Assessment Specifications
Calculus and Statistics and Modelling

General information

Domain	Mathematics
Level	3
Mode of Assessment	Written Examination
For Year	2011 (updated March 2011)
Standards	90635, 90636, 90638, 90639 90642, 90643, 90644, 90646

Format of the assessment – Calculus

All questions will provide opportunity for candidates to demonstrate all levels of performance: Achievement, Achievement with Merit, and Achievement with Excellence.

A single grade will be awarded holistically for each question.

Equipment to bring

An approved calculator is required.

Candidates who do not have access to graphing calculators may be disadvantaged. All permitted scientific or graphing calculators may be used by candidates entering level 3 Calculus.

Resources or information supplied

A Level 3 Calculus Formulae and Tables Booklet 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 graphing 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

Standard	90635
Title	Differentiate functions and use derivatives to solve problems
Domain	Calculus
Version	2
Number of Credits	6

Further clarification of the achievement standard

Candidates using graphing 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 $\frac{d^2P}{dx^2} > 0$" OR "You may assume that your solution is a minimum".

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.

Standard	90636
Title	Integrate functions and use integrals to solve problems
Domain	Calculus
Version	2
Number of Credits	5

Further clarification of the achievement 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.

Standard	90638
Title	Manipulate real and complex numbers, and solve equations
Domain	Algebra
Version	2
Number of Credits	5

Further clarification of the achievement standard

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

"Solve the following equation to fin an expression for x in terms of k:

$e^{kx-1} = 3$

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

Standard	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 achievement 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.

Format of the assessment – Statistics and Modelling

All questions will provide opportunity for candidates to demonstrate all levels of performance: Achievement, Achievement with Merit, and Achievement with Excellence.

A single grade will be awarded holistically for each question.

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

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 Formulae and Tables Booklet 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 achievement 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 Resource' to gain an understanding of the requirements for working when using graphing calculators.

Equipment to bring

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.

Standard	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.

Standard	90643
Title	Solve straightforward problems involving probability
Domain	Statistics
Version	2
Number of Credits	4

Content/Context details

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

Standard	90644
Title	Solve equations
Domain	Statistics
Version	2
Number of Credits	4

Further clarification of the achievement 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.

Standard	90646
Title	Use probability distribution models to solve straightforward problems
Domain	Statistics
Version	2
Number of Credits	4

Further clarification of the achievement 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.