

## Achievement Standard

**Subject Reference** Calculus 3.2

**Title** Integrate functions and use integrals to solve problems

**Level** 3 **Credits** 6 **Assessment** External

**Subfield** Mathematics

**Domain** Calculus

**Registration date** 16 November 2005 **Date version published** 30 January 2006

This achievement standard involves integrating functions and using integrals to solve problems.

	Achievement Criteria	Explanatory Notes
Achievement	<ul style="list-style-type: none"> <li>Integrate functions and use integrals to solve problems.</li> </ul>	<ul style="list-style-type: none"> <li>Functions will include a selection from the following types:               <ul style="list-style-type: none"> <li><math>ax^n</math>, where <math>n \in \mathbb{R}</math>, including <math>n = -1</math></li> <li>polynomials in expanded form</li> <li>exponential functions of the form <math>ae^{bx+c}</math> (base e only)</li> <li>trigonometric functions</li> <li>rational functions such as <math>\frac{ax+b}{x}</math>.</li> </ul> </li> <li>Problems will involve a selection from:               <ul style="list-style-type: none"> <li>rates of change problems, eg kinematics</li> <li>differential equations of the forms <math>y' = f(x)</math> or <math>y'' = f(x)</math> for the above functions or situations where the variables are easily separable</li> <li>finding areas under graphs of functions listed above</li> <li>finding volumes of solids of revolution around the <math>x</math> axis using polynomial functions</li> <li>finding areas using Simpson's Rule or the Trapezium Rule.</li> </ul> </li> <li>Diagrams may be provided for area and volume problems.</li> </ul>

	Achievement Criteria	Explanatory Notes
Achievement with Merit	<ul style="list-style-type: none"> <li>Use advanced integration techniques to find integrals and solve problems.</li> </ul>	<ul style="list-style-type: none"> <li>Integration will be based on a selection from:               <ul style="list-style-type: none"> <li>products of trigonometric functions</li> <li>simple algebraic substitutions</li> <li>rational functions of the type <math>\frac{f'(x)}{f(x)}</math></li> <li>rational functions of the type <math>\frac{ax+b}{cx+d}</math>.</li> </ul> </li> <li>Problems will be selected from:               <ul style="list-style-type: none"> <li>areas between graphs of polynomial functions</li> <li>areas under graphs of functions listed for achievement with merit or combinations of those listed for achievement eg <math>4x^3 \sin x^4</math> or <math>3x^5 + \cos x</math></li> <li>volumes of solids of revolution formed by rotating, around the <math>x</math> or <math>y</math> axis. The functions generated for integration will be of the types listed for achievement</li> <li>rates of change problems including kinematics</li> <li>differential equations where students may be required to write a differential equation to model a situation (applications could include growth and decay, inflation, Newton's Law of Cooling and similar situations) eg <math>y' = ky</math>.</li> </ul> </li> </ul>
Achievement with Excellence	<ul style="list-style-type: none"> <li>Solve more complex integration problem(s).</li> </ul>	<ul style="list-style-type: none"> <li>Problem(s) may include finding:               <ul style="list-style-type: none"> <li>areas between graphs of functions, other than polynomials, as listed above for achievement</li> <li>volumes of solids of revolution formed by rotating around an axis parallel to the <math>x</math> or <math>y</math> axis</li> <li>differential equations involving more difficult manipulation.</li> </ul> </li> </ul>

## General Explanatory Notes

- 1 This achievement standard is derived from *Mathematics in the New Zealand Curriculum*, Learning Media, Ministry of Education, 1992:
    - achievement objectives p. 86
    - suggested learning experiences pp. 25, 27, 29, 87
    - sample assessment activities pp. 88-89
    - mathematical processes pp. 24, 26, 28.
  - 2 The use of appropriate technology is expected but candidates must be able to demonstrate the skill of integration.
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## Quality Assurance

- 1 Providers and Industry Training Organisations must be accredited by the Qualifications Authority before they can register credits from assessment against achievement standards.
- 2 Accredited providers and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.

Accreditation and Moderation Action Plan (AMAP) reference

0226