Scholarship

2011 Assessment Report

Mathematics with Calculus

COMMENTARY

Many candidates had difficulty approaching several of the questions in the examination. Working without being given an appropriate method to solve a problem challenged many candidates. Constructing mathematical models to fit a context or satisfy given conditions was also required, and frequently not attempted.

On the other hand, the top ten candidates showed considerable flair and insight, writing clever and creative answers.

1(a) Many candidates found $x > -\ln(2-a)$, but few noted that this holds only when $0 < a < 2$. Fewer still noted that when the denominator is negative, $x < -\ln 2$.

1(b) Almost all candidates worked with $T = A_A + A_B$, and had difficulty finding the common factor – or cancelled the common factor without recognising its significance.

1(c) Only the most able candidates used the chain rule to simply show $\frac{d}{dx}(y^n) = ny^{n+m}$, with most working instead with the unwieldy expression for y^n.

2(a) Relatively few candidates found $\frac{dV}{dt}$ correctly.

2(b)(i) Several candidates found *A* as a function of *x* because of a minor error of working but did not find and correct the error (or did not see that *A* should not be a function of *x*).

2(b)(ii) Candidates could gain marks for this question with an incorrect or missing answer to 2(b)(i).

3(a) Most candidates performed well on this question, with about half answering correctly.

3(b) Many candidates tried (and failed) to convince their marker that they had found $\tan\left(\frac{\theta}{4}\right) = \tan\left(\frac{\tan^{-1} 20\sqrt{6}}{4}\right) = 0.4082 = \frac{1}{\sqrt{6}}$ without any intermediate working.

3(c) Constructing a mathematical model to fit a context was a difficult skill for most candidates.

4(a) Most candidates found the horizontal tangent lines, and many drew a diagram.

4(b) Many candidates had difficulty solving $\frac{1}{x^3} = \frac{1}{(d-x)^3}$ and did unnecessary algebraic work.

4(c) Many candidates drew an appropriate diagram to begin their work on this question.

5(a) Most able candidates could work with this unfamiliar function.

5(b) Very few candidates saw that for an even polynomial with real coefficients, one root implies three others: $-c, \pm\bar{c}$.

5(c) Only the very best candidates saw the roots as translated from a simpler form at the origin.

SCHOLARSHIP WITH OUTSTANDING PERFORMANCE

Candidates who were awarded Scholarship with Outstanding Performance typically:

- showed insight and flair with unorthodox solution methods
- applied skills and knowledge across different strands of the curriculum
- constructed and worked with mathematical models without guidance
- introduced new variables to a context where appropriate
- worked well with difficult inequalities
- used geometric symmetry
- wrote clear explanations of their answers where required
- moved between algebraic and geometric contexts successfully
- checked for and self-corrected errors in working.

SCHOLARSHIP

Candidates who were awarded Scholarship but not Scholarship with Outstanding Performance typically:

- used separation of variables to solve a simple differential equation
- worked well with trigonometric identities
- demonstrated the ability to fit a conic section to the given data
- demonstrated the ability to find factors and cancel appropriately
- used diagrams to support their answers
- demonstrated strong algebraic manipulation skills
- demonstrated strong differentiation skills
- worked confidently with unfamiliar mathematical functions
- identified key mathematical concepts in context
- showed good understanding of related rates.

OTHER CANDIDATES

Candidates who were not awarded Scholarship or Scholarship with Outstanding Performance typically:

- relied heavily on the second derivative test where the first derivative test may have been simpler
- worked poorly with logs and exponentials
- inappropriately cancelled common factors
- did not check their answers fit the question
- oversimplified real-world contexts inappropriately
- made mistakes working with mixed units
- did not give answers in the required form
- did unnecessary algebraic manipulation
- did not use trigonometric identities in an algebraic context.