepts & Skills	15 1	-+/- values of derivative as indications of the points at which the function is increasing or decreasing -Zero values of the derivative as an indication of stationary points -Concept of relative maxima and minima and greatest and least value of functions -Methods of determining nature of stationary points; -Greatest/least values of a function in an interval -Rules for differentiation including product and chain rule; -Evaluation of the derivative of a function at a point; -Interpretation of derivative as the gradient function -Interpretation of instantaneous rate of change at a point as the gradient of a tangent and derivative -QCS: Calculation and estimation with and without instruments	9 TEST	*New QMaths 12B* Chapter 6

COURSE ORGANISATION SEMESTER 4					
SEM	**UNIT: SYLLABUS TOPIC**	**TIME (55h)**	**SUBJECT MATTER**	**ASSESSMENT ITEM**	**TEXT**
SEM 4A	**18 PRACTICAL INTEGRATION:** Introduction to Integration (SLEs 6-7; 12-14) Quantitative Concepts & Skills	8	-Use of integration to find area -Practical applications of the integral -Trapezoidal rule for the approximation of a value of a definite integral numerically -QCS: Calculation and estimation with and without instruments; The summation notation	10 EXT. MAPS 11 TEST	*New QMaths 12B* Chapter 7
SEM 4A	**19 OPTIMISATION APPLICATIONS:** Optimisation (SLEs 1; 4-9) Rates of Change (SLEs 8; 11-12) Quantitative Concepts & Skills	15 2	-Zero values of the derivative as an indication of stationary points -Concept of relative maxima and minima and greatest and least value of functions -Methods of determining the nature of stationary points -Recognition of the problem to be optimised (maximised or minimised) -Identification of variables and construction of the function to be optimised -Applications of derivative to optimisation in life-related situations using a variety of function types -Interpretation of mathematical solutions and their communication in a form appropriate to the given problem -Evaluation of the derivative of a function at a point -Interpretation of instantaneous rate of change at a point as the gradient of a tangent and derivative -Rules for differentiation including product and chain rule -Interpretation of the derivative as the gradient function -QCS: Calculation and estimation with and without instruments	10 EXT. MAPS 11 TEST	*New QMaths 12B* Chapter 11
SEM 4A/B	**20 TRIGONOMETRIC EQUATIONS:** Periodic Functions & Applications (SLEs 4-5; 8-9; 11; 13; 15-16) Quantitative Concepts & Skills	10	-Applications of periodic function -Pythagorean identity $\sin^2 x + \cos^2 x = 1$ -Solution of trigonometric equations within a specified domain: algebraically in simple situations (multiple angles are not essential); using technology to any complexity -QCS: Calculation and estimation with and without instruments	11 TEST 12 TEST	*New QMaths 12B* Chapter 10
SEM 4B	**21 FINANCIAL APPLICATIONS:** Exponential /Logarithmic Functions (SLEs 5; 18-31) Quantitative Concepts & Skills	12 1	-Application of exponential and logarithmic functions, and the derivatives of exponentials -Applications of geometric progressions to compound interest including past, present, future values -Applications of geometric progressions to annuities and amortising a loan -QCS: Calculation and estimation with and without instruments; Simple interest; Rates, percentages, ratio and proportion; Basic algebraic manipulations; The summation notation	12 TEST	*New QMaths 12B* Chapter 8
SEM 4B	**22 GRAPHS AND TRANSFORMATIONS:** Introduction to Functions (SLEs 1-5; 11-14) Quantitative Concepts & Skills	7	-Concepts of function, domain and range -Ordered pairs, tables, graphs and equations as representations of functions and relations -Graphs as a representation of the points whose coordinates satisfy an equation -Distinction between functions and relations -Distinctions between continuous functions, discontinuous functions and discrete functions -Relationships between the graph of $f(x)$ and the graphs of $f(x)+a,\ f(x+a), af(x),\ f(ax)$ for both positive and negative values of the constant *a* -Concept of the inverse of a function -QCS: Plotting points using Cartesian coordinates; Calculation and estimation with and without instruments	12 TEST	*New QMaths 12B* Chapter 9

NOTE: Course organisation may be altered so that unit 21 preceeds unit 20,
allowing a 'Financial Simulation (Superannuation and Aviation Careers)' to take the place of an 'Optimal Construction' task in assessment item 10.
This will be noted with the submission for verification.
In this case, -unit 19 will be assessed by item '11 TEST'.
-unit 21 will be assessed by items '10 EXT. MAPS', '11 TEST', and '12 TEST'.
-unit 20 will be assessed by item '12 TEST'.

