Title	**Demonstrate and apply knowledge of calculus and data analysis for mechanical engineering**		
Level	**4**	**Credits**	**15**

Purpose	People credited with this unit standard are able to demonstrate and apply knowledge of: differentiation to solve mechanical engineering problems; integration to solve mechanical engineering problems; and data analysis used in mechanical engineering.

Classification	Mechanical Engineering > Applied Principles of Mechanical Engineering

Available grade	Achieved

Entry information	
Recommended skills and knowledge	Unit 21775, *Demonstrate knowledge of mathematical principles for mechanical engineering*, or demonstrate equivalent knowledge and skills.

Explanatory notes

1 References
Health and Safety at Work Act 2015 and supporting Regulations.

2 Definitions
Accepted industry practice refers to approved codes of practice and standardised procedures accepted by the wider mechanical engineering industry sectors as examples of best practice.
Workplace procedures refer to procedures used by the organisation carrying out the work and applicable to the tasks being carried out. They may include but are not limited to – standard operating procedures, safety procedures, equipment operating procedures, codes of practice, quality management practices and standards, procedures to comply with legislative and local body requirements.

3 Assessment information
- a Numerous reference texts and training manuals on calculus and data analysis are available and may be used; however, no one textbook or source of information is envisaged. All activities must comply with applicable workplace procedures and must be consistent with accepted industry practice.
- b Assessment is to be ‘closed book’, with all relevant formulae provided. Computers and/or non-programmable calculators may be used.

Outcomes and evidence requirements

Outcome 1

Demonstrate and apply knowledge of differentiation to solve mechanical engineering problems.

Evidence requirements

1.1 The concept of differentiation and its applications are described.

1.2 Graphs are used to illustrate and solve differentiation problems.

Range evidence is required of solutions to a minimum of two problems.

1.3 Differentiation techniques are applied to solve engineering problems.

Range techniques include but are not limited to – rates of change, maxima and minima problems, Newton-Raphson method for non-linear equations;
evidence is required of solutions to a minimum of two problems for each of the techniques.

Outcome 2

Demonstrate and apply knowledge of integration to solve mechanical engineering problems.

Evidence requirements

2.1 Integration techniques and their applications are described.

Range techniques include – use of standard integrals, integration by parts (first and second order), substitution, partial fractions;
evidence is required of two applications for each of the techniques.

2.2 Graphs are used to illustrate and solve integration problems.

Range evidence is required of solutions to a minimum of two problems.

2.3 Integration techniques are applied to solve engineering problems.

Range techniques may include but are not limited to – Simpsons' rule, differential equations to first order, areas, volumes, Root Mean Square (RMS) values, mean values, moments, centroids;
evidence is required of solutions to a minimum of two problems for each of the techniques.

Outcome 3

Demonstrate and apply knowledge of data analysis used in mechanical engineering.

Range techniques – polynomial, logarithmic, exponential;
evidence is required of using each technique twice on different data or data sets.

Evidence requirements

3.1 Appropriate functions are derived to fit data sets.

3.2 Correlation and simple linear regression techniques are applied to data, and interpretations and predictions are made.

Planned review date	31 December 2021

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	27 October 2005	31 December 2016
Rollover and Revision	2	19 March 2010	31 December 2021
Review	3	20 October 2016	N/A

Consent and Moderation Requirements (CMR) reference	0013

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Please note
Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMRs). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.