
TEST QUESTION ANALYSIS

Grade 12 Pre-Calculus Mathematics Achievement Test (January 2020)

Introduction

This document provides information about students' performance on each of the questions in the provincial test and analysis of several questions that students found most challenging. Teachers are encouraged to use and share this information with students.

General information about provincial mathematics tests is available in the *Grade 12 Mathematics Achievement Tests: Information Bulletin*, posted on the Manitoba Education website at www.edu.gov.mb.ca/k12/assess/infobulls/.

Archived provincial mathematics tests and marking guides are available on the department's website at www.edu.gov.mb.ca/k12/assess/archives/.

Policies and procedures related to provincial Grade 12 tests are available on the department's website at www.edu.gov.mb.ca/k12/assess/docs/pol_proc/.

Student Performance by Test Question

The graph on the next page shows how well students performed on each test question, using a 0–100% scale. A score close to 100% means that students performed well on the question, approaching 100% of its mark value. A score closer to 0 means students performed poorly on the question. The horizontal line represents the mean for all of the test questions.

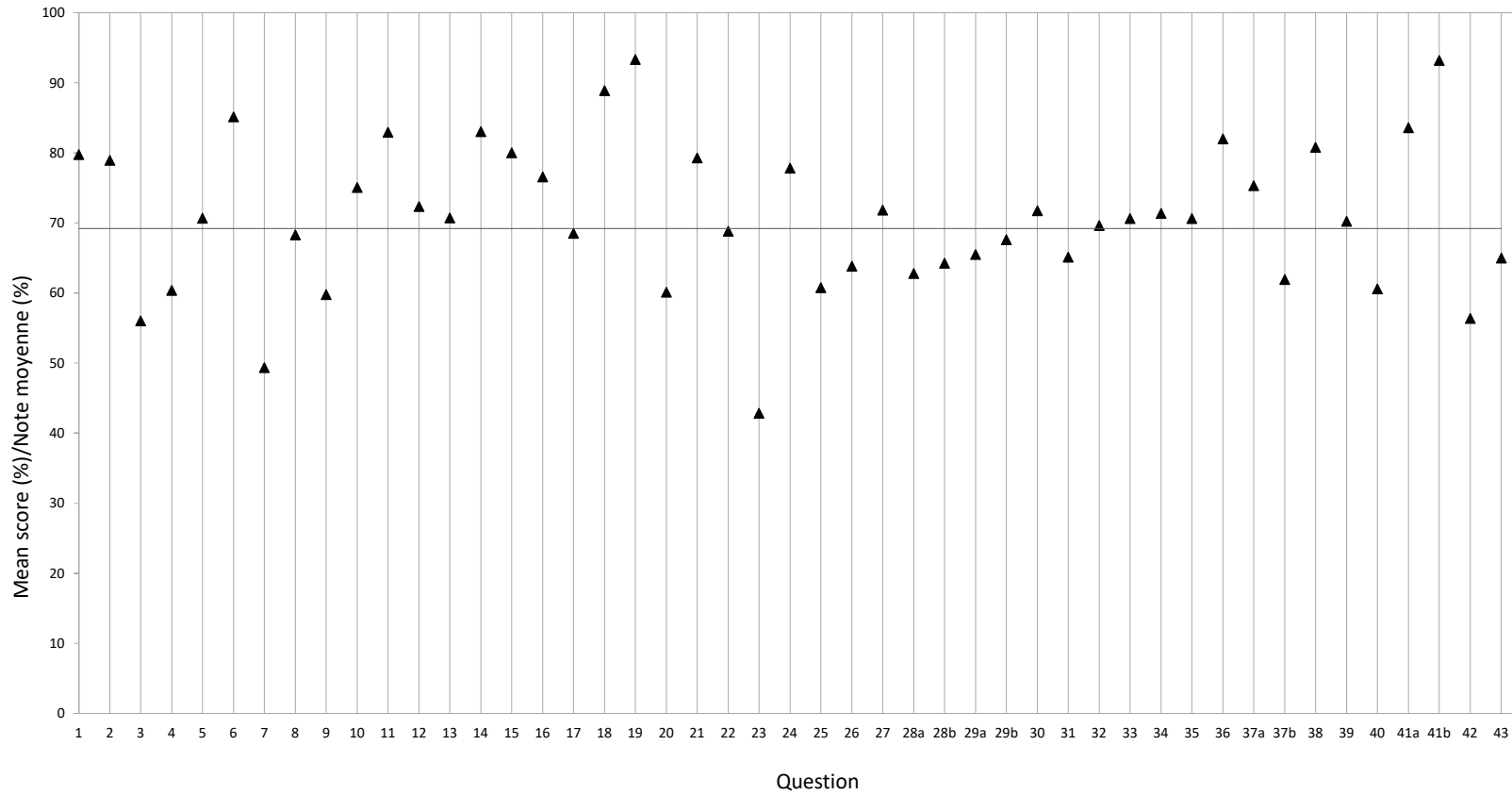
For example, Question 32 has a mean of 70%, meaning that the mean score for this question is 0.70 out of 1. Question 31 has a mean of 65%, but is worth 3 marks so the mean score for this question is 1.95 out of 3.