SAMPLE UNIT OF WORK **UNIT 7: DIFFERENTIAL CALCULUS --- SYLLABUS TOPIC: RATES OF CHANGE (12h)**

SUBJECT MATTER	CONTENT	LEARNING EXPERIENCES *including Technology*	RESOURCES
-Concept of rate of change	Recall and use concepts from Unit 5: Average and instantaneous rates of change Rates as gradients of secants & tangents Graphical representations of rates of change	Revisit SLEs from Unit 5: **SLE1** Determine average and instantaneous speeds from a distance/time graph. **SLE2** Use ***data-loggers*** and ***motion detectors*** with hand-held ***graphics calculators*** to explore average and instantaneous rates of change in distance/time graphs.	**Textbook:** *New QMaths 11B* Chapter 7
-Understanding of a limit in simple situations	Define and understand concept of a limit Calculate simple and factorised limits Explore limits involving infinity	**SLE3** Use a numerical technique to estimate a limit or an average rate of change. **SLE4** Use simple algebraic techniques to explore limits. **->**Explore practical and graphical applications of limits (eg. 0 as a limit when halving distance between two objects; undefined regions on a graph)	**Print Resources**: *Quest 11B* *Flight Theory-Dole* Ch. 2 Aviation Library
-Definition of the derivative of a function at a point -Derivative of simple algebraic functions from first principles	Recall formula for first principles Understand formula in relation to gradient, secant & tangent, and limit Find derivatives by first principles	**->**Use technology, ***Graphics calculator*** and ***Maths Helper Plus software***, to graphically portray deriving by first principles using progressive secants leading to a tangent.	
-Rules for differentiation including product and chain rules: $\frac{d}{dp}p^n$ for rational *n* values; $\frac{d}{dr}[kf(r)]$; $\frac{d}{ds}[f(s)+g(s)]$; $\frac{d}{dt}[f(t)g(t)]$ product rule; $\frac{d}{dx}f[g(x)]$ chain rule	Recall rules for differentiation including product and chain rules Find derivatives by rule Use various notations	**->**Support rules using first principle techniques. **->**Research origins of derivative notations on the ***internet*** (Leibniz and Newton).	**Technology**: -Graphics Calculators -Data Loggers -Maths Helper Plus -Excel -See **Aviation**
-Evaluation of the derivative of a function at a point -Interpretation of instantaneous rate of change at a point as the gradient of a tangent and as derivative	Substitute into derivative functions to find derivatives at specific points Calculate instantaneous rate of change using derivatives Calculate gradient at a point using derivatives Determine equation of tangent/normal to a curve	**->**Use ***graphing software*** and ***graphics calculators*** to investigate the relationship between the derivative and gradient/rate. **SLE5** Graph a function and its gradient function; relate the features of each to the other. **SLE6** Use a ***graphics calculator*** and ***Maths Helper Plus software*** to investigate the behaviour of a tangent to a curve and its relationship to the curvature at that point. **SLE9** Find the equation of the tangent to a curve under various given conditions.	
-Practical applications of instantaneous rates of change	Apply derivatives in practical situations to find instantaneous rate of change from: -Given mathematical models; -Simple models (linear and quadratic) generated by data collection; -Models generated by technology.	**SLE8** Determine the instantaneous rate of change of a variable with respect to another variable in life-related situations given the mathematical model. **SLE9** Compare the evaporation rate of water in open containers of varying cross-sections. **SLE11** Investigate the concept of marginal costs/profits related to the derivative of a cost/profit function. **SLE12** Apply the chain rule to life-related situations involving three variables. **AVIATION/AEROSPACE LINKS** **->**Apply differential calculus techniques using data collected from a practical flight simulation (***model/UAV***), ***wind tunnel***, or ***Roland fabrication***. **->**Investigate profit/cost models using aviation industry settings, airspeed measurement	**Aviation:** - Industry Partners -Models/UAV -Wind Tunnel -Roland Equipment -Print Resources -Radio Room
-QCS: Basic algebraic manipulations; Equation of a straight line; Gradient of a straight line; Plotting points using coordinates.	Recall and use: Factorisation and expansion in deriving Gradient formula for 1st principles and tangent Line equations to establish tangent Plotting points for function, tangent, derivative		

