



Australian Government

Department of Education, Employment and Workplace Relations

NWP552 Apply mathematical solutions to engineering problems

Release: 1

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Modification History

NWP552 Release 1: Primary release.

Unit Descriptor

This unit of competency sets out the knowledge and skills required to apply mathematical concepts and methods that are common to all engineering fields. This includes arithmetic, algebra, geometry, equations, functions, graphs and the use of scientific calculators but does not include differential and integral calculus.

Application of the Unit

This unit applies to engineering para-professionals in the water industry who are required to assist in solving engineering problems, usually under the supervision of an engineering professional.

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

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the tasks you need to be able to perform, to demonstrate that you can achieve the element. Where ***bold italicised*** text is used, further information is detailed in the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

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|---|--|
| 1 Identify computational requirements | 1.1 Determine the <i>computational task</i> through requests, design briefs or equivalent, and clarify with the <i>appropriate personnel</i> .
1.2 Seek expert advice with respect to the computational task and according to enterprise procedures when appropriate. |
| 2 Select appropriate mathematical method | 2.1 Interpret and understand industry codes, regulations and technical documentation relevant to the computational task.
2.2 Identify and use <i>sources of computational data</i> .
2.3 Make and record appropriate underlying assumptions for the computational task.
2.4 Identify, obtain and check required <i>resources</i> as fit for purpose. |
| 3 Perform computation | 3.1 Perform arithmetic operations, including decimals and fractions.
3.2 Efficiently perform computations using <i>features of a scientific calculator</i> .
3.3 Perform computations and record results.
3.4 Select methods for dealing with unexpected situations through discussions with appropriate personnel, job specifications and <i>enterprise procedures</i> . |
| 4 Verify and present results | 4.1 Discuss and verify results with appropriate personnel.
4.2 Present results in format required by initial request or brief. |

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills:

- conversion using unity brackets
- expand brackets in equations
- factor quadratics
- simplify algebraic fractions
- solve one variable equations
- solve linear equations algebraically and geometrically
- solve two linear functions simultaneously algebraically and geometrically
- solve up to three linear equations in three unknowns using inverse matrices and determinants
- solve quadratic equations by factoring and quadratic formula
- solve simultaneously linear and quadratic equations algebraically and geometrically
- solve exponential and simple log equations using indices, logs, calculator, and graphically
- solve trigonometric equations

- create, read and interpret charts and graphs
- algebraic manipulation of matrices

Required knowledge:

- trigonometry including trigonometric ratios, degrees, and radians
- exponential and logarithmic functions including laws of indices, and definition of the logarithm to any base
- quadratic functions including graphs of quadratic functions represented by parabolas
- matrices
- co-ordinate geometry including 2d planes
- geometry including pythagoras theorem, angles, triangles, sine, cosine, and tangent ratios and rules, and circles
- algebra substitution
- arithmetic including rational and irrational numbers, and surds

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

The candidate should demonstrate the ability to:

- perform mathematical computations for general engineering design and application purposes
- apply mathematical concepts in to engineering problems to new situations and different contexts

Context of and specific resources for assessment

Access to the workplace and resources including:

- documentation that should normally be available in a water industry organisation
- workplace specific equipment and technology
- supervision and experienced team members to provide observations, feedback and third party reports
- enterprise operating procedures and work allocation
- relevant codes, standards, and government regulations.

Where applicable, physical resources should include equipment modified for people with disabilities.

Access must be provided to appropriate learning and/or assessment support when required.

Assessment processes and techniques must be culturally appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed.

Validity and sufficiency of evidence require that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice
- a decision of competence should only be made when the assessor has complete confidence in the person's competence over time and in various contexts
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence
- where assessment is for the purpose of recognition (RCC/RPL), the evidence provided will need to be authenticated and show that it represents competency

demonstrated over a period of time

- assessment can be through simulated project-based activity and must include evidence relating to each of the elements in this unit.

In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in a manner appropriate to the skill levels of the candidate, any cultural issues that may affect responses to the questions, and reflecting the requirements of the competency and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. ***Bold italicised*** wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Computational task must include:

- arithmetic
- algebra
- geometry
- co-ordinate geometry
- matrices
- quadratic functions
- exponential and logarithmic functions
- trigonometric functions
- charts and graphs

Appropriate personnel may include:

- supervisor
- colleague
- foreman
- team leader
- supervising engineer
- teacher

Sources of computational data may include:

- tables
- graphs

Resources may include

- computer
- scientific calculator
- engineering tables and graphs
- regulations and codes of practices

Features of a scientific calculator may include:

- arithmetic functions
- trigonometric functions
- inverse trigonometric functions
- exponentials and logarithmic functions
- reciprocals
- scientific number representation
- engineering number representation
- rectangular to polar conversions

Enterprise procedures may include:

- the use of tools and equipment
- instructions, including job sheets, cutting lists, plans, drawings and designs
- reporting and communication
- manufacturers' specifications and operational procedures

Unit Sector(s)

Not applicable.

Competency Field

General Engineering.