Achievement Standard

Subject Reference	Mathematics and Statistics 2.7				
Title	Apply calculus methods in solving problems				
Level	2	**Credits**	5	**Assessment**	External
Subfield	Mathematics				
Domain	Calculus				
Status	Registered	**Status date**	17 November 2011		
Planned review date	31 December 2019	**Date version published**	5 February 2015		

This achievement standard involves applying calculus methods in solving problems.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Apply calculus methods in solving problems.	• Apply calculus methods, using relational thinking, in solving problems.	• Apply calculus methods, using extended abstract thinking, in solving problems.

Explanatory Notes

1 This achievement standard is derived from Level 7 of *The New Zealand Curriculum,* Learning Media, Ministry of Education, 2007; and is related to the achievement objectives
- sketch the graphs of functions and their gradient functions and describe the relationship between these graphs
- apply differentiation and anti-differentiation techniques to polynomials

in the Mathematics strand of the Mathematics and Statistics Learning Area. It is also related to the material in the *Teaching and Learning Guide for Mathematics and Statistics*, Ministry of Education, at http://seniorsecondary.tki.org.nz.

This standard is also derived from *Te Marautanga o Aotearoa*. For details of *Te Marautanga o Aotearoa* achievement objectives to which this standard relates, see the Papa Whakaako for the relevant learning area.

2 *Apply calculus methods in solving problems* involves:
- selecting and using methods
- demonstrating knowledge of calculus concepts and terms
- communicating using appropriate representations.

Relational thinking involves one or more of:

- selecting and using a logical sequence of steps
- connecting different concepts or representations
- demonstrating understanding of concepts
- forming and using a model;

and also relating findings to a context, or communicating thinking using appropriate mathematical statements.

Extended abstract thinking involves one or more of:

- devising a strategy to investigate a situation
- demonstrating understanding of abstract concepts
- developing a chain of logical reasoning, or proof
- forming a generalisation;

and also using correct mathematical statements, or communicating mathematical insight.

3 *Problems* are situations which provide opportunities to apply knowledge or understanding of mathematical concepts and methods. Situations will be set in real-life or mathematical contexts.

4 Methods include a selection from those related to:

- derivatives and anti-derivatives of polynomials given in expanded form
- gradient functions
- gradient at a point
- equation of a tangent
- turning points where $f'(x) = 0$ and their nature
- function from a derived function
- rate of change problems (such as kinematics).

5 Assessment Specifications for this achievement standard can be accessed through the Mathematics and Statistics Resources page found at http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/ncea-subject-resources/.

Replacement Information

This achievement standard replaced AS90286, AS90807, unit standard 5244, unit standard 5260, and unit standard 5261.

Quality Assurance

1 Providers and Industry Training Organisations must have been granted consent to assess by NZQA before they can register credits from assessment against achievement standards.

2 Organisations with consent to assess and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.

Consent and Moderation Requirements (CMR) reference 0233