Assessment Report

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Level 1 Mathematics and Statistics 2021

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Standards 91028 91031 91037

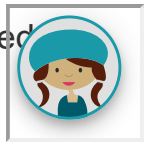
Part A: Commentary

The examination provided opportunities for candidates to demonstrate knowledge and understanding of the whole syllabus. Candidates will be advantaged by preparing for the examination with a thorough review of several years past examinations to familiarise themselves with possible content and the style of wording of the assessment.

Question parts may follow-on from each other and be linked, so a candidate should be actively looking for this connection and, if necessary, turning to earlier pages in the question booklet.

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.

Candidates must read the questions carefully to ensure that the content of the context is understood fully, and are encouraged to use bullet-point responses so that they can check-off that they have answered what the question has required.



The examination will assume that the student will have access to a scientific calculator (or graphical calculator) which will enhance their performance. However, candidates need to remember that answers written directly from a calculator are likely to be awarded an achieved grade for that question part, at best. Candidates should back-up their answer with supporting working.

Each separate Achievement Standard will require a range of required methods and procedures, all of which may be assessed. Similarly, a combination of these methods and procedures may be required in any part of any question for the award of any level of achievement. Evidence of relational and abstract thinking may be demonstrated by the linking of these, leading towards all levels of achievement within that part of the question.

Part B: Report on standards

91028: Investigate relationships between tables, equations and graphs

Examinations

The examination contained three questions, each with multiple parts. Candidates were required to answer all parts of all questions. The questions covered the requirements of the 2021 assessment specifications and achievement standards at Level 6 of the New Zealand curriculum.

Within forming and drawing the relationship between linear, quadratic and exponential functions, candidates were required to comment on and interpret these results, using equations, to solve problems within context. Candidates who had prepared themselves thoroughly in terms of all aspects of tables, equations and graphs in relation to linear, quadratic and exponential graphs were able to perform at a level that justified their level of preparation. Candidates should be familiar with the features of linear, parabola and exponential graphs.

Question One focussed mainly on three people playing a computer game. Their points total could be modelled by linear, quadratic and exponential equations. Candidates needed to form the equations of the three models, draw the models and interpret the leading and winning situation of the three players during the game. The higher grades were attained by how well the candidate compared, communicated and commented upon the points total of the three players. There

was also the opportunity to display knowledge of linear graphs and their transformation.

Question Two focussed mainly on the analysis and interpretation of quadratic and exponential functions to model the digging of holes at a popular New Zealand beach. The models were describing the size, shape and depth of the holes as they filled with water. Candidates had to form these various models and then analyse them using their graphs knowledge and understanding. There was also the opportunity to display the skills necessary to draw an exponential graph, given its equation, on a set of axes prepared for the candidate.

Question Three focussed on two differing aspects of the achievement standard content. The first part required the candidate to form the quadratic equation for a given pattern context. Candidates then had to draw the graph but recognise that it should be displayed as a graph representing the discrete points applicable to the pattern. The second part required candidates to investigate the situation of a person creating a planter-box from a set length piece of wood. Candidates had to form the equation that would lead to the various areas, draw the graph, show their table of values and hence make various deductions from the evidence that they collected. Being able to combine all three aspects of equation, table and graph along with appropriate comments would lead a candidate to achieving a higher grade.

There was also the opportunity to display knowledge of finding the equation of a simple parabolic graph.

Observations

Success for a candidate on this achievement standard will expect students to be able to work with, linking and commenting upon all three aspects of tables, equations and graphs.

Candidates need to be familiar with and confident in applying aspects in all of linear, quadratic and exponential functions.

Candidates will need to be able to create tables and graphs and equations from a problem in context. The application of their graphs knowledge and understanding will refer to context in a variety of situations. These interpretations could include needing to distinguish between whether the graph being drawn should be continuous, discrete or piecewise (step).

Candidates will be required to distinguish whether the context being analysed is linear, quadratic or exponential or a combination of these. Forming the equations

of each of these will be a crucial aspect of the assessment. Similarly, being confident in their drawing and interpretation will also be important. For the higher grades, candidates will need to apply, interpret and comment upon a combination of tables, graphs and equations of linear, quadratic and exponential functions.

Equations for a function must be given as an equation and not as an expression i.e. $y = f(x)$.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- were able to form the equation of a linear function from its graph
- were able to form the equation of a quadratic function from its graph or from context
- were able to draw a parabolic graph from t he context of the information provided
- were able to draw an exponential graph from its equation with enough accuracy
- could produce values in a table from the context of the information provided
- attempted enough of the opportunities available within the examination
- were familiar with and reasonably confident with at least two out of linear, quadratic and exponential functions
- were able to find the relationship between tables and graphs
- were able to find the relationship between tables and equations.

