
GENERAL COMMENTS

Grade 12 Applied Mathematics Achievement Test (January 2018)

Student Performance—Observations

The following observations are based on local marking results and on comments made by markers during the sample marking session. These comments refer to common errors made by students at the provincial level and are not specific to school jurisdictions.

Information regarding how to interpret the provincial test and assessment results is provided in the document *Interpreting and Using Results from Provincial Tests and Assessments* available at www.edu.gov.mb.ca/k12/assess/support/results/index.html.

Various factors impact changes in performance over time: classroom-based, school-based, and home-based contexts, changes to demographics, and student choice of mathematics course. In addition, Grade 12 provincial tests may vary slightly in overall difficulty although every effort is made to minimize variation throughout the test development and pilot testing processes.

When considering performance relative to specific areas of course content, the level of difficulty of the content and its representation on the provincial test vary over time according to the type of test questions and learning outcomes addressed. Information regarding learning outcomes is provided in the document *Grades 9 to 12 Mathematics: Manitoba Curriculum Framework of Outcomes* (2014).

Relations and Functions (provincial mean: 64.7%)

Conceptual knowledge

Students had difficulty relating the initial value of an exponential function to a real-life situation. Many students struggled to obtain a minimum of three values from a contextual situation in order to perform a quadratic regression. Some students had difficulty using a logarithmic equation to determine the x -value for a given y -value; they were more inclined to solve incorrectly for the y -value. Many students struggled with the concept of half-life; most knew to reduce the remaining amount by dividing by two, but did not use the correct time frame (every three days, as given). Students also struggled with determining the range for an exponential function that matched the context of a half-life experiment.

Procedural skill

When solving for the dependent variable of a sinusoidal equation, some students mistakenly had their calculator in degree mode instead of radian mode. Students correctly used the TRACE function on their graphing calculators or Desmos, but failed to properly identify the maximum value of a sinusoidal function. Students consistently used the incorrect x -value (in the context of the situation) in a quadratic regression model to determine the y -value. Some students did not know to perform a logarithmic regression even when specifically asked in the question; instead they presented linear or cubic regression models. When graphing data, some students mixed up the location of the dependent and independent variable on the Cartesian plane.

Communication

Students found it difficult to give a contextual explanation involving the initial value of a decreasing exponential function. Students made bracket errors when stating the range of a function.

Probability (provincial mean: 56.3%)**Conceptual knowledge**

When converting odds in favour of an event into a probability, some students wrote an expression in the form part:part, while others rewrote a separate odds statement. Some students added probabilities instead multiplying them when finding the probability of non-mutually exclusive events. Students did not always reduce both the numerator and the denominator when finding probabilities of independent events. When asked to find probabilities of conditional events, some students did not consider all possible outcomes in the sample space. Students did not find the probability using complements efficiently. Oftentimes, they opted to use cases and as a result, many calculation errors were made.

When asked to count the number of groups, students occasionally used permutations instead of combinations. Conversely, when asked to compute the number of arrangements, students used combinations instead of permutations.

Procedural skill

Students occasionally included extra branches when drawing tree diagrams as graphic organizers. When asked to determine the number of numeric codes (e.g., combination lock), students often failed to consider all sets of conditions (e.g., repetition of digits, divisibility of digits, etc.) in their solution.

Communication

Students often expressed probabilities as fractions and decimals. They then wrote the equivalent probability as a percent, but did not express it to the appropriate number of decimal places.

Financial Mathematics (provincial mean: 58.6%)**Conceptual knowledge**

When asked to calculate the depreciating value of an asset, some students multiplied the depreciation rate by time instead of raising the rate to the power of time. Many students did not understand the answers they were calculating when finding the breakeven point when renting. When using the TVM solver, present and future values were commonly mixed up. Other common errors were incorrectly entering the total number of payments and the number of payments per year. Students often forgot to include the down payment when calculating the maximum affordable house price, or they mistakenly subtracted it from the total rather than adding it.

Procedural skill

Students had difficulty substituting values into the formula when determining the rate of return for a given portfolio. Some students calculated the return for each type of investment, then added the calculations and divided by two, rather than using the formula, which resulted in an incorrect answer. Other students added the total returns, even though some were losses and some were gains. Some students could not perform the algebraic manipulation required to isolate the monthly mortgage payment when using the GDSR formula. Instead, they used guess and check which often resulted in an inaccurate answer. Other students did not use 32% as the suggested maximum GDSR. When calculating the total cost of buying a house, students correctly found the total cost for one year, but then forget to multiply by the total number of years. Other students made arithmetic errors.