Analysis of Challenging Questions

On the pages following the graph, some test questions that students found most challenging are presented, with an analysis of common sources of confusion or conceptual misunderstanding.

Student Performance by Test Question—Graph

Grade 12 Pre-Calculus Mathematics Achievement Test (January 2020)—Test Question Mean Scores
 Test de réalisation, Mathématiques pré-calcul, 12^e année (janvier 2020) — Notes moyennes par question de test



Note: The horizontal line represents the mean for all of the test questions.

Remarque : La ligne horizontale représente la moyenne pour toutes les questions de test.

Analysis of Challenging Questions—Details

Question: 3

Provincial Mean: 56.0%

Specific Learning Outcome(s): T5

- Solve, algebraically and graphically, first- and second-degree trigonometric equations with the domain expressed in degrees and radians.

Achievement Indicator(s):

- Determine, algebraically, the solution of a trigonometric equation, stating the solution in exact form when possible.

Question 3

3 marks

Solve for θ , algebraically, over the interval $[0, 2\pi]$.

$$3\sin^2\theta + 6\sin\theta + 2 = 0$$

Common Errors:

- Students used the quadratic formula to solve for θ rather than $\sin\theta$.
- Students tried factoring instead of using the quadratic formula.
- Students used incorrect factors and/or incorrect angles.
- Students found angles in other quadrants.
- Students did not reject the impossible solution in final answer.

Question: 7

Provincial Mean: 49.4%

Specific Learning Outcome(s): R8

- Demonstrate an understanding of the product, quotient, and power laws of logarithms.

Achievement Indicator(s):

- Determine, using the laws of logarithms, an equivalent expression for a logarithmic expression.

Question 7

2 marks

If $\log 4 = m$ and $\log 3 = n$, express $\log 48$ in terms of m and n .

Common Errors:

- Students incorrectly substituted $\log 4$ with $\log m$ and equated $m + m + n$ with m^2n , which was used as the final answer.
- Students did not know how to start solving the question.

Question: 23

Provincial Mean: 42.8%

Specific Learning Outcome(s): R13

- Graph and analyze radical functions (limited to functions involving one radical).

Achievement Indicator(s):

- Sketch the graph of the function $y = \sqrt{f(x)}$, given the graph of the function $y = f(x)$, and explain the strategies used.

Question 23

1 mark

Given $f(x) = \frac{1}{2}x - 3$, state the coordinates of an invariant (unchanged) point when sketching the graph of $y = \sqrt{f(x)}$.

Common Errors:

- Students used $x = 0$ instead of $y = 0$ in their solution.
- Students did not know/understand the concept of an invariant point.

Question: 42

Provincial Mean: 56.4%

Specific Learning Outcome(s): R9

- Graph and analyze exponential and logarithmic functions.

Achievement Indicator(s):

- Identify the characteristics of the graph of an exponential function of the form $y = a^x$, $a > 0$, including the domain, range, horizontal asymptote, and intercepts, and explain the significance of the horizontal asymptote.

Question 42

3 marks

State the range, the y -intercept, and the equation of the asymptote of the exponential function,

$$f(x) = 3^{x-1} + 2.$$

Range: _____

y -intercept: _____

Equation of the asymptote: _____

Common Errors:

- Students had difficulty identifying the range before the asymptote.
- Students were unable to identify both the asymptote and range if they did not understand either of the two concepts.