Achievement Standard

Subject Reference   Calculus 3.4

Title   Manipulate real and complex numbers, and solve equations

Level   3   **Credits**   5   **Assessment**   External

Subfield   Mathematics

Domain   Algebra

Registration date   16 November 2005   **Date version published**   16 November 2005

This achievement standard involves manipulating real and complex numbers, and solving equations.

	Achievement Criteria	Explanatory Notes
Achievement	• Manipulate real and complex numbers, and solve equations.	• Manipulation will be based on a selection from: – conversion between polar and rectangular forms of real and complex numbers – simplification of sums, differences, products, and quotients of surds or complex numbers expressed in rectangular form – simplification of products or quotients of complex numbers expressed in polar form – use of De Moivre's theorem in the simplification of expressions such as $(5\operatorname{cis}\frac{\pi}{2})^{10}$. • Equations will be based on a selection from: – quadratic – cubic (limited to rational roots only) – exponential, such as $2^{3x+1} = 5$ – logarithmic, such as log(x + 5) = 1.34 (any base). • Candidates will be expected to have a knowledge of: – the remainder and factor theorem – the process of completing the square.

	Achievement Criteria	Explanatory Notes
Achievement with Merit	• Solve more complicated equations.	• Assessment will be based on a selection of those equations identified for achievement, plus: − irrational equations, such as $x + 2 = 2\sqrt{x}$ − cubic equations with one integer root and two complex roots − equations of the form $z^n = a$, $z^n = r\operatorname{cis}\theta$, $z^n = a + b\,\mathrm{i}$ where a, b are real and n is a positive integer.
Achievement with Excellence	• Solve problem(s) involving real or complex numbers.	• Problems will require a chain of reasoning. • Problems may include: − algebraic proofs − loci – geometric representation of complex numbers − multi-step equations − binomial expansions for small positive integer exponents

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. 164
   • suggested learning experiences pp. 25, 27, 29, 165
   • sample assessment activities pp. 166–167
   • mathematical processes pp. 24, 26, 28.

2   Familiarity with Argand diagrams will be expected.

3   Equations and manipulation questions could involve the use of variables instead of numbers. eg $z = (a + b\mathrm{i})(c + d\mathrm{i})$.

4   The use of appropriate technology is expected.

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