Candidates whose work was assessed as **Not Achieved** commonly:

- were not able to form the equation of a linear function from its graph
- were not able to form the equation of a simple quadratic function from its graph
- were not able to draw an exponential graph from its given equation
- were not able to complete a table of values from a given pattern in context
- did not complete enough of the examination.

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

- were able to transform a given graph and form its new equation
- could formulate a quadratic equation from a given parabolic graph where the coefficient of x2 is not unity
- could formulate an exponential equation from given information
- could draw graphs of a linear function and an exponential function from given information
- has knowledge of how altering the coefficients of quadratic graphs will affect the features of the graph itself
- could interpret, link and comment upon a pair of relationships of tables, equations and graphs
- could recognise and distinguish between relationships which are either continuous or discrete
- could interpret and form equations for a pattern in context.

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

- could link all understandings of tables, equations and graphs in context and interpret and comment on these by describing a variety of features of graphs
- could form and solve quadratic equations to solve problems, using a breadth of good algebra skills or graphical methods
- had a clear and deep knowledge and understanding of all aspects of linear, quadratic and exponential graphs in context
- could utilise a combination of all of equations, tables and graphs to interpret and solve an optimisation problem.

91031: Apply geometric reasoning in solving problems

Examinations

The examination contained three questions, each with multiple parts. Candidates were required to answer all parts of all questions. The questions covered the requirements of the 2021 assessment specifications and achievement standard at Level 6 of the New Zealand curriculum.

Question One focussed mainly on diagrams related to the context of geometric string art. Applications of Pythagoras' Theorem and trigonometry were utilised within the various question parts. Some of the question parts required relational thinking and abstract thinking to be able to interpret the situations present, requiring multiple steps of working and interpretation. Candidates were required to be able to produce their solutions in an appropriate correct mathematical manner.

Question Two focussed mainly on solving and analysis of problems involving the knowledge of and use of the various geometric circle theorems. There was also an opportunity for candidates to solve a problem requiring deeper relational thinking in relation to straight line geometric reasoning. The use of algebra in solving a problem in which angles were not given numerically was required for the question that provided the opportunity for accessing the excellence target.

Question Three focussed on further opportunities for displaying knowledge and skills in solving problems involving Pythagoras' Theorem and trigonometry. Some candidates chose to utilise a similar triangles method approach while solving a problem. This question also assessed the candidates' knowledge with respect to the use of bearings linked to trigonometry as well as trigonometry applied to a three-dimensional situation.

Observations

Students need to be aware that success within this Achievement Standard requires knowledge and understanding of all aspects of the components i.e. Pythagoras' Theorem; Trigonometry; Straight Line Geometry; Circle Geometry; Similar Triangles.

Problems will aim to link these various aspects so that candidates will be required to be confident with all aspects.

All diagrams are always drawn "not to scale" so candidates should not make assumptions based on how the diagram looks, but should respond based upon geometric reasoning and interpretation. The candidate must not assume any information not provided in the question without deciding, with justification, if that information is actually true or not.

Candidates should be aware that the presentation of their solutions need to be mathematically correct at all levels of attainment. Methods which are not presented in the necessary formal manner will not be awarded grades.

Candidates are encouraged to use the labelling provided in the question to help them produce their solution in a clear and logical manner. The labelling provided

is given as a help to the candidate.

Candidates should develop the habit of self-checking to decide if their solutions are sensible and appropriate solutions to the problem given.

Candidates will need the formal geometric reasons to provide the justification of their solutions. When the question stipulates that “justify your answer with clear geometric reasoning” then the examiner requires each step of the solution to have a geometric justification.

Evidence can be obtained from every question part which are not necessarily in order of difficulty within a question. Candidates need to be aware that the application of their knowledge and understanding will be in context in a variety of situations.

Grade awarding

Candidates who were assessed as **Achievement** commonly:

- attempted most parts of all questions
- possessed knowledge in Pythagoras’ Theorem, trigonometry and straight-line geometry but were not confident with the necessary circle geometry theorems
- were able to find the values of missing angles using geometric reasoning knowledge but were not able to supplement this with the formal reasoning behind their decisions.

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

- did not attempt enough proportion of the opportunities available throughout the entire paper
- did not able to recognise and select the appropriate method that was required in a specific question part
- could not distinguish between the required different methods, using Pythagoras’ Theorem, in finding the length of the hypotenuse or of the alternative sides
- could not choose the correct trigonometric ratio necessary to solve a problem
- did not recognise that Pythagoras’ Theorem and trigonometric methods can only be applied in right-angled triangles

- did not have enough knowledge of the geometric circle theorems.

