Assessment Report

New Zealand Scholarship Calculus 2020

Standard 93202

Part A: Commentary

This examination delivered a large number of bite-size questions (22 sub-questions) that spanned most of the curriculum enabling the candidates to attempt a broad range of problems. Good candidates were able to demonstrate skills across the mathematics curriculum. Outstanding candidates showed that they could synthesise their knowledge and solve problems requiring insights into multiple strands of the mathematics curriculum. Many solutions provided were innovative, succinct and demonstrated a well-developed mathematical maturity on the part of the candidate. Less successful candidates lacked fundamental algebraic skills as well as grassroot techniques in the use of calculus skills such as the product rule, quotient rule and chain rule.

While there were candidates who demonstrated poor examination technique, such as not numbering their responses in a manner that was commensurate with the examination paper, this was a minority group.

The paper was long and required three hours of dedicated concentration, as delivered by the successful students. These students provide well-structured responses which were clearly laid out, communicating their solutions and the underpinning logic with panache.

Part B: Report on performance standard

Candidates who were awarded Scholarship with **Outstanding Performance** commonly:

- synthesised the skills from each of the standards and applied these skills to the questions requiring a cohesive knowledge across said standards
- set out their solutions clearly delivering elegance and flair when manipulating algebraic and trigonometric expressions
- demonstrated a good understanding of ‘concavity’ of curves; (Question 2bii)
- used equivalence of left and right limits as a necessary condition for establishing continuity and differentiability (Question 3c)
- demonstrated mathematical rigourby verifying the presence of a right angle within a triangle before using right angled trigonometry (Question 3c)
- displayed elegance in manipulating abstract expressions while applying ‘First Principles of Differentiation’ (Question 4a)
- demonstrated strong integration techniques
- executed implicit differentiation skills
- recognised that an integrandmay vary in polarity over the given interval, and used sub-intervals when finding the areas between the curve and the x-axis; (Question 4b)
- exhibited aptitude in applying the outcomes of one problem towards the solution of another (Question 5ai and 5aii)-were able to see the connection between problems and deploy synergies (Question 1c(i) and 1c(ii))
- demonstratedinsight in identifying patterns and could systematically discuss each case in solving problems(Question 5d)

- showed mastery of algebraic skills.

Candidates who were awarded **Scholarship** commonly:

- set out their solutions clearly delivering elegance and flair when manipulating algebraic and trigonometric expressions
- distinguish between a function's turning points and points of inflection (Question 2bii)
- demonstrated mathematical rigourby verifying the presence of a right angle within a triangle before using right angled trigonometry (Question 3c)
- exhibited aptitude in applying the outcomes of one problem towards the solution of another. (Question 5ai and 5aii)- were able to see the connection between problems and deploy synergies (Question 1c(i) and 1c(ii))
- demonstrated good mastery of the fundamental calculus skills, i.e. product, quotient and chain rules as well as the 'reverse chain rule' when integrating an expression
- deployed good algebraic skills such as simplifying rational expressions and manipulating trigonometric identities
- factorised expressions successfully, in particular when the common factor is '–1'.

Other candidates

Candidates who were **not** awarded Scholarship commonly:

- lacked the algebraic skills needed at this level
- made careless algebraic errors (such as losing negatives when integrating by parts, expanding a squared binomial, factorising and the extraction of –1 as a common factor)
- struggled to manipulate trigonometric expressions successfully
- lacked even the basic calculus skills such as differentiating functions using the product or quotient rule
- oversimplified or trivialised problems (e.g. incorrectly writing L = 2T and W = 3T in Question 3c)
- lacked perseverance and attempted to "fudge" proofs rather than find their minor algebraic errors
- used a calculator to find decimal approximations when exact solutions were clearly expected
- did not know how to use the reverse chain rule to correctly find an antiderivative
- were unable to recognise trigonometric patterns such as trig ratios of double angles.

Subject page

Previous years' reports

2019 (PDF, 216KB)

2018 (PDF, 101KB)

2017 (PDF, 40KB)

2016 (PDF, 189KB)
