

## CERTIFICATE IV IN ADULT TERTIARY PREPARATION (10765NAT)

### PURE MATHEMATICS (MATHS B)

The Pure Mathematics Specialisation applies to those who require foundation General Mathematic knowledge and skills for entrance to tertiary study in a relevant discipline or field.

*There are three units of study within the Pure Mathematics Specialisation.*

#### **ATPPMA001 - Unit 1:**

*Solve pure mathematics problems involving trigonometry and algebra.*

This unit describes the performance outcomes, skills and knowledge required to apply problem solving skills to predictable and routine pure mathematics problems involving trigonometry and algebra. It requires the ability to perform mathematical calculations and to solve problems which include introductory mathematical concepts, linear functions and quadratics, and trigonometry and measurement. Communication using concise and systematic mathematical language and conventions is required.

#### **ATPPMA001 - Performance Criteria:**

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| <b>1. Develop solutions to trigonometry and algebra problems</b> | <p>1.1 Determine procedures, concepts, techniques and technology to be used to develop a solution</p> <p>1.2 Select and apply problem solving processes, calculations or procedures to reach a solution</p> <p>1.3 Analyse and interpret the validity of the result, make judgments and draw conclusions</p>  |
| <b>2. Present mathematical information and solutions</b>         | <p>2.1 Explain mathematical reasoning for the application of algebra and trigonometry to solve problems using logical and sequenced ideas and information</p> <p>2.2 Organise and represent algebraic and trigonometry ideas, and information and results using mathematical language, conventions and technology appropriate to the audience and purpose</p> |

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### **ATPPMA001 – Performance Evidence:**

- Solved pure mathematics problems, embedded in practical contexts, that incorporate each of the following:
  - Using commutative, associative and distributive laws
  - Applying order of mathematical operations
  - Simplifying and solving simple algebraic equations using algebra techniques
  - Graphing linear functions:  $y=mx+c$ ;
  - Solving two simultaneous linear equations using algebra
  - Using the distance between two points and mid-point formulae
  - Explaining the relationship between parallel and perpendicular lines
  - Graphing quadratics:  $y=ax^2+bx+c$
  - Using the quadratic formula to find zeroes;
  - Locating turning points;
  - Recognising the perfect square form and the factorised form of a quadratic
  - Solving word problems that result in quadratic equations and/or linear functions
  - Solving similar triangles
  - Converting between metric units of measurement
  - Applying Pythagoras' theorem
  - Using trigonometry to solve right angle triangle problems
- Justified actions and decisions in reaching conclusions using mathematical reasoning

### **ATPPMA001 – Knowledge Evidence:**

- Mathematical reasoning including recognising assumptions, discriminating between valid and invalid arguments, analysis of results and comparing data
- Basic number and algebra skills
- Commutative, associative and distributive laws
- Order of operations
- Basic algebra skills: solving simple equations, simplifying algebraic expressions
- Basic Linear Functions and Quadratics
- Linear functions:  $y=mx+c$ ; graphing skills; solution of two simultaneous linear equations; distance between two points and mid-point formulae; relationship between parallel and perpendicular lines
- Quadratics:  $y=ax^2+bx+c$ ; quadratic formula and zeroes; turning point analysis; the perfect square form and the factorised form; graphing skills
- Solving word problems that result in quadratic equations and/or linear functions
- Trigonometry and measurement
- Similar triangles
- Length, area, total surface area and volume of common shapes
- Metric conversions of measurement
- Pythagoras' theorem
- Trigonometry and the right angle triangle
- Sine and Cosine rules
- Algebraic and trigonometry terminology, language, conventions and technology appropriate for audience and purpose

**ATPPMA002 - Unit 2:**

*Solve pure mathematics problems involving statistics and functions.*

This unit describes the performance outcomes, skills and knowledge required to apply problem solving skills to predictable and routine pure mathematics problems involving statistics and functions. It requires the ability to comprehend and apply mathematical concepts and techniques drawn from relations and functions, probability and statistics, index laws, and exponential and logarithmic functions. The communication of arguments and strategies requires the concise and systematic application of statistical and mathematical language and conventions.

