2024 NCEA Assessment Report

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Subject: Mathematics

Level: 2

Achievement standard(s): 91261, 91262, 91267

General commentary

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

Where a candidate gives two responses to a question, they need to make it clear which response they wish to be marked.

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 context is fully understood and are encouraged to check that they have answered what the question has required.

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 tested the candidate's 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 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:

- found the discriminant of a quadratic equation (Q1 b)
- identified the three correct factors and formed an equation but were not able to expand them correctly. Alternatively, they formed equations by substituting roots and made them equal to zero but were not able to solve a simultaneous equation
- solved a quadratic equation and factorised a quadratic equation
- cross-multiplied but did not expand correctly (Q2 c)
- formed a correct expression but did not put the brackets around the radius
- solved a log equation or understood a log expression (Q3 a,c)
- used a common base or could take logs on both sides (Q3 b).

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

- correctly manipulated algebraic expressions
- expanded at least two brackets with terms including fractional indices
- factorised the different types of quadratics and with unknowns
- used algebraic expressions to describe a situation
- worked through several steps with care
- worked with negative terms without error
- attempted excellence questions in part.

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

- used their mathematical knowledge to solve unfamiliar problems
- communicated their mathematical knowledge effectively
- were able to start and finish a proof using clear mathematical communication
- were able to form and solve a quadratic equation and justify their solution within the given context
- were confident manipulating complex equations and fractions.

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

- had very little knowledge of Level 2 Algebra
- did not follow instructions such as “solve” or “calculate the discriminant”
- lacked understanding of quadratic equations or log equations.

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.

Commentary

Responses to graph-related questions showed some improvement this year, but candidates still struggled with symmetry and smoothness in their drawings. To be awarded the marks, students need parabolas to be symmetrical, nicely shaped, and with no feathering (a single curve).

While substitutions were simple whole numbers, errors in more complex calculations were common, and many students failed to provide the necessary substitution evidence to earn MEI marks.

A recurring issue in kinematics questions was candidates neglecting to include the "+c" term or to account for the initial state. This indicates a lack of understanding of applying calculus to kinematics. As always, many candidates reverted to physics for this question, which involves no use of calculus so is not considered for any grade.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- differentiated a function and found a gradient
- integrated to find the function
- differentiated a cubic and solved the derivative
- solved a kinematics problem, including finding the constant of integration
- sketched a gradient function from a given function
- found a rate of change
- differentiated a function and found the coordinates given the gradient.

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

- integrated a gradient function and found the value of the constant
- found the turning points of a cubic
- drew a well-shaped, symmetrical negative parabola, with the correct roots
- found the equation of a tangent at a given point
- used kinematics to find an expression for distance including the constant of integration
- wrote a correct linear equation from a given gradient function, integrated to find the original function, including the constant, and provided a well-drawn graph of the original function.

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

- read and understood the information provided in the question and related the provided information with the relevant calculus and algebra content knowledge and skills
- used knowledge of turning points in relation to maxima and minima to solve problems, then justified their answer
- set up a practical problem, used calculus, and found the requirements asked
- plotted a parabolic function when given the function’s gradient function, giving the axis intercepts and stationary point as well as correctly identifying the function’s equation
- completed a proof successfully by using calculus to show that the minimum value of a given function is equal to another given term.

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

- used poor algebraic skills in solving quadratics
- neglected to include the constant of integration
- did not know how to differentiate or integrate
- could not sketch functions showing key concepts (turning points, roots of equations)
- did not understand the rate of change
- used physics to solve kinematic equations
- could not write the equation of a straight line
- made numerical errors when completing the substitution calculation.

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. To achieve this standard candidates needed to demonstrate an understanding of all three major areas of the curriculum: two-way tables, probability trees and the normal distribution. Candidates who clearly had a deeper understanding, displaying relational thinking and abstract thinking, were rewarded with higher grades.

Commentary

Question parts are not necessarily in order of difficulty and valuable recognition can be found by attempting all parts of the question. Many candidates do not attempt the written responses to questions which often can demonstrate the higher levels of understanding and thinking.

