Assessment Specifications

This document contains the assessment specifications for level 3 Calculus and level 3 Statistics and Modelling

Calculus - General information

Sub-field	**Mathematics**
Level	3
Mode of Assessment	Written Examination
For Year	2011
This document contains the assessment specifications for Achievement Standards:	**90635, 90636, 90638, 90639, 90833, 90834, and 90839**

Format for the assessment for all achievement standards

Within each paper all questions will have multiple parts and the question as a whole will provide opportunity for all grades of performance - achievement, achievement with merit, and achievement with excellence; there are no stand-alone questions for lower achievement grades. A single grade will be awarded holistically for each question with reference to the relevant criteria of the achievement standard. These grades will contribute to the overall level of performance awarded to the candidate.

Candidates need to attempt all questions in order to ensure they provide enough evidence.

Equipment to bring

An approved calculator is required.

Candidates who do not have access to graphing calculators may be disadvantaged. All permitted scientific or graphics calculators may be used by candidates entering level 3 Calculus including standards 90635, 90636, 90638, and 90639.

Candidates entering level 3 CAS Calculus standards (90833, 90834 and 90835) may use any silent, hand-held, non-printing calculator that contains its own power source and is not capable of transferring data between calculators by infra-red means during the examination.

Resources or information supplied

A Level 3 *Calculus Useful Formulae Sheet* will be supplied.

Special Notes

Candidates will be expected to answer questions that demonstrate an understanding of the mathematical concepts rather than directly transferring results from their graphing calculator. This may involve use of unknown constants.

Candidates and teachers should be aware of the standard of evidence that is required in answering questions. Statements indicating the evidence required can be found in the graphing calculator resource on the NZQA website.

As good mathematical practice, candidates should be encouraged to show intermediate steps clearly and logically communicating what is being calculated. Candidates who just give the correct response only may lose the opportunity to provide evidence for other grades or to have minor errors ignored.

Unless otherwise stated, rounding of any numerical answers to three significant figures will be of sufficient accuracy. Minor errors caused by rounding will not be penalised. Inappropriate use of units may count as a minor error and not be penalised. It is expected that relevant working will be shown.

When graphics calculators are used to solve a problem, candidates must provide evidence of their differentiation and integration skills.

Content/Context details

Problems will be set in real-life or in mathematical contexts.

Solutions for problems providing opportunities for achievement with merit and achievement with excellence may incorporate content knowledge from other Level 3 Calculus achievement standards.

Specific Information for individual External Achievement Standards

Achievement Standard Number 90635

Title Differentiate functions and use derivatives to solve problems

Domain Calculus

Version: 2 **Number of Credits:** 6

Further clarification of the standard

Candidates using graphic calculators will not receive credit for correct solutions to problems assessed against this standard where they have not provided the correct derived function.

Problems assessing optimisation at achievement and achievement with merit level will not require candidates to prove that a solution is a maximum or a minimum. This will be given by a statement such as:

'you may assume that $\frac{d^2P}{dx^2} > 0$'. "you do not need to confirm the nature of your solution"

Product and quotient rules for combinations of straightforward functions may be assessed at achievement level as provided for by version 2 of this standard.

Lists of types of problems in the explanatory notes at achievement, achievement with merit and achievement with excellence levels are not exclusive lists.

Problems will assess understanding of concepts of differentiation.

Candidates must show any derivatives that are needed to solve the problems.

Candidates may be required to form their own equations for problems that provide evidence for achievement with merit and achievement with excellence.

Achievement Standard Number 90636

Title Integrate functions and use integrals to solve problems

Domain Calculus

Version: 2 **Number of Credits:** 6

Further clarification of the standard

Candidates using graphic calculators will not receive credit for correct solutions to problems assessed against this standard where they have not provided the correct integrated function.

That is, candidates must show the results of any integration needed to solve a problem.

Candidates may be required to form their own equations for problems providing evidence for achievement with merit and achievement with excellence.

Achievement Standard Number 90638

Title	Manipulate real and complex numbers, and solve equations
Domain	Algebra
Version: 2	**Number of Credits:** 5
Further clarification of the standard	Candidates will be required to demonstrate high-level algebra skills in a logical manner, including the manipulation of pronumerals. Problems that allow candidates to provide evidence for achievement with excellence may require candidates to devise their own model.

Achievement Standard Number 90639

Title	Sketch graphs of conic sections and write equations related to conic sections
Domain	Algebra
Version: 3	**Number of Credits:** 3
Further clarification of the standard	Problems that allow candidates to provide evidence for achievement with excellence may require candidates to demonstrate a variety of techniques related to conic sections and differentiation. More complex conic section problems in assessment of achievement with excellence may require knowledge of foci, eccentricity and directrix.

Achievement Standard Number 90833

Title Demonstrate an understanding of calculus concepts when solving differentiation and integration problems

Domain Calculus

Version: 1 **Number of Credits:** 3

Further clarification of the standard

Candidates using CAS technology will not receive credit for correct solutions to problems assessed against this standard where they have not provided evidence of understanding showing a logical sequence of steps.

The types of problems listed in the explanatory notes are not exclusive.

Candidates may be required to form their own equations for problems that provide evidence for achievement with merit and achievement with excellence.

