

# **National Certificate of Educational Achievement**

## **2014 Assessment Report**

### **Mathematics and Statistics Level 2**

- 91261      Apply algebraic methods in solving problems**
- 91262      Apply calculus methods in solving problems**
- 91267      Apply probability methods in solving problems**

## COMMENTARY

In general, candidates who gained higher grades:

- interpreted, in a mathematical context, the information presented in a question using the correct language and were able to solve problems in context, especially where they are required to form models
- used their graphics calculator appropriately showing evidence of applying their knowledge of the standard rather than just providing an answer generated by their calculator
- exhibited a range of skills in solving problems
- demonstrated an understanding of mathematical language e.g. “real solutions”.

Candidates who did not achieve higher grades:

- showed a lack of algebra skills which influenced the level of achievement across other standards
- used guess-and-check, and gave correct-answers-only, which did not provide evidence for higher levels of achievement
- did not use their graphics calculator to check the validity of their answer
- demonstrated a weakness with numerical skills including dealing with fractions and decimals even with a calculator allowed.

## STANDARD REPORTS

### 91261 Apply algebraic methods in solving problems

#### ACHIEVEMENT

**Candidates who were awarded Achievement for this standard demonstrated the required skills and knowledge. They commonly:**

- manipulated expressions involving a range of exponents including logs and rational expressions
- understood the meaning and nature of roots of equations and their relationship to the discriminant
- were competent in factorising at NZ Curriculum level 7.

#### NOT ACHIEVED

**Candidates who were awarded Not Achieved for this standard lacked some or all of the skills and knowledge required for the award of Achievement. They commonly:**

- did not demonstrate an understanding of the knowledge required by the standard with respect to indices, discriminants, roots and solutions to equations, real roots
- cancelled terms in algebraic fractions incorrectly
- incorrectly substituted values into equations, particularly negative values
- did not understand how to write the general form of a parabola
- could not express a rate of decrease using correct terminology such as percentage or proportion.

## **ACHIEVEMENT WITH MERIT**

**In addition to the skills and knowledge required for the award of Achievement, candidates who were awarded Achievement with Merit commonly:**

- demonstrated the ability to manipulate a range of algebraic expressions including indices, fractions and factorising
- appropriately applied the quadratic formula
- knew the relationship between the discriminant and real roots of a quadratic equation
- could find a model for a situation in context.

## **ACHIEVEMENT WITH EXCELLENCE**

**In addition to the skills and knowledge required for the award of Achievement with Merit, candidates who were awarded Achievement with Excellence commonly:**

- applied algebraic skills, often using their own sophisticated approach, to solve an unfamiliar problem and determine all valid solutions
- understood the properties of the discriminant and successfully used it to find all relevant solutions involving inequalities in solving a given problem
- used their knowledge of quadratics and factorising techniques to solve a polynomial equation (quartic) and determine all valid solutions
- solved rational equations and applied algebraic logic to validate the final solution
- were able to successfully develop and apply a quadratic model in context by incorporating knowledge of other strands of mathematics like graphing
- understood and applied the laws of indices and logarithms to solve an equation
- were able to successfully develop and solve an exponential model in context.

## **OTHER COMMENTS**

Candidates were often careless in their 'squaring of negative values' following substitution into equations, often resulting in final answers which were meaningless in the context of the question – such a solution should have been an alarm that something was wrong in the earlier working.

## **91262 Apply calculus methods in solving problems**

### **ACHIEVEMENT**

**Candidates who were awarded Achievement for this standard demonstrated the required skills and knowledge. They commonly:**

- understood processes associated with gradient including finding tangents to curves, turning points and rates of change
- were able to determine when to differentiate and when to integrate and applied the processes appropriately
- substituted into formulae correctly and had a basic understanding of basic algebraic techniques
- demonstrated accurate graphing skills to sketch gradient functions.

## **NOT ACHIEVED**

**Candidates who were awarded Not Achieved for this standard lacked some or all of the skills and knowledge required for the award of Achievement. They commonly:**

- were unable to distinguish between the need to differentiate and integrate or apply the techniques appropriately
- failed to recognise the relationship between a gradient function and an original function and could not graph the respective relationship between the two
- would make equations equal to zero without understanding
- substituted incorrect values into derived functions
- misunderstood the significance of the constant of integration and how to calculate it correctly or did not recognise that an integrated function required a constant.

