



Australian Government

MEM234022 Apply advanced calculus to technology problems

Release: 1

MEM234022 Apply advanced calculus to technology problems

Modification History

Release 1. Supersedes and is equivalent to MEM234022A Apply advanced calculus to technology problems.

Application

This unit of competency defines the skills and knowledge required to apply advanced calculus in an engineering or related application and includes differential and integral calculus. It includes 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 covering calculus and differentials.

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 calculus	1.1 Identify and define a problem requiring application of calculus 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 calculus	2.1 Determine appropriate calculus to be applied 2.2 Identify and gain access to appropriate computational devices

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	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 calculus	3.1 Apply appropriate technique 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.	
Calculus refers to one or more of the following:	- the techniques listed under Knowledge Evidence - a related technique.
Computational devices include:	- calculators with calculus functions - computer software packages.
Appropriate action includes:	- taking necessary steps to obtain required data - obtaining some relevant proxy for the desired data - choosing a different calculus and computational device which will

	function with available data.
Appropriate techniques include:	• selected calculus which will yield required outcome • 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 MEM234022A Apply advanced calculus to 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 MEM234022 Apply advanced calculus 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 calculus technique 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 stakeholder/s 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:

- differential calculus including:
- standard derivatives and rules:
 - power rule
 - product rule
 - quotient rule
 - chain or function of a function rule
 - standard derivatives for common functions
- higher order derivatives
- graph sketching
- maxima and minima (optimisation)
- rates of change
- small increments (errors and approximations)
- implicit differentiation
- logarithmic differentiation
- partial differentiation
- directional derivatives

- integral calculus including:
 - integration techniques (areas and volumes)
 - partial fractions
 - integration by parts
 - trigonometric and hyperbolic substitution methods
 - improper integrals
 - integration of partial derivatives
 - evaluation of arc lengths
 - evaluation of surface areas
 - mean and root mean square (RMS) values
 - approximate integration (the trapezoidal and Simpson's rules)
 - evaluation of centre of mass
 - evaluation of centroidal positions in plane regions
 - evaluation of moments of inertia and second moments of area
 - evaluation of work and energy
 - evaluation of centres of pressure on submerged plates.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying advanced calculus 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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