



Australian Government

MEM234024 Apply advanced mathematics to technology problems

Release: 1

MEM234024 Apply advanced mathematics to technology problems

Modification History

Release 1. Supersedes and is equivalent to MEM234024A Apply advanced mathematics in technology problems.

Application

This unit of competency defines the skills and knowledge required to apply advanced mathematics in an engineering or related application and includes a range of mathematical techniques. It covers both the application of theory in simple calculations either manually or through the use of relevant software packages for more complex situations.

It is suitable for paraprofessionals and technologists required to solve advanced mathematical problems in an engineering or related field, or for those pursuing technologist careers and qualifications.

Individuals completing this work either already have or are developing skills and experience in mathematics.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Nil

Competency Field

Engineering science

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Identify a need for the application of advanced mathematics	1.1 Identify and define a problem requiring application of mathematics 1.2 Determine data currently available for analysis 1.3 Identify ways of obtaining other required data 1.4 Determine information required from outcome
2. Prepare to solve problem by advanced	2.1 Determine appropriate mathematics to be applied

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
mathematics	2.2 Identify and gain access to appropriate computational devices 2.3 Collect required input data 2.4 Analyse collected data for suitability and completeness 2.5 Take appropriate action to address any deficiencies found
3. Solve problem using advanced mathematics	3.1 Apply appropriate techniques to collected data 3.2 Check answer to ensure it is within the expected rational results 3.3 Interpret answer to determine information required by problem definition and translate the result of the statistical analysis into a form which is useable by relevant stakeholders.
4. Communicate outcomes	4.1 Communicate outcome to relevant stakeholders by appropriate means 4.2 Explain outcome to stakeholders as appropriate 4.3 Confirm that the result of the analysis assists in the resolution of the problem

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Mathematics includes one or more of:	- the techniques listed under Knowledge Evidence - a related technique.
Computational devices include:	- calculators with appropriate mathematical functions - computer software packages.
Appropriate action	taking necessary steps to obtain required data

includes:	• obtaining some relevant proxy for the desired data • choosing a different mathematical and computational device which will function with available data.
Appropriate techniques include:	• selected mathematical technique which will yield required outcome • a technique which is appropriate for the available data and which is relevant to the problem.
Appropriate communication includes one or more of the following:	• report • presentation • verbal communication • web-based • electronic or hard copy.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM234024A Apply advanced mathematics in technology problems.

Links

Companion Volume Implementation Guides are available on VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM234024 Apply advanced mathematics to technology problems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- identifying and defining problems
- identifying appropriate mathematical techniques for engineering or related problems
- applying the appropriate technique to the problem and solving and confirming answer using the technique on at least two occasions
- communicating the outcome of the analysis in a manner suited to the audience and confirming the outcome has addressed the problem.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- exponential, trigonometric and hyperbolic functions including:
 - functionality and inverse functions
 - exponential and logarithmic functions
 - trigonometric and inverse trigonometric functions
 - hyperbolic and inverse hyperbolic functions
- series including:
 - of arithmetic and geometric progressions
 - limits
 - linear and quadratic approximations (Taylor polynomials)
 - partial sums
 - geometric series
 - power series
 - Maclaurin series
- vectors including:
 - vectors in three-dimensions

- i j k notation
- magnitude (or modulus) of a vector
- unit vectors and direction angles
- scalar or 'dot' product of two vectors
- vector or 'cross' product of two vectors
- resolution of vectors
- differentiation and integration of vectors
- dynamics including:
 - Newton's Laws of Motion
 - energy, work and power
 - the work-energy theorem
 - moment of a force
- analytical geometry including:
 - equation of a plane
 - the angle between two planes
 - the distance from a point to a plane
 - lines in three-dimensional space
- graphing techniques including:
 - coordinate geometry
 - graphs of exponential growth and decay
 - graphs with logarithmic scales
 - method of least squares
 - polar coordinates and polar graphs
 - graphs of functions of two variables
 - quadric surfaces
- complex numbers including:
 - introduction to complex numbers including:
 - Cartesian form
 - the Argand plane
 - trigonometric and polar form
 - subsets of the complex plane
 - De Moivre's theorem
 - exponential form of complex numbers
 - applications to mesh current network analysis
- linear algebra including:
 - matrix algebra including:
 - basic operations
 - applications
 - transformations
 - determinants

- systems of equations I, including:
 - solutions and inverses
 - applications
 - systems of equations II (numerical techniques)
 - systems of equations III (other systems).

Assessment Conditions

- Assessors must:
 - have vocational competency in applying advanced mathematics to technology problems at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Where possible assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
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