Communication

Some students' explanations were vague when stating the advantages of investing, while other students gave definitive rather than possible advantages (e.g., long-term investments *will* yield a higher rate of return rather than *may* yield). When asked to explain the advantages of buying rather than renting a house, some students did not relate the advantages to finance.

Design and Measurement (provincial mean: 41.6%)**Conceptual knowledge**

Students had difficulty identifying, and then using, the appropriate formulas for given shapes and scenarios (e.g., volume formulas were used to find surface area, cylinders were mistaken as spheres, etc.). Some students incorrectly copied formulas from the *Formula Sheet*, while others used fictitious formulas.

Procedural skill

Students incorrectly used linear conversions instead of the required cubic conversions when determining the amount of cement needed to build a patio and the cost of gravel needed for a baseball field. Some students had difficulty manipulating formulas, while others had trouble isolating variables. When asked to find the area of a quarter-circle, some students forgot to divide by four.

Communication

Many students did not consider whole units when purchasing materials. Some students rounded too soon, often when using π .

Logical Reasoning (provincial mean: 64.6%)

Conceptual knowledge

When calculating the non-intersected regions of Venn diagrams, some students forgot to subtract the overlapping regions. Other students forgot to include the overlapping regions when identifying elements in “or” situations. Determining the number of elements not included in any regions was often forgotten.

Procedural skill

When asked to order symbols involving inequality values from least to greatest, some students ordered them from greatest to least. Other students added extra symbols to their order (e.g., inequality symbols, roman numerals included in the question, etc.).

Communication

Students often forgot to include a box when using a Venn diagram.

Communication Errors

Errors that are not related to the concepts within a question are called “Communication Errors” and these were indicated on the *Scoring Sheet* in a separate section. There was a maximum 0.5 mark deduction for each type of communication error committed, regardless of the number of errors committed for a certain type (i.e., committing a second error for any type did not further affect a student’s mark).

The following table indicates the percentage of students who had at least one error for each type.

E1	Final Answer	12.9%
E2	Notation	13.8%
E3	Transcription/Transposition	14.9%
E4	Whole Units	7.5%
E5	Units	14.7%
E6	Rounding	36.0%

Marking Accuracy and Consistency

Information regarding how to interpret the marking accuracy and consistency reports is provided in the document *Interpreting and Using Results from Provincial Tests and Assessments* available at www.edu.gov.mb.ca/k12/assess/support/results/index.html.

These reports compare the local marking results to the results from the departmental re-marking of sample test booklets. Provincially, 45.0% of the test booklets sampled were given nearly identical total scores. In 45.9% of the cases, local marking resulted in a higher score than those given at the department; in 9.2% of the cases, local marking resulted in a lower score. On average, the difference was approximately 2.3% with local marking resulting in the slightly higher average score.

Survey Results

Teachers who supervised the Grade 12 Applied Mathematics Achievement Test in January 2018 were invited to complete a feedback form regarding the test and its administration. A total of 98 forms were received. A summary of their comments is provided below.

After adjusting for non-responses:

- 97.9% of teachers indicated that all of the topics in the test were taught by the time the test was written.
- 96.8% of teachers thought that the test content was consistent with the learning outcomes outlined in the curriculum documents and 91.5% thought that the difficulty of the test was appropriate.
- 91.8% of teachers indicated that their students used a study sheet on classroom assessments and 90.3% of teachers indicated that all of their students used a study sheet during the test. 80.6% of teachers indicated that students were given time to make their study sheets during class.
- 70.4% of teachers indicated that their students used the *Formula Sheet* on classroom assessments and 77.7% of teachers indicated that all of their students used the *Formula Sheet* during the test.
- During the test, 81.7% of teachers indicated that all of their students used a graphing calculator, 11.2% indicated that at least some of their students used computer software, 13.5% indicated that at least some of their students used Internet applets, and 13.5% indicated that at least some of their students used apps on a mobile device.
- 93.2% of teachers indicated that students were able to complete the test in the time allowed.