RELATED ASSESSMENT

ITEM 4: SUPERVISED TEST	ITEM 5: EXTENDED MODELLING AND PROBLEM-SOLVING TASK
POSSIBLE TECHNIQUES: Short items, Practical exercises, Response to stimulus TECHNOLOGY: Graphics calculator TIME: 2 hours (or 2x1 hour) CONDITIONS: Supervised exam with no source materials	POSSIBLE THEME: Radio coverage of ultralight race with linear, parabolic, polynomial flight paths UNIT LINK: Race is described using derivative functions to analyse speed and acceleration TECHNOLOGY: Graphing software TIME: 3 weeks CONDITIONS: Some supervised classwork; Final task as supervised exam-TECHNIQUE: Paragraph

SAMPLE UNIT OF WORK **UNIT 8: TRIGONOMETRIC FUNCTIONS---**
SYLLABUS TOPICS: PERIODIC FUNCTIONS & APPLICATIONS (6h); QCS (1h)

SUBJECT MATTER	CONTENT	LEARNING EXPERIENCES	RESOURCES
-Definition of a radian and its relationship with degrees	Draw and label the unit circle Define radian Convert between degrees, π radians, radians	→Use ***measurement equipment*** to establish unit circle →Explore working with radians and conversions using ***graphics calculators*** and ***Excel***	**Textbook:** *New QMaths 11B* Chapter 8
-Definition of the trigonometric functions sin, cos and tan of any angle in degrees and in radians	Revisit ratio definitions from Unit 1 Create reference triangles from first principles (45^o-45^o-90^0 and 30^o-60^o-90^o) Use triangles to find sin, cos, tan of any angle (0, π/6, π/4, π/3, π/2) in all quadrants	**SLE 6** Explore the exact values of trigonometric ratios including the angles 0, π/6, π/4, π/3, π/2, etc. **SLE 7** Using the unit circle, evaluate the trigonometric functions sin, cos and tan of any angle in degrees and radians →Use ***measurement equipment*** to establish triangles (45^o-45^o-90^0 and 30^o-60^o-90^o)	**Print Resources**: *Quest 11B* *Flight Theory-Dole* *Ch. 15* Aviation Library
-Graphs of y=sin x, y=cos x, and y=tan x for any angle in degrees and radians	Sketch graphs of simple trigonometric functions based on the unit circle Interpret graphs of trigonometric functions	**SLE 7** Using the unit circle explore the graphs of y=sin$x$, y=cos x, and y=tan x **SLE 11** Sketch y=sin x, y=cos x, and y=tan x for any angle in degrees and radians →Graph simple functions using ***graphics calculator***, ***Excel***, ***Maths Helper Plus software***	
-Significance of the constants A, B, C, D on the graphs of $y=A$ sin B (x+C) + D, $y=A$ cos B (x+C) + D	Revisit definitions of period, amplitude, phase shift, and equilibrium from Unit 4 Define and interpret the meaning of A, B, C, D Sketch graphs of the trigonometric functions $y=A$ sin B (x+C) + D and $y=A$ cos B (x+C) + D Given a graph, determine A, B, C, D and develop a trigonometric function	**SLE 10** Investigate the effect of the constants A, B, C, and D on the graphs of $y=A$ sin B (x+C) + D, $y=A$ cos B (x+C) + D using ***graphics calculators*** **SLE 18** Use a ***graphing calculator*** or ***computer package*** to investigate the superposition of two almost equal frequencies of sinusoidal waves to produce "beats", and identify the properties of the resulting function → Graph and manipulate trigonometric functions using ***graphics calculator***, ***Excel***, ***Maths Helper Plus software***	**Technology**: -Graphics Calculators -Maths Helper Plus -Excel -See **Aviation** -Measurement equipment
-Applications of periodic functions	Apply trigonometric functions in practical situations: -Obtain data to create a graph and function -Using a trigonometric graph for a practical situation, determine values and meaning of A, B, C, D and state the related function -Given a trigonometric function describing a practical situation, sketch a graph and determine values and meaning of A, B, C, D Interpolate and extrapolate from trigonometric functions/graphs to find further data and make predictions	**SLE 3** Investigate the repetitive nature of daily temperature and human pulse. **SLE 5** Find the period, amplitude and frequency of functions which are used to model biorhythms, tide heights, ECG's, hormone cycles, etc. **SLE 8** Investigate the periodic motion of a mass on the end of a spring, solving simple trigonometric equations to find displacement, velocity and acceleration **SLEs 13,8** Plot the tide heights at a specified point over a 24-hour period, calculating the rate at which the water level is changing using a sine function **SLE 8** Investigate and model the periodic motion of a pendulum, **AVIATION/AEROSPACE LINKS:** →Explore the period, amplitude and frequency of periodic (oscillatory) phenomena including planetary motion, comets, reciprocating motion →Investigate: the path of a point on a moving circular aircraft part such as within a motor or on a propeller →Describe an aircraft/satellite flight path or longitudinal stability with trigonometric functions →Collect flight data from a ***wind tunnel*** that may be described as a periodic function	
-QCS: Calculation and estimation with and without instruments; Basic algebraic manipulations; Plotting points using Cartesian coordinates	Recall and use: Calculation, estimation and algebraic methods as required to establish/find ratios and solve for unknowns in functions Plotting points to develop trigonometric graphs		**Aviation:** - Industry Partners -Print Resources -Wind tunnel

