

<b>Title</b>	<b>Demonstrate knowledge of trade calculations and units for mechanical engineering trades</b>		
<b>Level</b>	<b>2</b>	<b>Credits</b>	<b>6</b>

<b>Purpose</b>	People credited with this unit standard are able to: carry out arithmetic, algebraic, and trigonometric operations; use tables and graphs; and define and apply quantities and units of measure in a mechanical engineering environment.
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<b>Classification</b>	Mechanical Engineering > Engineering Core Skills
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<b>Available grade</b>	Achieved
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**Guidance Information**

- 1 Reference and legislation  
*The International System of Units (SI), 8<sup>th</sup> edition* (France: Bureau International des Poids et Mesures, 2006). Available at [http://www.bipm.org/utis/common/pdf/si\\_brochure\\_8\\_en.pdf](http://www.bipm.org/utis/common/pdf/si_brochure_8_en.pdf).
- 2 Definitions  
*Basic trigonometry* – sine, cosine, tangent.  
*Quantities* – properties ascribed to phenomena, bodies, or substances that can be quantified; eg force, length, pressure.  
*Value of a quantity* – the quantitative expression of a particular quantity, expressed as a numerical value with unit; e.g. 1.7 m, 1700 mm, 0.75 kPa, 30 lb/in<sup>2</sup>.
- 3 Assessment information
  - For assessments, formulae and conversion factors shall be supplied, and use of calculator is permitted.
  - Assessments must reflect mechanical engineering applications.
- 4 Typical formulae for evidence requirement 1.6:

$$A = \frac{d^2 \pi}{4} \qquad F = \frac{W \times l}{L} \qquad L = \frac{F \times a}{F - W}$$

$$T = 2\pi \sqrt{\frac{m}{D}} \qquad W = \frac{2PR}{R - r} \qquad F = ma$$

**Outcomes and performance criteria**

**Outcome 1**

Carry out arithmetic and algebraic operations for mechanical engineering.

**Performance criteria**

- 1.1 Basic arithmetic operations are carried out.
- Range operations – addition, subtraction, multiplication, and division of whole and decimal numbers.
- 1.2 Fractions are converted to decimals and percentages, and vice-versa.
- 1.3 Multiples are expressed to the power of 10, and vice-versa.
- Range mega, kilo, unit, deci, centi, milli, micro.
- 1.4 Engineering calculations are carried out using calculators.
- Range calculations involving addition, subtraction, multiplication, division, square, square root, cube, sine, cosine, tangent.
- 1.5 Area and volume calculations are carried out for two and three dimensional shapes using given data.
- Range area – square, rectangle, triangle, circle;  
volume – box, cylinder, cone.
- 1.6 Given formulae are transposed to solve for an unknown quantity.
- Range formulae – as used in basic mechanics.

**Outcome 2**

Carry out trigonometric operations for mechanical engineering.

**Performance criteria**

- 2.1 Lengths and angles are calculated in right-angle triangles.
- Range evidence is required of two calculations using Pythagoras' theorem, and two calculations using basic trigonometry.

**Outcome 3**

Use tables and graphs for mechanical engineering.

- Range graphs of mechanical engineering functions with two sets of curves on common axis.  
Evidence is required of two graphs.

**Performance criteria**

- 3.1 Graphs are sketched from tabular data on graph paper.

3.2 Tables are constructed by reading values from given graphs.

#### Outcome 4

Define and apply quantities and units of measure in a mechanical engineering environment.

#### Performance criteria

4.1 Unit names and symbols are matched to the corresponding quantities.

Range SI base quantities may include – length, mass, temperature, time; SI derived quantities may include – area, volume, speed, velocity, acceleration, angular velocity, force, torque, energy, work, power, efficiency, pressure; other quantities may include – rotational speed, torque, efficiency. Evidence is required for ten quantities.

4.2 Elementary quantities are defined and applied.

Range may include – speed, velocity, area, volume, force, pressure, work, power, rotational speed, torque, efficiency. Evidence is required for six quantities.

4.3 The difference between mass and weight is demonstrated.

Range demonstration includes calculations and an explanation.

4.4 Quantity values are re-stated using different SI prefixes.

Range for instance – 2049 mm = 2.049 m, 0.055 mm = 55 µm, 234 Pa = 0.234 kPa. Evidence is required for at least three re-statements using different units and prefixes.

4.5 Quantity values expressed in imperial units are converted to metric and vice versa.

Range conversions between – ft and mm, in and mm, in and µm, lb and kg, lb/in<sup>2</sup> and Pa, °F and °C. Evidence is required for ten conversions.

#### Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	22 September 2005	31 December 2016
Review	2	17 November 2011	31 December 2022
Review	3	18 February 2016	31 December 2022
Rollover	4	28 September 2017	31 December 2022

<b>Consent and Moderation Requirements (CMR) reference</b>	0013
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

**This unit standard is expiring**