NZQA
New Zealand Qualifications Authority
Mana Tohu Matauranga O Aotearoa

Assessment Report

Level 1 Mathematics and Statistics 2016

Standards 91027 91028 91031 91037

Part B: Report on Standards

MCAT 91027

While there was a wide variation in the levels of performance as would be expected, a higher level of algebraic process than usual was shown by many candidates. Questions that might have appeared to be from a higher level of the curriculum were elegantly solved using combinations of procedures from this L1 achievement standard and often involved year 9 and 10 mathematics. Candidates who were successful with this knew how to address problems by selecting a correct sequence of procedures. This was commendable. These candidates frequently performed better than some who had obviously been taught higher level mathematics such as logarithms and the quadratic formula but failed to follow the procedure through correctly. As a consequence of having some of this type of questions in this year's 2017 MCAT paper teachers need to take care that they do not try to cram more higher level algebra into their programmes but instead look at the strategies involved, teach their students the basic procedures including how to apply them and to think through an appropriate sequence of procedures. There will not be questions in papers that can only be solved by the use of higher level knowledge. They may be able to use rules taught at higher levels but with sound knowledge and thinking the higher mathematics is not required.

Candidates who had basic concepts of the graphs of parabola and the relationship between the solutions of a quadratic equation were able to answer questions more confidently.

Where candidates knew the general shape of positive and negative parabolas they could indicate this which helped them in identifying the x values for which a quadratic expression would have positive and negative values.

It is important that the candidates have a clear understanding of what the variables represent in questions where they are given a description of the situation or are required to write their own equations.

Candidates must be reminded that this is an algebra standard and hence algebra must be used. This includes being able to generalise situations rather than simply giving numerical examples. It is unlikely that the candidate will gain any significant credit for this level of working.

Correct answers only will in general not be accepted. Guess and check is an acceptable method of solving exponential equations at this level but where there are common factors these should first be eliminated.

Numerical substitution was poorly done in often higher level of achievement papers. There was poor understanding demonstrated by many candidates in order of operations as well as in general number skills. To receive credit for substitution problems candidates are required to perform the numerical operations correctly.

Many candidates did not consider their answers in context eg left negative answers for measurement.

Candidates need to be encouraged to attempt all questions, even if they cannot complete everything as an attempt will often provide evidence for achievement from a question targeting a higher level of performance.

91028: Investigate relationships between tables, equations and graphs

Candidates who were awarded **Achievement** commonly:

- were able to write a linear equation.
- correctly plotted points from a table
- interpreted aspects of linear graphs
- sketched a parabola
- found the maximum of a parabola
- recognised an exponential graph.

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

- could not write an equation
- could not interpret a graph
- could not distinguish between linear, quadratic and exponential graphs
- could not complete a table of values
- did not understand the symmetry of parabolas.

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

- used a graph to answer a question
- wrote the equation of a parabola
- sketched a parabola
- found the equation of an exponential graph
- used an equation to complete a table
- recognised the limitations of a situation

- distinguished between linear, quadratic and exponential relationships.

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

- correctly interpreted a situation in context
- translated graphs and recognised what shift was occurring
- constructed a formula and found the coordinates of turning points and intercepts
- recognised the symmetry of parabolas
- found the equation of a reflected exponential graph
- understood and answered an investigative question.

Standard-specific comments

Some candidates found the three questions with parabolas (1(b) and 2(a) in particular) relatively difficult.

91031: Apply geometric reasoning in solving problems

Candidates who were awarded **Achievement** commonly:

- calculated correctly lengths/ angles using Pythagoras Theorem and/or right angle trigonometry
- calculated angles using parallel line rules and/or circle geometry
- had incomplete or vague geometric reasoning that prevented them gaining a higher grade
- gave disorganised and illogical geometric reasons
- could use properties to find angles with reasons in one step questions
- understood the properties of right angle and isosceles triangles.

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

- could not correctly use Pythagoras or Trigonometry to find angles and lengths
- could not use their calculator properly to find missing angles with trigonometry
- were confused over rules for angles (common incorrect rules were cointerior angles are equal; opposite angles in a quadrilateral are equal; tan/rad for 90^{o})
- did not read the questions correctly
- incorrectly applied rules to the wrong geometric situation.

