NZQA
New Zealand Qualifications Authority
Mana Tohu Matauranga O Aotearoa

Assessment Report

Level 2 Mathematics and Statistics 2016

Standards 91261 91262 91267

Part A: Commentary

Candidates were assessed on the application of knowledge of mathematics from level 7 of the New Zealand Curriculum, however candidates are reminded that knowledge from level 6 or lower is also expected, e.g. graphing knowledge within the algebra assessment and algebra knowledge within the calculus assessment.

Part B: Report on Standards

91261: Apply algebraic methods in solving problems

Candidates who were awarded **Achievement** commonly:

- solved simple logarithmic equations, showing an understanding of the properties of logarithms and logarithmic statements
- applied logarithmic rules to simplify an expression
- manipulated expressions involving a range of exponents and indices
- interpreted, in a mathematical context, the information presented in a question and could set up a mathematical model to solve that problem
- factorised quadratic equations with the coefficient of x^2 greater than one and determined the solutions
- derived a quadratic equation from known solutions
- manipulated an equation with indices to create a common base
- used algebraic techniques to write parabolic equations (including the coefficient for x^2) which modelled practical situations represented in graphs
- re-wrote an algebraic rational equation and gathered terms in preparation for making a new subject
- demonstrated they could complete the square for a quadratic expression
- understood the meaning of 'solutions of an equation' and their relationship to the discriminant
- applied the quadratic formula to obtain solutions to equations with non-numeric coefficients

- used a graphics calculator to solve problems without algebraic evidence, so depriving themselves of the opportunity to gain a higher grade.

Candidates who were assessed as **Not Achieved** commonly:

- did not fully demonstrate an understanding of the knowledge required by the standard with respect to indices, discriminants, roots and solutions to equations
- appeared unfamiliar with the process of completing the square
- were unable to convert a rate of depreciation into a relevant decimal
- were unable to rewrite a logarithmic equation into index form
- manipulated fractions incorrectly using their calculator
- did not form a common base when solving an equation involving multiple indices terms
- failed to recognise that a graph cutting the x axis corresponds to y = 0
- omitted the use of brackets and incorrectly substituted values (especially negatives) into rules
- misunderstood that the coefficients for the discriminant relate to the quadratic equation being in the form “= 0”
- were unable to write an equation(s) to model a practical situation mathematically
- did not realise when an answer was correct and so went on to undo a correct response by applying incorrect simplification techniques
- did not use a graphics calculator to solve straight forward quadratic equations or check the validity of their answers.

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

- demonstrated the ability to manipulate a range of algebraic expressions including logarithms, indices, fractions, rational expressions and factorising
- found a model for a situation in context, and derived an appropriate and meaningful solution(s) in context
- solved a range of equations including logarithmic and exponential to provide an answer in context, when appropriate
- used the solutions of a pair of quadratic equations to demonstrate the stated relationship between the solutions
- formed a quadratic equation from solutions and identified the coefficients for each term
- rearranged a rational expression
- applied the discriminant to an equation and determined the solutions written as an inequality
- related the concepts and solution from one question to a subsequent question.

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

- applied algebraic and logarithmic skills to solve a problem and determine all valid solutions
- used the quadratic formula to find solutions to a pair of equations, then determined the relationship between the solutions
- understood the properties of the discriminant and successfully used it to find all relevant solutions to a given problem, identifying all constraints
- developed an equation or equations to model a contextual situation and used algebraic techniques to answer the problem in context
- applied the laws of indices, logarithms and algebra to solve an equation with valid solutions

- used their knowledge of quadratics and applied the information provided on a graph to solve a problem after having made suitable substitutions, then determine a valid solution in context.

Standard-specific comments

To reach Achieved or higher grades, candidates needed to demonstrate algebraic techniques.

The vocabulary of algebra needs to be understood so that candidates fully understand the meaning of each question.

Any constraints which are relevant to either the context or algebraic answer need to be applied to final solutions.

Consideration should be given by candidates to checking answers to ensure their validity and that the final answer represents the context of the question being asked.

