2023 NCEA Assessment Report

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Subject: Mathematics and Statistics
Level: Level 2
Achievement standard(s): 91261, 91262, 91267

General commentary

The majority of candidates made good attempts across all questions in the papers and markers reported that the grades awarded appeared to be a good reflection of the skills demonstrated in their responses.

Candidates should attempt all parts of all questions. Question parts are not necessarily in order of difficulty, and each question part could contain multiple levels of award, depending on the quality of the response.

Studying past papers can be useful preparation for the examination but candidates should also be ready for unfamiliar problems, particularly at excellence level.

Candidates must read the questions carefully to ensure that the content of the context is understood fully, and are encouraged to check that they have answered what the question has required.

When taking the square root, candidates commonly neglected the negative value.

Report on individual achievement standard(s)

Achievement standard 91261: Apply Algebraic Methods in Solving Problems

Assessment

The questions assessed a candidate's understanding of Algebra and their ability to apply skills and concepts to unfamiliar and familiar situations. The examination covered candidates' ability to manipulate algebraic expressions, determine the nature of the roots of a quadratic equation, and form and solve linear, quadratic, and exponential equations

Commentary

Overall, candidates who had a good and broad understanding of the different concepts fared better than those who just knew the methods. The excellence questions covered a wide range of the syllabus.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- expanded and factorised to simplify an expression
- solved simple quadratic equations
- simplified using index rules and convert logs to index form
- made a start on questions (as opposed to leaving them blank).

Candidates who were awarded **Achievement with Merit** commonly:

- simplified negative and fractional exponents
- recognised multiple solutions to equations in context
- demonstrated understanding of how to use the discriminant
- manipulated algebraic fractions
- attempted a significant range of questions
- coped with complex expressions – simplifying log laws, creating and solving equations
- carried out a variety of multi-step problems successfully.

Candidates who were awarded **Achievement with Excellence** commonly:

- worked without error – using algebraic rearrangement correctly
- demonstrated understanding of the nature of log and indices - and the connection between the two so could simplify correctly
- demonstrated understanding of mathematical terms
- made a connection between an expression and its graph
- solved a "disguised" quadratic equation
- modelled a situation using a quadratic expression with non-unitary coefficient of x^2
- applied a mathematical solution to the context to develop a complete answer
- demonstrated some understanding of, and interest in, more than just the bare-bones syllabus for the course.

Candidates who were awarded **Not Achieved** commonly:

- did not demonstrate understanding of even basic concepts covered by this standard
- did not perform even elementary skills, such as solving a quadratic equation, factorising and simplifying an algebraic fraction, simplifying a log expression, or dealing with powers.

Achievement standard 91262: Apply Calculus methods in solving problems

Assessment

The questions assessed a candidate's understanding of Calculus and their ability to apply skills and concepts to unfamiliar and familiar situations. The examination appeared to correctly reward those candidates who the markers deemed to be working at Achieved and Merit level. Some of the algebra content in the Excellence questions did make the calculus processes more challenging.

Commentary

Substitution errors were common. In addition, a lack of working made it difficult for markers to see where the error was made. Candidates found difficulty in solving a cubic expression. Those who could sketch the function or derivative would often lack labelling of their axes.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- found the gradient of a function by correctly differentiating and substituting
- found the equation of a function given $f'(x)$, including '+ c'
- differentiated a function and set equal to zero
- sketched a reasonable gradient function (negative cubic) from a given negative quartic graph
- differentiated and substituted to give a rate of change
- formed a velocity equation from a given deceleration

- found turning points of a given function
- formed a reasonable relationship and correctly differentiate.

Candidates who were awarded **Achievement with Merit** commonly:

- found the value (or range of values) where a function was a min/max/decreasing
- differentiated and solved to find the turning points of a function
- sketched an accurate and well-shaped gradient function
- formed, differentiated, and solved an equation for area in a optimisation problem
- solved a kinematics question involving deceleration and velocity, and formed a general distance equation
- formed a tangent equation.

Candidates who were awarded **Achievement with Excellence** commonly:

- set up, solved and justified a multi-step optimisation problem
- found the value (or range of values) where a function was min / max/decreasing
- made sure they actually answered the question after reading the questions carefully.

