# Achievement Standard

**Subject Reference**          Calculus 3.3

**Title**                                Solve problems and equations involving trigonometric functions

**Level**     3          **Credits**     4          **Assessment**     Internal

**Subfield**     Mathematics

**Domain**     Trigonometry

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This achievement standard involves solving problems using trigonometric functions to model situations and solving trigonometric equations.

| | Achievement Criteria | Explanatory Notes |
|---|---|---|
| **Achievement** | • Solve straightforward problems with models involving trigonometric functions. | • Problems will involve a selection from given trigonometric functions of the form:<br>− $A\sin B(x + C) + D$<br>− $A\cos B(x + C) + D$<br>− $A\tan B(x + C) + D$<br>where C or D may be zero.<br><br>• Solution of the problems may require knowledge of amplitude, period, and frequency. |
| | • Solve straightforward trigonometric equations. | • Equations to be solved will involve a selection from the following forms:<br>− $A\sin B(x + C) = K$<br>− $A\sin Bx = K$<br>− $A\cos B(x + C) = K$<br>− $A\cos Bx = K$<br>− $A\tan B(x + C) = K$<br>− $A\tan Bx = K$. |

|  | Achievement Criteria | Explanatory Notes |
|---|---|---|
| **Achievement with Merit** | • Model situations using trigonometric functions and solve trigonometric problems. | • Candidates will be required to form an equation for the model and use the model to solve problems.<br>  − The form of the model will be selected from:<br>  $y = AsinB(x + C) + D$<br>  $y = AcosB(x + C) + D$<br>  $y = AtanB(x + C) + D$<br>  − Information that allows them to find A, B, C or D may be given or collected. The information may be in the form of data<br>  − Only one of C and D may be zero. |
|  | • Use trigonometric manipulation. | • Manipulation will include a selection from proving trigonometric identities and solving more difficult equations. It will involve some of the following:<br>  − reciprocal relationships<br>  − Pythagorean identities<br>  − compound angle formulae<br>  − double angle formulae<br>  − sum and product formulae<br>  and combinations of these.<br><br>• Where manipulation involves solving equations, candidates may be asked to provide:<br>  − a general solution<br>  − solutions within a specified domain. |

| | Achievement Criteria | Explanatory Notes |
|---|---|---|
| **Achievement with Excellence** | • Apply knowledge of trigonometric relationships to solve more complex problem(s). | • Problem(s) will require a chain of reasoning and may involve:<br>  − a proof<br>  − developing a formula from a given starting point(s)<br>  − rewriting a trigonometric expression in terms of a single trigonometric function<br>  − identifying and rectifying a flaw in reasoning<br>  − evaluation of the model (limitations, improvements, long-term accuracy) where data has been collected<br>  − solving more complex equations<br>  − solving 3-D trigonometric problems.<br><br>• Candidates will be required to choose and apply appropriate trigonometric relationships. (Knowledge of the sine and cosine rules may be required.) |

**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 p. 166
   • mathematical processes pp. 24, 26, 28

2  The use of appropriate technology is expected.

3  Candidates will be expected to use both radians and degrees.

4  Problems may include circular motion, pendulum motion, tides and biorhythms.

**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