**ATPPMA002 - Performance Criteria:**

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| <b>1. Develop solutions to statistical problems</b> | 1.1 Determine procedures, concepts and techniques to be used to develop a solution using statistical functions.<br>1.2 Formulate a coherent strategy to represent the problem mathematically.<br>1.3 Select and apply statistics and functions methods to solve the problem.<br>1.4 Analyse and verify the result and make a judgment on the solution using mathematical reasoning. |
| <b>2. Present statistical information</b>           | 2.1 Explain mathematical reasoning when applying statistical functions using logical and sequenced ideas and information.<br>2.2 Organise and represent statistical information using mathematical language, conventions and technology appropriate to the audience and purpose.  |

### **ATPPMA002 – Performance Evidence:**

- Solved pure mathematics problems, embedded in practical contexts, that incorporate each of the following:
  - Sketching fundamental shapes and forms for typical functions, such as linear and quadratic equations
  - Determining the mean, mode and median for both grouped and ungrouped data
  - Determining the range, interquartile range, standard deviation for grouped and ungrouped data
  - Determining linear regression and correlation
  - Using the normal distribution (Z –scores) to solve problems
  - Using index laws to simplify algebraic expressions
  - Using the concept of logarithms as the inverse of exponentials
  - Using exponential and logarithmic notation
  - Using logarithm laws
  - Sketching graphs of typical exponential and logarithmic functions
  - Converting between radian measure and degrees
  - Sketching typical periodic functions, such as  $y = a \sin \{b(x + c)\} + d$

### **ATPPMA002 – Knowledge Evidence:**

- Mathematical reasoning including recognising assumptions, discriminating between valid and invalid arguments, analysis of results and comparing data
- Relations and Functions
- Concepts of function, domain and range
- Review of linear and quadratic function
- Cubics and other polynomials: a brief examination of the general shape and form of these functions
- Graphs of familiar reciprocal and irrational functions (e.g.  $y=1/x$ ,  $y=\sqrt{x}$ )
- Probability and Statistics
- Measures of Central Tendency
- Measures of dispersion
- Linear regression and correlation
- Introduction to theoretical probability
- Probability and the normal distribution (z-scores)
- Exponentials and Logarithms
- Index laws: simplification of algebraic expressions, solving familiar exponential equations
- Concept of logarithms being the inverse of exponentials; exponential and logarithmic notation
- Logarithm laws including change of base law
- Graphs of exponential and logarithmic functions
- Euler's number
- Growth and decay problems
- Circular Functions
- Radian measure and typical uses
- Solving trigonometric equations
- Periodicity: trigonometric functions and their graphs
- e.g.  $y = a \sin \{b(x + c)\} + d$
- Statistical mathematics terminology, language, conventions and technology appropriate for audience and purpose

**ATPPMA003 - Unit 3:**

*Solve pure mathematics problems involving calculus.*

This unit describes the outcomes skills and knowledge required to apply problem solving skills to predictable and routine pure mathematics problems using calculus. It requires the ability to apply mathematical methods to develop solutions and perform mathematical calculations applying both differentiation and anti-differentiation including integration. Communication using concise and systematic mathematical language and conventions is required.

**ATPPMA003 - Performance Criteria:**

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|--|---|
| <b>1. Use calculus to solve mathematics problems</b> | 1.1 Determine procedures concepts and techniques to be used to develop a solution using calculus.<br>1.2 Formulate a coherent strategy to represent the problem mathematically.<br>1.3 Select and apply calculus methods to solve the problem.<br>1.4 Analyse and verify the result and make a judgment on the solution using mathematical reasoning. |
| <b>2. Present calculus ideas and information</b>     | 2.1 Explain mathematical reasoning using logical and sequenced ideas and information.<br>2.2 Organise and represent calculus ideas, information and results using mathematical language, conventions and technology appropriate to the audience and purpose.  |

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**ATPPMA003 – Performance Evidence:**

- Solved pure mathematics problems, embedded in practical contexts, that incorporate each of the following:
  - Performing differentiation from first principles
  - Using the rule if  $f(x) = ax^n$  then  $f'(x) = nax^{n-1}$  to differentiate
  - Determining equations of tangents and normals
  - Using the chain, product and quotient rules
  - Using first and second derivatives
  - Sketching and stationary point analysis using calculus
  - Calculating:
    - anti-derivatives as the reverse process of differentiation
    - definite and indefinite integrals
    - areas under curves using calculus
    - rate functions and optimisation

**ATPPMA003 – Knowledge Evidence:**

- Mathematical reasoning including recognising assumptions, discriminating between valid and invalid arguments, analysis of results and comparing data
- Differentiation by first principles
- Differentiation by rule: if  $f(x) = ax^n$  then  $f'(x) = nax^{n-1}$
- Equations of tangents and normals
- Chain, product and quotient rules
- First and second derivatives
- Curve sketching and stationary point analysis
- Anti-derivatives: integration as the reverse process of differentiation
- Finding definite and indefinite integrals
- Areas under curves
- Problems involving the integration of rate functions and interpretation of results
- Differential calculus and optimisation problems
- Calculus terminology, language, conventions and technology appropriate for audience and purpose