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

- applied angle relationships that involved at least two steps in order to find missing angles.
- attempted proofs or generalisations omitting key steps or reasons
- selected and used clear geometric reasons with clear logical steps
- understood well at least two of the following areas of geometry (circle, parallel lines, and geometry
- related solutions to the context appropriately.

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

- applied trigonometry / Pythagoras to solve extended problems, involving many steps
- understood most properties of quadrilaterals, parallel lines, circles, and right angled triangles and selected appropriate methods in most situations
- performed complete geometric proofs involving several steps.
- used correct geometrical terminology
- concluded their proofs with a statement
- used a clear chain of thought involving multiple steps towards solution
- connected different concepts to solve problems.

Standard-specific comments

Those candidates who used sine and cosine rule to find solutions in 3) b) and 1)b commonly found greater success.

91037: Demonstate understanding of chance and data

Candidates who were awarded **Achievement** commonly:

- interpreted a time series graph in a basic fashion
- justified their decisions for predictions
- identified and described an unusual feature of a time series graph
- compared trends on a time series graph
- identified significant features from a box and whisker graph and a dot plot graph
- interpreted a suitable comparison, using distance between medians, between a pair of box and whisker graphs
- drew a line of best fit on a scatter graph
- interpreted basic comparisons between a pair of scatter graphs
- calculated simple probabilities from information provided in a two-way table.

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

- did not provide sufficient detail when describing an unusual feature on a time series graph
- did not understand the correction interpretation of a statistical trend
- described outliers on box and whisker graphs that did not actually exist
- did not use distance between medians or overlap when making conclusions in the comparison between two box and whisker graphs
- were not able to calculate simple probabilities from a two-way table

- did not recognise that at this level responses such as “likely”, “not likely”, etc are not appropriate.

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

- identified and described multiple unusual features in a time series graph
- described multiple comparisons of trends of time series graphs
- produced valid comments from interpreting connections between a pair of time series graphs
- compared and explored in greater depth the appropriate interpretations between figures provided in a graphical manner
- produced multiple significant features and comparisons between a pair of box and whisker graphs
- interpreted a suitable comparison, using appropriate comments about the relative position of medians and boxes, between a pair of box and whisker graphs
- recognised that an appropriate model for a line of best fit need not be linear
- described the strength of the relationship between two variables by describing how points lie in relation to the line of best fit
- solved probability problems involving the use of the word “or”
- derived an appropriate integer value for an “expected value” probability problem.

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

- clearly identified and described a multitude of unusual features of a time series graph – peaks, troughs, as well as interpreting idiosyncrasies and correlations in the graph
- used abstract thinking in interpreting the connections between a pair of time series graphs in context
- interpreted graphs accurately to make appropriate judgements from the figures provided in a graphical manner, in context
- clearly described a multitude of significant features of a pair of box and whisker graphs – shape, symmetry, shift, overlap, measures of centre and spread
- used accurately, and interpreted fully, the “overall visible spread” when comparing two box and whisker graphs or were able to recognise and communicate effectively how sampling variability could affect the results, especially in marginal circumstances
- described the strength of the relationship between two variables by describing in detail how points lie in relation to the line of best fit, particularly as to how the strength of the relationship may vary between different parts of the graph
- solved probability problems involving the use of the word “and”.

Standard-specific comments

The majority of candidates wrote full and detailed responses.

Candidates were well-prepared for questions relating to the interpretation and analysis of box and whisker graphs and scatter graphs. However, some of the technical statistical words relating to interpretation of time series graphs were not fully understood. Candidates targeting the top grades must show a deeper understanding of “looking behind” the graphs and data in order to interpret their meaning in context. Also candidates need to recognise that there is a difference between the appropriateness of a line of best fit model and its strength -they are different concepts.

Candidates were well-prepared for probability problems, which were also generally answered confidently.

Candidates utilising the DBM and OVS method need a thorough understanding of how and when it should be used and interpreted, especially when the decision is marginal.

Candidates must reinforce their ideas with statistical evidence provided in the question. Also they should look for several pieces of varying evidence to support their conclusions. Candidates also need to ensure that the specific directions in the question are actually addressed, such as: compare, describe, justify, give statistical evidence, comment on showing numerical working.

Mathematics and Statistics subject page