RELATED ASSESSMENT

ITEM 4: SUPERVISED TEST	ITEM 5: EXTENDED MODELLING AND PROBLEM-SOLVING TASK
POSSIBLE TECHNIQUES: Short items, Practical exercises, Response to stimulus TECHNOLOGY: Graphics calculator TIME: 2 hours (or 2x1 hour) CONDITIONS: Supervised exam with no source materials	POSSIBLE THEME: Radio coverage of ultralight race UNIT LINK: Height of one ultralight is described using a trigonometric function TECHNOLOGY: Graphing software TIME: 3 weeks CONDITIONS: Some supervised classwork; Final task as supervised exam-TECHNIQUE:Paragraph

INTENDED ASSESSMENT PLAN:

SEM	ITEM	SUBJECT MATTER	GENERAL OBJECTIVES	CATEGORY: DESCRIPTION AND CONDITIONS
1	1	**UNITS 1, 2; 3 (part)**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator TIME: ~2 hours (or 2x1 hr) CONDITIONS: Supervised test with no source materials
1	2	**UNITS 1, 2, 3**	KAP MAPS CAJ	**PART A-EXTENDED MAPS TASK PART B-REPORT** POSSIBLE THEME: PART A-Proposal on flight paths obtained by sin/cos rules PART B-Report on flight test data using statistics TECHNOLOGY: Excel and Maths Helper Plus TIME: 3 weeks CONDITIONS: Lessons on Excel and Maths Helper; Small group data collection; Individual work, some as supervised classwork; Final task as test ---Paragraph response
1	3	**UNITS 3, 4, 5; 6 (part)**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator TIME: ~2 hours block exam CONDITIONS: Supervised test with no source materials
2	4	**UNITS 6, 7, 8**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator TIME: ~2 hours (or 2x1 hr) CONDITIONS: Supervised test with no source materials
2	5	**UNITS 3, 4, 5, 6, 7, 8**	KAP MAPS CAJ	**EXTENDED MAPS TASK** POSSIBLE THEME: Oral on flight race (Ultralight) with position, speed, acceleration TECHNOLOGY: Graphing software; Internet research TIME: 3 weeks CONDITIONS: Individual with some supervised classwork; Final task as test ---Paragraph response
2	6	**UNITS 9, 10, 11**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator TIME: ~2 hours block exam CONDITIONS: Supervised test with no source materials
MONITORING				
3	7	**UNITS 12,13,14**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator TIME: ~2 hours (or 2x1 hr) CONDITIONS: Supervised exam with no source materials
3	8	**UNITS 12, 13,14,15**	KAP MAPS CAJ	**PART A-EXTENDED MAPS TASK PART B-REPORT** POSSIBLE THEME: PART A-Comparison of functions used in aircraft engineering PART B-Report on aircraft faults/maintenance with probability and statistical analysis TECHNOLOGY: Graphing software; Excel TIME: 3 weeks CONDITIONS: Small group data simulation; Individual work, with some supervised classwork; Final task as test ---Paragraph response
3	9	**UNITS 15,16,17**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator TIME: ~2 hours block exam CONDITIONS: Supervised exam with no source materials
4	10	**UNITS 16,18,19**	KAP MAPS CAJ	**EXTENDED MAPS TASK** POSSIBLE THEME: Investigation of areas and volumes of aircraft components (fuel tanks, propellers) with optimal construction TECHNOLOGY: Graphing software; Excel; Internet research; Roland TIME: 3 weeks CONDITIONS: Individual work, with some supervised classwork; Small group practical for model construction and data collection
4	11	**UNITS 18,19, 20 (part)**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator; Excel/Maths Helper TIME: ~2 hours (or 2x1 hr) CONDITIONS: Supervised exam with no source materials; Computer component: modelling
VERIFICATION				
4	12	**UNITS 20,21,22**	KAP MAPS CAJ	**SUPERVISED TEST** POSSIBLE TECHNIQUES: Short items, Practical exercises, Stimulus response TECHNOLOGY: Graphics calculator; Excel/Maths Helper TIME: ~2 hours (or 2x1 hr) CONDITIONS: Supervised exam with no source materials; Computer component: depreciation/appreciation schedules
EXIT				