Appropriate working is expected and required, in all questions. An absence of working in many questions will be graded as "Correct Answer Only" and will only be awarded a grade u, at best. In normal distribution questions, an annotated diagram is expected for each part.

Some candidates were not familiar with the use of scientific standard form when the calculator produces very small values for the probabilities.

Some candidates were not sure which value from the two-way tables should be used as the denominator and the numerator. It was also evident that candidates are more adept at interpretations that follow when the relative risk is bigger than 1, compared to making appropriate conclusions when the relative risk is less than 1.

The use of appropriate diagrams in the solving of normal distribution problems is recommended and, in some parts, essential. Additionally, that a sufficient degree of accuracy is expected. This is usually regarded as at least four decimal places in probability questions, however, when this is applied to "expected values" then the final value needs to be rounded to a whole number, where appropriate in the context.

Many candidates tend to have a weaker aspect out of the three concepts assessed: probability tree diagrams, two-way tables, normal distribution. There is still a frequent weakness with candidates being able to answer effectively the normal distribution-focussed question.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- calculated basic probabilities within the context of a normal distribution problem, with or without the use of a graphical calculator
- calculated basic probabilities, with or without the support of a probability tree diagram
- calculated basic probabilitiues using information provided within a two-way table
- demonstrated a deeper knowledge in one or two components of the content but then very little, or none, in the third aspect
- found the z-value within a normal distribution problem but then could not utilise this value to find the solution to inverse normal problems or to find the standard deviation in normal distribution problems
- recognised basic features of a normal distribution
- found an approximate value for the median of a set of data provided in a graph
- recognised that a distribution was skewed because of the data provided
- recognised when a z-value should have a positive or negative value.

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

- found an expected value using probabilities found in a probability tree, realising that this value needed to be a whole number to relate to the context
- successfully interpreted and used inverse normal distribution techniques to find a required minimum value, with or without the use of a graphical calculator
- demonstrated a sequence of steps to find a missing standard deviation value, in a normal distribution question, with or without the use of a graphical calculator
- calculated relevant probability values that required the selection from multiple locations in a two-way table
- found relevant probability values that required inverse calculations on a probability tree diagram
- introduced and formed an algebraic equation that represented a situation with probabilities shown on a probability tree.

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

- used relative risk theories to calculate probabilities and also interpret those values appropriately and clearly
- recognised and interpreted, in sufficient detail, statistical features of a normal distribution and compared these features with an alternative distribution
- recognised why a given distribution may not be an appropriate distribution
- made relevant comments that could connect and compare estimated median values and shape, centres and spread of data
- introduced, formulated and subsequently solved an algebraic equation that represented a situation with probabilities shown on a tree
- communicated their solutions in a clear and precise manner, utilising annotated normal distribution and probability tree diagrams
- calculated and interpreted relative risk values from a two-way table and which the subsequent comments needed to relate to “less likely”, using these values to evaluate a claim made
- made valid and appropriate comments to the responses that required deeper understanding and insight, connecting values found and general theory
- were confident, knowledgeable, and well-rehearsed about all three aspects of the achievement standard
- combined calculating relevant probabilities, comparing probabilities, perhaps with relative risk calculations, and identifying the errors in the reasoning of a suggested interpretation.

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

- did not understand when probabilities should be added and when they should be multiplied
- were not familiar with the definition of a distribution and hence could not describe any features of a distribution
- chose only to answer select parts of the entire assessment, indicating a lack of knowledge and understanding of all three components of the achievement standard
- were not able to find simple probabilities requiring use of normal distribution theories, with or without the use of a graphical calculator
- were not able to find simple probabilities requiring interpreting values from a probability tree
- were not able to find simple probabilities requiring interpreting values from a two-way table
- submitted probability answers in which values were not in the range of $0 < p < 1$
- were not able to estimate the median from a given distribution within sufficient accuracy
- were not confident in their knowledge of relevant, necessary probability definitions and how they should be applied in context.