91262: Apply calculus methods in solving problems

Candidates who were awarded **Achievement** commonly:

- differentiated basic polynomials
- found the gradient at a point
- drew a parabola (gradient function) with the correct x intercepts
- drew a positive cubic given a gradient function of a parabola
- anti-differentiated basic polynomials, including finding the constant of integration
- answered kinematic problems using physics formulae.

Candidates who were assessed as **Not Achieved** commonly:

- did not know when to substitute and when to solve
- only differentiated but did not know what to do to solve the required question
- completed Achievement-level questions but often included minor errors which could not be ignored at this level
- were unable to relate relevant features of function / gradient sketches
- did not find the constant of integration.

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

- interpreted given information and successfully used multiple pieces of information
- used calculus in answering a question without communicating exactly what the answer to the question was
- found a local minimum without justification
- found the equation of a tangent given a function and coordinate

- found an unknown variable in an expression given the gradient
- drew a cubic with the correct turning points given a gradient function of a parabola
- used kinematics without communicating exactly what the answer to the question was.

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

- found an equation of a function given a gradient function with an unknown variable and a coordinate on the function
- found a local minimum and justified it accurately
- dealt with unfamiliar situations, like multiple variables
- communicated the answer to the question
- applied calculus to a rate of change problem involving pi
- solved a quadratic with a variable and gave the positive and negative solutions
- used inequality signs correctly
- answer kinematics problems using calculus
- showed working to make it clear when the constant of integration was zero
- communicated effectively with correct calculus notation, good algebra skills and no incorrect mathematical statements.

Standard-specific comments

Some candidates showed weak basic algebraic manipulation and solving skills. If this resulted in a minor error that did not affect the level of difficulty of the problem, this may have been ignored.

91267: Apply probability methods in solving problems

Candidates who were awarded **Achievement** commonly:

- drew a probability tree diagram from the information provided
- found straightforward probabilities from a probability tree diagram
- understood that proportion and risk are calculated in the same way as a probability
- calculated straightforward probabilities from information presented in contingency tables
- found probabilities involving a normal distribution, either using a graphic calculator or probability tables
- made valid comments on either a frequency histogram or a probability distribution graph
- found proportions from a frequency histogram
- understood the link between two tables of information that presented probabilities in a different form, i.e. two tables rather than in a tree diagram or a contingency table.

Candidates who were assessed as **Not Achieved** commonly:

- could not draw probability tree diagrams
- did not recognise the similarity between proportions and probabilities
- added or divided probabilities along branches on a probability tree
- could not solve problems with contingency tables, particularly when the sample space was reduced

- did not understand absolute risk
- could not use their graphic calculator to solve normal distribution problems
- did not make the link between the calculation of a Z value in the standard normal distribution and the probability associated with it when using tables
- did not use statistical language when describing comparisons between a normal probability distribution and a frequency histogram.

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

- calculated a relative risk
- calculated probabilities for multiple events using a probability tree diagram
- solved an inverse normal distribution problem when given a probability
- used statistical language effectively to compare two graphs
- completed a contingency table when provided with more complex information, and then used it to calculate a probability.

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

- applied conditional probability correctly when given a complex probability problem
- calculated, and then interpreted a relative risk correctly
- had a comprehensive knowledge of the three aspects of centre, shape and spread when comparing graphs and used supporting numerical evidence
- applied their understanding of probability to complex probability situations
- solved a complex probability problem where two tables of probabilities were given and demonstrated an understanding of the relationship and connection between the tables
- linked answers from previous questions to a current question and evaluated a claim, providing appropriate evidence.

Standard-specific comments

While latitude was given in the marking, many candidates were inclined to round or truncate their answers at an intermediate stage, rather than at the end of a problem.

The concept of proportion and its relationship to probability and risk is not well understood by some candidates.

There was an improvement in the presentation of answers where distributions were compared. However, there was weakness in the use of statistical language and in using a methodical approach to compare shape, centre and spread.

Of note were the increased number of candidates who described shape well, and especially the concept of ‘skewness’.

Candidates were required to construct a tree diagram and contingency table without being directed to do so. Some candidates lacked this skill

Mathematics and Statistics subject page