NOTE: For assessment item 10, a 'Financial Simulation (Superannuation and Aviation Careers)' can take the place of an 'Optimal Construction' task if course organisation is altered so that unit 21 preceeds unit 20.
This will be noted with the submission for verification.
In this case, -item 10 will assess units 16, 18, 21.
-item 11 will assess units 18, 19, 21 (part).

MATHEMATICS B STUDENT PROFILE

STUDENT NAME:_____

TEACHER/S: _____ _____ **200___ - 200___**

Assessment Instruments (Units)		Mathematics B Assessment Criteria			Level of Achievement
		Criterion K & P	Criterion M & P	Criterion C & J	
Semester 1 Formative	1. Test: Units 1-3	B	C B D	C	
	2. Ext.MAPS/Report: Units 1-3	B	A C E	B	
	3. Test: Units 3-6	C	B C D E	C	
	Semester 1 Summary	**B**	**C**	**C**	**C**
Semester 2 Formative	4. Test: Units 6-8	C	C C C E	C	
	5. Ext.MAPS: Units 3-8	A	C D B E	A	
	6. Test: Units 9-11	A	B D A E	B	
	Semester 2 Summary	**B**	**C**	**B**	**B**
Monitoring Semesters 1&2		**B**	**C**	**B**	**HA**
Semester 3 Summative	7. Test: Units 12-14	C	B C E	C	
	8. Ext.MAPS/Report: Units 12-15	A	A B B B	A	
	9. Test: 15-17	C	C E D E	C	
	Semester 3 Summary	**C**	**C**	**C**	**C**
Semester 4 Summative	10. Ext.MAPS: Units 16, 18-19	D	E D E	D	
	11. Test: Units 18-20	C	B D B D	C	
	Verification Semesters 3&4	**C**	**C**	**C**	**SA**
	12.Test: Units 20-22	D	C D E	D	
Exit Semesters 3&4		**C**	**C**	**C**	**SA**
SAI					**###**

APPENDIX: OPTIONAL EXTENSION TO WORK PROGRAM
LEVEL OF ACHIEVEMENT GUIDELINES

1. *Each assessment item is to be marked using the* **MATHEMATICS B CRITERIA GRID.** *Task/question specific marking information will appear on answer keys.*

AVIATION HIGH

MATHEMATICS B CRITERIA GRID

Name_____

Knowledge and Procedures	**STANDARD**				
Student work characteristics:	**A**	**B**	**C**	**D**	**E**
Recall, access, selection, of mathematical definitions, rules, procedures					
Application of mathematical definitions, rules, procedures					
Numerical calculations, spatial sense, algebraic facility					
Selection and use of technology					

KAP STANDARD ACHIEVED **The standard is evidenced by student work characteristics and is usually suggested by the % cut-off.**	**INDICATIVE %:** % Cut-Off: **/##** A ≥ 85 B ≥ 70 C ≥ 50 D ≥ 25 (+/-5) **%**	**STANDARD:**

Modelling and Problem-Solving	**QUESTION** (See individual marking grids on answer key for task specific information.)																									
Student work characteristics:	**Q**					**Q**					**Q**					**Q**					**Q**					
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
Problem-solving strategies to interpret, clarify, analyse																										
Identification of assumptions and effects, parameters and/or variables																										
Use of data and mathematical models																										
Interpretation of results and validation of arguments																										
MAP STANDARD INDICATORS **The indicators suggest achievement on each item and must be compiled as evidence to support a standard.**																										