Achievement Standard Number 90834

Title Demonstrate an understanding of equations and expressions when solving problems

Domain Calculus

Version: 1 **Number of Credits:** 4

Further clarification of the standard

Candidates using CAS technology will not receive credit for correct solutions to problems assessed against this standard where they have not provided evidence of understanding showing a logical sequence of steps.

The types of problems listed in the explanatory notes are not exclusive.

Candidates may be required to form their own equations for problems that provide evidence for achievement with merit and achievement with excellence.

Candidates will be required to demonstrate high-level algebra skills in a logical manner, including the manipulation of pronumerals.

Problems that allow candidates to provide evidence for achievement with excellence may require the candidate to form their own model.

Achievement Standard Number 90835

Title	Demonstrate an understanding of patterns and relationships when solving problems
Domain	Calculus
Version: 1	**Number of Credits:** 4
Further clarification of the standard	Candidates using CAS technology will not receive credit for correct solutions to problems assessed against this standard where they have not provided evidence of understanding showing a logical sequence of steps. The types of problems listed in the explanatory notes are not exclusive. Candidates may be required to form their own equations for problems that provide evidence for achievement with merit and achievement with excellence. Problems that allow candidates to provide evidence for achievement with excellence may require the candidate to demonstrate a variety of techniques related to conic sections and differentiation. More complex conic section problems may require candidates to show knowledge of foci, eccentricity and directrix to achieve with excellence.

Assessment Specifications

This document contains the assessment specifications for **level 3 Statistics and Modelling**

Statistics and Modelling – General information

Sub-field	**Statistics and Probability (Statistics and Modelling)**
Level	3
Mode of Assessment	Written Examination
For Year	2011
This document contains the assessment specifications for Achievement Standards:	**90642, 90643, 90644, and 90646**

Format for the assessment for all achievement standards

The questions in each paper will not necessarily be arranged in order of increasing difficulty.

For any paper, sufficiency for achievement with excellence could require a candidate to show evidence of understanding in more than one question.

For any paper, a single question will provide evidence for more than one grade level. This evidence may occur through answering multiple parts of a question (e.g. Achieved in (a), merit in (b) and excellence in (c)), or the depth of understanding exhibited in a single question answer may determine whether that question is awarded achieved, merit or excellence. A single grade will be awarded holistically for each question with reference to the relevant criteria of the achievement standard. These grades will contribute to the overall level of performance awarded to the candidate.

Resources or information supplied

A Level 3 Statistics and Modelling Useful Formulae Sheet will be supplied.

Special notes

Units will not be assessed, but candidates may be required to interpret solutions in context.

Sensible rounding is expected. Early rounding may be penalised.

Further clarification of the standards

Candidates' solutions to questions providing evidence for achievement with excellence need to be communicated in a logical manner.

Where the term 'justify' is used, candidates' statements need to be supported by and linked to valid calculations or data.

Candidates need to be familiar with the 'Graphics Calculator Document' to gain an understanding of the requirements for working when using graphic calculators.

Equipment to bring

A calculator is required.

Candidates entering Level 3 Statistics and Modelling may use any silent, hand-held, non-printing calculator that contains its own power source and is not capable of transferring data between calculators by any means during the examination.

Specific Information for individual External Achievement Standards

Achievement Standard Number 90642

Title	Calculate confidence intervals for population parameters
Domain	Statistics
Version: 2	**Number of Credits:** 3
Content/Context details	Questions will be set in real-life contexts. Questions providing evidence for achievement with merit and achievement with excellence may require candidates to interpret their solutions in context. For achievement, the paper will be written in such a way that candidates must meet the standard in at least two of: • confidence intervals for means • confidence intervals for proportions • confidence intervals for the difference of two means.

Achievement Standard Number 90643

Title	Solve straightforward problems involving probability
Domain	Probability
Version: 2	**Number of Credits:** 4
Content/Context details	Questions will be set in real-life or mathematical contexts.

Achievement Standard Number 90644

Title	Solve equations
Domain	Algebra
Version: 2	**Number of Credits:** 4
Further clarification of the standard	For achievement, the paper will be written in such a way that candidates must meet the standard in at least two of: • solving systems of three linear equations • solving a non-linear equation using numerical methods • optimizing an objective function using linear programming. When solving non-linear equations candidates must ensure they learn both the Newton-Raphson method and the bisection method, as a question may specify which method is to be used. When using the Newton-Raphson method or the bisection method, candidates are expected to show evidence of each iteration (which may be by showing each value of $x_n - f(x_n)/f'(x_n)$ for the Newton-Raphson method or by giving a table showing each interval for the bisection method) as well as providing a final decision/comment. Candidates should be aware that, for the bisection method, an iteration is complete when the new interval is established. Rounding correctly to a specified accuracy is required for problems involving solving a non-linear equation using the Newton-Raphson method or the bisection method at the achievement with merit level. When optimizing an objective function using linear programming the calculation of vertices within the feasible region may be required, rather than just reading approximate values from the graph.
Content/Context details	Questions will be set in real-life or mathematical contexts.

Achievement Standard Number 90646

Title	Use probability distribution models to solve straightforward problems
Domain	Probability
Version: 2	**Number of Credits:** 4
Further clarification of the standard	For achievement, the paper will be written in such a way that candidates must meet the standard in at least two of: • Binomial distribution • Poisson distribution • Normal distribution. Continuity corrections should only be used when it has been stated that measurements have been rounded.
Content/Context details	Questions will be set in real-life or mathematical contexts.