## **ACHIEVEMENT WITH MERIT**

**In addition to the skills and knowledge required for the award of Achievement, candidates who were awarded Achievement with Merit commonly:**

- managed to deal with multi-step problems including identifying turning points
- had a solid grasp of the algebra required
- understood the relationships in kinematics
- answered questions in context relevant to the task
- could justify why a point is a maximum or minimum using calculus.

## **ACHIEVEMENT WITH EXCELLENCE**

**In addition to the skills and knowledge required for the award of Achievement with Merit, candidates who were awarded Achievement with Excellence commonly:**

- showed full understanding of a task and were able to think through the steps required to solve it
- could form a model
- specifically showed working and thinking when the constant of integration was equal to zero
- could justify why a point is a maximum or minimum using a variety of calculus concepts
- explained why a function is decreasing between two points without specifically being asked to in the question
- were able to present solutions in correct mathematical statements
- had sound algebra skills
- solved a multi-step kinematics problem with basic differentiation skills
- understood key concepts.

## **OTHER COMMENTS**

The basic concepts of calculus relating to gradients, integrals and rates of change were generally well understood by the candidates who completed this standard. A higher level of algebraic competence would ensure candidates could use the calculus skills they possess more effectively at the higher levels of achievement. Applying knowledge accurately to solve the problem in context and giving contextually appropriate solutions would also result in higher achievement grades. It is encouraging to observe the connections between concepts being represented in a relational way by candidates.

A number of candidates had difficulty explaining the existence of a zero constant.

## **91267 Apply probability methods in solving problems**

### **ACHIEVEMENT**

**Candidates who were awarded Achievement for this standard demonstrated the required skills and knowledge. They commonly:**

- understood and interpreted simple probabilities from situations involving contingency table and normal distribution
- calculated an absolute risk
- made valid points in context when discussing features of a graph or distribution
- applied given probabilities and made correct conclusions.

### **NOT ACHIEVED**

**Candidates who were awarded Not Achieved for this standard lacked some or all of the skills and knowledge required for the award of Achievement. They commonly:**

- did not realise that proportions are probabilities
- showed little or no working
- could not correctly identify the group of interest when calculating a probability from a table
- could not understand probabilities associated with outcomes given in table form
- could not understand the standard normal distribution
- talked very vaguely about distributions without giving numerical support
- did not use statistical language when describing features of a distribution
- multiplied probabilities when addition was appropriate and vice versa.

### **ACHIEVEMENT WITH MERIT**

**In addition to the skills and knowledge required for the award of Achievement, candidates who were awarded Achievement with Merit commonly:**

- could successfully calculate a relative risk and probabilities including when the sample space was reduced
- used relational thinking to interpret and compare two histograms with different scales and explained an answer in context
- could interpret situations associated with probability.

### **ACHIEVEMENT WITH EXCELLENCE**

**In addition to the skills and knowledge required for the award of Achievement with Merit, candidates who were awarded Achievement with Excellence commonly:**

- assessed a claim correctly and supported their answer with appropriate statistical calculations
- interpreted a relative risk correctly and used it to make a meaningful comparison
- found a z-score using inverse normal probability and then successfully calculated a population mean from the given information
- compared two related sample distributions using centre, shape and spread using statistical language in a logical manner with relevant supporting numerical evidence
- interpreted and calculated multiple event probabilities using a tree diagram
- set up an algebraic equation involving probabilities and then solved it.

## OTHER COMMENTS

While there were some quality scripts presented for the 2014 paper, in general the standard of scripts at the upper end was disappointing. The paper had a number of question parts which were a little different in their presentation from the previous two years. While candidates appeared to handle well the sections that were familiar to them and which they clearly expected, they showed a lack of adaptability to successfully answer the questions that were less familiar.

Question 1 was the best done question. Most candidates were able to successfully tackle the achieved parts of this question, but relatively few realised that they should be taking a relative risk approach to answer the claims in the later parts.

In Question 2 candidates had been well-prepared for the basic problems associated with the Normal Distribution. However, very few candidates could make much sense when it came to interpreting the two sample distributions, and even fewer were able to show a good grasp of statistical language and reasoning.

Question 3 involved a relatively simple game of chance. It was very poorly done. While most candidates were able to show basic understanding of the probability table, few were able to apply the knowledge to build up and interpret the processes involved in tree a diagram. This appears to be a clear area of weakness in candidates' understanding of probability.

In preparing candidates for future papers attention needs to be paid to the following areas:

- relative risk is an important tool when assessing claims that involve risk.
- risk needs to be understood as a probability.
- candidates need to take a methodical approach to comparing distributions and consider all of centre, shape and spread.
- using tree diagrams is an important skill in solving many probability problems.