Communication and Justification	**STANDARD**				
Student work characteristics:	**A**	**B**	**C**	**D**	**E**
Mathematical terminology, symbols, conventions					
Organisation and presentation					
Analysis and translation					
Mathematical reasoning					
Justification of procedures, decisions, results					
Reasonableness of results					
CAJ STANDARD ACHIEVED **The standard is evidenced by student work characteristics.**					

2. *Results for each assessment item are recorded on the* **MATHEMATICS B STUDENT PROFILE***.*

AVIATION HIGH

MATHEMATICS B STUDENT PROFILE

STUDENT NAME:_____ **TEACHER/S:**_____ **201_-201_**

Assessment Instruments (Units)		Mathematics B Assessment Criteria			Level of Achievement
		Criterion K & P	Criterion M & P	Criterion C & J	
Semester 1 Formative	1. Test: Units 1-3	B	C B D	C	
	2. Ext.MAPS/Report: Units 1-3	B	A C E	B	
	3. Test: Units 3-6	C	B C D E	C	
	Semester 1 Summary	**B**	**C**	**C**	**C**
Semester 2 Formative	4. Test: Units 6-8	C	C C C E	C	
	5. Ext.MAPS: Units 3-8	A	C D B E	A	
	6. Test: Units 9-11	A	B D A E	B	
	Semester 2 Summary	**B**	**C**	**B**	**B**
Monitoring Semesters 1&2		**B**	**C**	**B**	**HA**
Semester 3 Summative	7. Test: Units 12-14	C	B C E	C	
	8. Ext.MAPS/Report: Units 12-15	A	A B B B	A	
	9. Test: 15-17	C	C E D E	C	
	Semester 3 Summary	**C**	**C**	**C**	**C**
Semester 4 Summative	10. Ext.MAPS: Units 16, 18-19	D	E D E	D	
	11. Test: Units 18-20	C	B D B D	C	
	Verification Semesters 3&4	**C**	**C**	**C**	**SA**
	12.Test: Units 20-22	D	C D E	D	
	Semester 4 Summary	**C**	**C**	**C**	**C**
Exit Semesters 3&4		**C**	**C**	**C**	**SA**
SAI					**###**

3. *At the end of each semester and at monitoring/verification/exit, the student folios will be reviewed and a standard will be determined for each criteria*(KAP, MAP, CAJ).

Within each criterion, an A to E standard will be awarded. This standard will match demonstrated work characteristics to the full range of minimum syllabus standard descriptors. Consideration will be given to the relative contribution of each assessment item with respect to subject matter, conditions, and fullest/latest.

For the MAP criterion, MAP indicators on the profile suggest achievement on each question/task but do not individually reflect the entire range of work characteristics required by the syllabus. Sufficient MAP opportunities will be provided by the assessment package, usually within each assessment item, to allow students to demonstrate the full range over time. Therefore, the MAP indicators can be compiled as evidence to support a standard.

The table below will be used to propose a likely standard in each criteria (KAP, MAP, and CAJ):

STANDARD	PROFILE (KAP results, MAP indicators, CAJ results)
A	Consistently **A**'s
B	Consistently **B**'s or better, with the remainder generally **C**'s
C	Consistently **C**'s or better, with the remainder generally **D**'s
D	Consistently **D**'s or better
E	Consistently **E**'s

Note: Trade-offs might be applied; A, B, C, D, A, A, could equate to a B standard.

The proposed standard may be altered to ensure that the work characteristics displayed in the student folio match the syllabus descriptors.
However, the syllabus states that: "When determining a standard for each criterion, it is not always necessary for the folio to display each descriptor for a particular standard. The standard awarded should be informed by how the work qualities match the descriptors overall. The typical standards are applied to the **summative** body of work selected for review."

4. *At the end of each semester and at monitoring/verification/exit, the standards for the criteria will be combined to determine an overall level of achievement.*

The table, taken from the syllabus, indicates the **minimum** combination of standards across the criteria for awarding each level of achievement.

VHA	Standard *A* in any two criteria and no less than a *B* in the remaining criterion
HA	Standard *B* in any two criteria and no less than a *C* in the remaining criterion
SA	Standard *C* in any two criteria, *one of which must be the* Knowledge and procedures *criterion,* and no less than a *D* in the remaining criterion
LA	At least Standard *D* in any two criteria, *one of which must be the* Knowledge and procedures *criterion*
VLA	Standard *E* in the three criteria (Not meeting the minimum requirements for LA.)