



Australian Government

MEM23007 Apply calculus to engineering tasks

Release: 1

MEM23007 Apply calculus to engineering tasks

Modification History

Release 1. Supersedes and is equivalent to MEM23007A Apply calculus to engineering tasks

Application

This unit of competency defines the skills and knowledge required to apply calculus, including differentiation and integration techniques, to engineering applications. Engineering applications requiring calculus techniques may include determining the point of maximum bending moment, slope and deflection for a beam, determining the depth of parabolic mirrors or determining moments of inertia of a range of engineering components and solving rectilinear motion problems.

The unit applies to engineering or related activities and 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.

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

Pre-requisite Unit

MEM23004 Apply technical mathematics

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. Determine scope of calculus techniques required for an engineering application	1.1 Analyse an engineering application for required calculus tasks 1.2 Develop systematic methods for layout and solution validation, including any required external sign-off of solution 1.3 Identify calculus technique and any software required for analysis and resolution of identified engineering application tasks 1.4 Identify required sources for professional and technical assistance
2. Apply differential and integration techniques to	2.1 Apply standard differentiation and integration rules to solve engineering problems

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
engineering applications	2.2 Check solution is laid out in a correct manner and is error free 2.3 Review solution to ensure it provides information relevant to resolution of engineering application task 2.4 Report results and document calculations, graphs and analysis

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 techniques required include one or more of the following:	• identification of appropriate limits • use of standard derivatives and rules and application of second and third derivatives • finding rates of change and slopes of curves • calculating maximum and minimum values of curves • solving first and second order differential equations • use of standard integrals and rules and finding constants of integration • finding areas under and between curves • integrating algebraic, trigonometric and exponential functions • the definite integral • identification of appropriate methods to solve more complex integration applications.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23007A Apply calculus to engineering tasks.

Links

Companion Volume implementation guides are found in VETNet -

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

Assessment Requirements for MEM23007 Apply calculus to engineering tasks

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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:

- analysing engineering applications to determine relevant calculus techniques
- applying relevant differentiation and integration concepts and tools to engineering applications on at least two occasions
- solving mathematical problems related to engineering and manufacturing using calculus techniques including method of substitution and using trigonometric identities on at least two occasions
- validating results of mathematical problems using calculus either analytically and/or graphically
- manipulating engineering and manufacturing-related mathematical functions and equations using calculus techniques on at least two occasions
- analysing mathematical problems by using appropriate calculus techniques to achieve engineering and manufacturing solutions on at least two occasions
- communicating results of calculus-based analysis in accordance with procedures.

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:

- how to identify appropriate limits and their application to engineering problems being solved with calculus techniques
- differentiation rules and techniques
- partial differentiation
- relationship between differentiation and attributes of mathematical curves and graphs
- optimisation of variables based on maximum and minimum values of mathematical curves and graphs
- integration as the reverse of differentiation
- integration rules and techniques
- definite integral
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying calculus in engineering situations 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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