Australian Government

# MEM23004A Apply technical mathematics

**Release 1**

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

# MEM23004A Apply technical mathematics

## Modification History

Release 1 - New unit. Replaces MEM23001A, but not equivalent.

## Unit Descriptor

This unit of competency covers the application of mathematical analysis, graphical and software techniques to engineering problems. It includes exponential and logarithmic functions, trigonometric equations involving single and double angles, sequences and series, two dimensional vector analysis, complex numbers, determinants and matrices.

## Application of the Unit

The unit applies to engineering or related activities requiring specific mathematical techniques. It is suitable for people giving technical support to design, operations or maintenance activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

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| 1 | Determine scope of technical mathematical techniques required for an engineering application | 1.1 | Analyse an engineering application for required technical mathematical tasks |
| | | 1.2 | Develop systematic methods for layout and solution checking |
| | | 1.3 | Determine mathematical software required for analytical and graphical solutions and validate software using traditional solutions to simple examples |
| 2 | Apply technical mathematical techniques to engineering application | 2.1 | Use appropriate software for analytical and graphical solutions |
| | | 2.2 | Convert between different number systems |
| | | 2.3 | Use appropriate mathematical techniques required for analysis and solution |
| | | 2.4 | Use appropriate data representations to communicate the solution to others. |
| | | 2.5 | Report results and document calculations, graphs and analysis |

# Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- solving mathematical problems using standard engineering software packages, and validating software results of simple examples analytically and/or graphically
- manipulating values using decimal, binary and hexadecimal number systems
- graphing and analysing functions for solutions:
  - exponential and logarithmic functions
  - trigonometric functions
- using the techniques of sequences and series to solve simple mathematical problems
- using the techniques of two dimensional vectors to solve mathematic and applied problems
- solving problems involving complex quantities using the properties, operations and theorems of complex numbers
- using determinant and matrix analysis to solve algebraic and vectorial problems
- using probability to assess likely occurrences

### Required knowledge

Required knowledge includes:

- software for mathematical analysis and graphical representations
- binomials and polynomials
- exponential and logarithmic functions
- trigonometric equations
- sequences and series
- two dimensional vectors
- complex numbers
- determinant and matrices
- probability
- stability analysis using plots

# Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

Guidelines for the Training Package.

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| **Overview of assessment** | A person who demonstrates competency in this unit must be able to apply mathematical analysis, graphical and software techniques to engineering-related problems within the context of delegations and other checking and technical oversight procedures. The candidate may demonstrate competence through either working individually or as part of a team. |
| **Critical aspects for assessment and evidence required to demonstrate competency in this unit** | Assessors must be satisfied that the candidate can competently and consistently:<br>• solve mathematical problems using software<br>• validate software results of simple examples analytically and/or graphically<br>• manipulate values using decimal, binary and hexadecimal number systems<br>• graph and analyse exponential, logarithmic and trigonometric functions for solutions<br>• use the techniques of sequences and series to solve simple mathematical problems<br>• use the techniques of two dimensional vectors to solve mathematic and applied problems<br>• solve problems involving complex quantities using the properties, operations and theorems of complex numbers<br>• use determinant and matrix analysis to solve algebraic and vectorial problems<br>• use probability to assess likely occurrences. |
| **Context of and specific resources for assessment** | • This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.<br>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.<br>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities. |
| **Method of assessment** | • Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.<br>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. |

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| | • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.<br>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.<br>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.<br>• Assessment may be in conjunction with assessment of other units of competency where required. |
| **Guidance information for assessment** | Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed. |

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

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| **Engineering applications related to mathematical techniques in this unit** | Most engineering disciplines will have applications supported by the technical mathematics skills described in this unit, including mechanical, manufacturing, maintenance and mechatronics engineering. Examples of engineering applications requiring mathematical skills described in this unit may include:<br>• vector analysis of force systems on beams and bodies<br>• trigonometric plots related to waveforms for amplitude, frequency and phase shift analysis<br>• matrix and determinant solutions of vector systems or simultaneous equations<br>• complex plane analysis of control systems for stability analysis |
| **Scope of technical mathematical techniques** | The scope of technical mathematical techniques required for an engineering application will vary and may include:<br>• standard mathematical software<br>• decimal, binary and hexadecimal number systems<br>• graph exponential and logarithmic functions required for the engineering application<br>• solve trigonometric equations involving single and double angles<br>• solve problems using simple binomials and polynomials |

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| | • solve problems involving simple sequences and series in the engineering application<br>• analyse two dimensional vectors<br>• analyse complex numbers and represent graphically<br>• analyse simple algebraic and vectorial problems using determinants and matrices<br>• evaluate probability as a predictive tool in simple situations |
| **Number system** | Number systems may include:<br>• decimal<br>• binary<br>• hexadecimal |

# Unit Sector(s)

**Competency field**

**Unit sector** Engineering science

# Custom Content Section

Not applicable.