Candidates who were awarded **Not Achieved** commonly:

- attempted to use non-calculus methods to solve problems
- did not complete basic differentiation or integration skills.

Achievement standard 91267: Apply probability methods in solving problems

Assessment

The questions assessed a candidate's understanding of Probability and their ability to apply skills and concepts to unfamiliar and familiar situations. In order to achieve this standard in this assessment, candidates will need to demonstrate an understanding of all three major areas of the curriculum: 2-way tables, probability trees, and the normal distribution. The examination, as a whole, did suitably reward candidates with the appropriate grade for the level of their understanding and application of the content for this Achievement Standard.

Commentary

Many candidates were familiar with and confident in applying "relative risk" at the appropriate times in problem solving. The majority of candidates were able to calculate relative risk values, however, this assessment also ensured that the candidates are also able to interpret these relative risk calculations. Some candidates were obviously not sufficiently familiar with answers appearing on their calculator in standard form (scientific form). Candidates should also understand that probabilities must have an answer between 0 and 1. Candidates who are confident in using fraction keys and normal distribution keys on their calculator are at a greater advantage.

The majority of candidates were lacking in confidence about interpreting a relative risk that led to a "less likely" conclusion. It was also difficult for candidates to recognise when to use relative risk and when it is not appropriate.

It is becoming more evident that most candidates now have access to a graphical calculator, which enables the normal distribution calculations to be evaluated significantly easier compared to those candidates using the traditional tables. There are also fewer candidates, consequently, now opting out of this normal distribution question.

Candidates who are confident, knowledgeable, and well-rehearsed in the three components (trees, tables, normal distribution) are the ones who are attaining the higher Merit and Excellence grades.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- recognised how a change in contextual circumstances would influence a normal distribution model
- indicated that the normal distribution model would not be appropriate
- calculated basic probabilities in a normal distribution problem
- used the relevant values to calculate probabilities from a two-way table
- used a probability tree to help evaluate simple probabilities
- calculated an appropriate relative risk
- calculated the Lower Quartile and Upper Quartile, using a normal distribution model, with the support of an annotated diagram
- evaluated simple expected values.

Candidates who were awarded **Achievement with Merit** commonly:

- recognised how multiple changes in contextual circumstances would influence a normal distribution model. and likely to indicate that the normal distribution model would not be appropriate
- provided an essential, appropriate diagram to support their evidence while solving the normal distribution problems
- calculated an appropriate relative risk, and interpreted its meaning clearly and accurately
- were able to form and solve a linear equation that evolved from the analysis of a probability tree and information provided
- used relevant values to calculate probabilities from a two-way table, and then use their result to justify a given claim
- calculated expected values using a two-way table, giving answers as whole numbers as per the context
- calculated expected values using a normal distribution model, giving answers as whole numbers as per the context
- calculated the inter-quartile range, using an inverse normal distribution model, with the support and evidence of an annotated diagram
- linked several branches on a probability tree to solve a more-involved probability problem.

Candidates who were awarded **Achievement with Excellence** commonly:

- calculated an appropriate relative risk, including “inverse relative risk”, and also interpret their meanings clearly and accurately
- calculated the standard deviation using an inverse normal distribution method, with the support and evidence of an annotated diagram
- formed, solved, and interpreted a linear equation that evolved from the analysis of a probability tree and information provided
- linked multiple branches on a probability tree to solve a highly-involved probability problem;
- were able to interpret and solve an involved probability problem
- distinguished between the appropriate usage of the phrases required in relative risk of “as likely”, “more likely”, “less likely”.

Candidates who were awarded **Not Achieved** commonly:

- were unable to decide whether to add, multiply or divide the various probabilities found
- incorrectly converted between fractions, decimals, and percentages
- approximated their solutions too vigorously, so that the final solution was too inaccurate to gain credit
- failed to interpret a calculator answer that was given in standard form
- unable to recognise that a probability answer must be between 0 and 1

- were not able to calculate basic probabilities in a normal distribution problem
- failed to recognise that the branches in a tree diagram must always add up to 1
- failed to select appropriate values to use from a two-way table
- were confused by the contextual nature of some of the questions.
