

## Assessment Report

# New Zealand Scholarship Calculus 2025

## Performance standard 93202

### General commentary

The 2025 Scholarship Calculus examination was a rigorous and demanding assessment that appeared to be more difficult for candidates than the previous year. The examination identified those working at Scholarship and Outstanding Scholarship level, there was a noticeably higher proportion of low scores than in 2024. While the paper included accessible entry-point questions, many candidates still struggled with these, suggesting that a significant number were underprepared. Attaining scores of 7 to 8 proved especially difficult, as the “Outstanding” questions required subtle reasoning and a high level of mathematical maturity. Once again, the markers were pleased to witness the elegant, novel solutions demonstrated by the top candidates.

The format of the examination remained consistent, with each question consisting of one or two straight-forward problems, and several that required more insight and / or perseverance. It was clear that candidates were expecting this as many left questions blank and moved on to access other areas of the paper. The write-in booklet helped candidates space out their answers to be easily marked. There was more space given to questions that involved more working, and it should be noted that when limited space is provided for a question, the intended answer should not take more than that. Many candidates needed to use the space at the back of the booklet to solve Question 1(b) when it could be simply re-arranged to a quadratic equation.

The paper covered a wide range of the curriculum, although students with strong algebra skills and ability working with trigonometric identities were at an advantage. There was a heavy emphasis on complex numbers and trigonometry, with trigonometry appearing repeatedly across multiple questions, including those from other areas of mathematics. Many candidates appeared unfamiliar with inverse functions despite them being listed as an achievement objective in Level 8 of the NZ Curriculum. Whilst the difficulty to cover the breadth of the mathematics listed in the NZC given time constraints must be acknowledged, it is stressed that candidates need to have a thorough understanding of the entire curriculum, rather than limiting their exposure to a selection of NCEA Level 3 achievement standards.

### Report on performance standard

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

- showed insight, flair and perseverance in their solutions
- demonstrated an ability to grasp unfamiliar concepts and develop strategies to solve problems involving them
- realised that  $z^{2025} = \bar{z}$  had more than 2025 solutions in Question 1(c)
- sketched an accurate Argand diagram in Question 1(d) with  $\frac{1}{z}$ ,  $iz$  and  $\bar{z}$  correctly plotted
- manipulated trigonometric identities concisely, and found general solutions for trigonometric equations

- displayed ‘critical thinking’ skills in forming and optimising a mathematical model in Question 3(c) that considered multiple scenarios and reflection on the context
- were able to use substitution to verify the solution to the differential equation in Question 4(b) or found the inverse of the power function instead
- applied the Fundamental Theorem of Calculus in Question 4(c).

Candidates who were awarded **Scholarship** commonly:

- showed clear communicational skills by setting out answers logically
- solved equations involving exponentials and complex discriminants accurately
- solved systems of equations including those with trigonometric expressions
- were able to find the second derivative of a parametric equation
- optimised a situation by forming, differentiating and solving an equation
- used trigonometric identities to simplify integrands and find exact values
- integrated “upwards” to find the area below  $y = \sin^{-1}(x)$  in Question 4(a)
- differentiated  $y = \sin^{-1}(x)$  by finding the reciprocal of  $\frac{dx}{dy}$  in Question 4(b)
- understood how to evaluate limits
- recognised patterns and apply them to solve problems, such as in Question 2(b) and Question 3(b).

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

- did not attempt or fully complete responses
- provided long-winded approaches when no real progress was being made
- produced careless algebraic errors, including incorrect manipulation of rational expressions and integers, and did not re-check through work or verify solutions
- showed limited experience in dealing with unfamiliar / extended questions, appearing to have no strategy in attempting multi-step problems
- demonstrated weak foundational skills in solving problems with complex numbers, such as plotting in the Argand diagram and working in polar form
- did not demonstrate an understanding of basic techniques from the calculus domain, such as differentiating parametric functions or forming an expression to solve a typical optimisation problem
- did not demonstrate an understanding of the reverse chain rule, writing  $\int \sin(e^x) dx = \frac{-\cos(e^x)}{e^x}$  or similar
- did not demonstrate skills required for the manipulation of trigonometric identities and neglected to consider general solutions when solving trigonometric equations
- did not demonstrate an understanding of inverse functions, confusing them with reciprocals (multiplicative inverses) in thinking  $\sin^{-1}(x)$  and  $\operatorname{cosec}(x)$  were the same function.