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

- could produce a solution to a geometric reasoning problem, requiring multiple steps of thinking, and produce their result in the necessary systematic, formal, mathematical manner
- were knowledgeable about all aspects of the material included in this Achievement Standard
- were confident in the use and application of problems involving similar triangles
- were able to apply geometric reasoning to a problem involving bearings.

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

- could solve a problem involving multiple steps whilst communicating heir method and reasoning in a precise and clear manner
- were able to apply geometric reading to a three-dimensional trigonometric problem, including presenting the solution in a precise and clear manner
- were able to incorporate algebraic skills and knowledge into solving a geometric reasoning problem, establishing an algebraic relationship.

91037: Demonstrate understanding of chance and data

Examinations

The examination contained three questions, each with multiple parts. Candidates were required to answer all parts of all questions. The questions covered the requirements of the 2021 assessment specifications and achievement standard at Level 6 of the New Zealand curriculum. Within reading and interpreting statistical representations or analysing statistical investigations, candidates were required to comment on the appropriate and / or misleading aspects of graphical displays of data or statistical information provided in other formats.

Question One focussed on the analysis and interpretation of bivariate data in context. The context was of claims made through the ACC. The introductory paragraph provided some background knowledge on this context so it was essential that candidates take the opportunity to read through this information

carefully. The aspects of bivariate data being investigated were interpreting different features, lines of best fit, usefulness of the line of best fit. This question also contained aspects related to probability and requiring candidates to judge the effectiveness of deductions being made.

Question Two focussed mainly on the analysis and interpretation of multivariate data provided in a box and whisker graph. Students were assessed on their knowledge and understanding of differing forms of average, comparing distributions, making an inference from the box and whisker graph, and sampling variability. There was also a further opportunity for students to display their knowledge and understanding of probability with information provided in a two-way table.

Question Three focussed on interpreting various time series graphs, similarly following through on the context of ACC claims from dog injuries. Students needed to know how to read information from a time series graph, make predictions related to confidence levels, discuss trends and unusual features, and to compare time series graphs related to differing aspects of the context.

Observations

Candidates need to be aware that essay-style responses are not required. Bullet-point answers are acceptable and may help the candidate ensure that they have answered all aspects of the question.

When interpreting statistical graphs then knowledge and understanding of what the graphs is communicating is essential. For this achievement standard examination time series, bivariate data graphs, and multivariate data graphs should be expected.

Candidates should be familiar with the terminology of “statistical models”.

Candidates may be expected to find conditional probabilities using an informal approach.

There are often comments and directions in the questions that should guide the candidates towards the expectation of a full answer e.g. “describe and interpret at least two features,” “justify your answer using statistical reasons,” “give at least two different statements to support your decision,” “describe at least three different key features,” “justify your prediction,” and “provide evidence from the graph”.

A significant number of candidates did not support their decision with appropriate justification which the question required and stated.

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Grade awarding

Candidates who were assessed as **Achievement** commonly:

- could calculate simple probabilities from interpreting a bar graph histogram
- could calculate simple probabilities from a two-way table
- could draw an appropriate line of best fit in a bivariate data graph
- were knowledgeable on the differing forms of average and the benefits of each
- were able to interpret multivariate data from a contextual situation
- were able to interpret a time series graph.

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

- did not attempt all aspects of the examination
- could not identify similarities or differences comparing two multivariate data graphs represented in a box and whisker graph
- could not describe or interpret features in a bivariate data graph
- did not have basic probability knowledge
- could not interpret a time series graph
- would produce answers with no justification.

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

- were able to identify at least two features in a bivariate data graph
- could comment on the appropriateness of a bivariate data model
- were able to provide justified responses to the usefulness of a bivariate data model
- could compare two probabilities to decide upon their how likely each is in comparison to the other
- could describe similarities and differences between two multivariate distributions presented in a box and whisker graph

- could make an appropriate inference from two multivariate distributions presented in a box and whisker graph
- were aware of sampling variability and its implications with regards to making inferences from a set of data
- could make justified predictions from a time series graph
- could compare and comment upon the comparisons between two or more time series graphs.

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

- could demonstrate abstract thinking in interpreting and reflecting upon a probability-related situation
- were confident in all aspects of a multivariate data box and whisker graph, knowing about multiple factors of centre, shift, shape, spread whilst connecting this to making an appropriate inference.
- provided justification for their comments, including numerical data and calculations
- were able to demonstrate insight by analysing a time series graphs in depth and with a high level of understanding and interpretation, backed up with appropriate numerical calculation and justification.

Mathematics and Statistics subject page

Previous years' reports

2020 (PDF, 209KB)

2019 (PDF, 300KB)

2018 (PDF, 124KB)

2017 (PDF, 48KB)

2016 (PDF, 244KB)