
GENERAL COMMENTS

Grade 12 Applied Mathematics Achievement Test (June 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

Many students did not understand that the initial value of an exponential regression equation occurs at time $t = 0$, and not at time $t = 1$. As a result, many incorrect regression equations were generated. Students had difficulty making connections between a given quadratic function and the context of the question. Some of these students did more work than required causing them to lose marks (e.g., they determined the height above a given height and not the horizontal distance), while others selected the incorrect intersection point (the intersection point to the left of the vertex rather than to the right). Some students struggled with identifying whether a value represented the dependent or independent variable.

Procedural skill

Several students had difficulty drawing the graph of a quadratic function, mainly due to lack of neatness and attention to detail. Often, the vertex and intercepts were either missing or incorrect, and the scales on the x - and y -axes increased by inconsistent increments.

Communication

Some students transcribed the b -value of their sinusoidal regression equation incorrectly (i.e., 0.7 instead of 0.07) resulting in an $\textcircled{E3}$ communication error. Other common communication errors were incorrect rounding and missing units.

Probability (provincial mean: 55.6%)

Conceptual knowledge

When asked to use the percentage of people to determine the number of people, students left their answer as a percentage, resulting in an incomplete answer. Many students struggled with determining the odds against an event. Some students wrote the odds in favour of the event, while others wrote the odds against the event divided by 100.

Students had difficulty determining all possible sums when rolling two dice. They also had difficulty determining the correct sample space, which resulted in multiplying two incorrect fractions.

Students had severe difficulty determining the conditional probability that an event will occur given that another event has already occurred. Many did not know where to start and randomly multiplied two numbers given in the question. Others successfully calculated the numerator, but did not know to use their answer from part (a) as the denominator. When asked to find the probability of two dependent events, some students did not consider the two cases; some multiplied the two cases instead of adding them, while others did not decrease the value of the denominator by one.

Within a pathway problem, some students did not consider the requested detour, which over-simplified the problem. Other students added the number of ways to the detour and the number of ways to the final destination rather than multiplying them.

Students had difficulty recognizing that they needed to use combinations when asked to calculate the number of games played by one team in a tournament. Some used permutations, while others multiplied the number of teams, n , by $n - 1$. When asked to determine the probability that a team would play first, many students did not consider that the total number of games played is half of the number of participating teams.

Procedural skill

Students knew to use a tree diagram to determine the probability of two dependent events, but many diagrams were incorrect. They had either incorrectly labelled branches or had incorrect complements (i.e., $0.82 + 0.08 \neq 1$). Others did not correctly express percents as decimals (e.g., $8\% \neq 0.8$). When creating passwords with digits and letters, some students did not consider zero as a possible digit, others ignored the directive and allowed for repetition, while others were uncertain of the number of letters in the alphabet. All of these cases resulted in incorrect permutations. In some instances, students had correct work but either no final answer or an incorrect one.

Communication

Students correctly wrote probabilities in decimal form, but did not express them to the appropriate number of decimal places. Some students incorrectly expressed odds as a decimal (e.g., $\frac{14}{11} = 1.27$).

Financial Mathematics (provincial mean: 58.4%)

Conceptual knowledge

Many students were able to calculate correct answers, but did not understand how to interpret these answers or how to relate them to a contextual situation. When using the TVM solver, some students had difficulty distinguishing between present value and future value, others did not understand the effect the negative sign has on investment values and/or loan values, while others struggled to input the correct number of total payments. Students showed little understanding of the impact of a down payment when determining the maximum house value. Students struggled with identifying the amount of money saved as they had trouble calculating the total cost of a mortgage over different amortization periods. When calculating net worth, some students had difficulty identifying assets and liabilities. Students had difficulty working backwards with the Rule of 72.

Procedural skill

Students had difficulty determining the number of compounding periods per year; they did not change the automatic C/Y entry or they input an incorrect value.

Communication

Some students' answers were vague when explaining whether the bank would lend money, while others did not specifically refer to 50% when referencing the debt-to-equity ratio.

Design and Measurement (provincial mean: 70.0%)

Conceptual knowledge

Students struggled finding the volume of one part of a composite shape. Instead of calculating two separate volumes and then subtracting, they subtracted linear dimensions and used the difference to calculate one volume. When given a certain volume and asked to calculate how many specific-sized units it contains (i.e., a pile of grain consists of how many bushels), students multiplied the volume by the unit size instead of dividing.

Procedural skill

When asked to find the volume of a cone, some students forgot to divide by 3, while others had difficulty substituting the correct values for variables. Some students did not recognize that a coin has a cylindrical shape and incorrectly used formulas for spheres.

Communication

Many students experienced difficulty using whole units appropriately. Although many students did include units with their final answer, it was not always the correct unit (e.g., cm or cm² instead of cm³).

Logical Reasoning (provincial mean: 53.5%)

Conceptual knowledge

Students could have benefitted from using a variety of strategies to solve a logic problem. Many appeared to have used “guess and check”, but this did not lead them to the correct solution. Students struggled greatly filling in a partially completed truth table. Given hypothesis, p , and conclusion, q , some students were able to determine $\sim p$, but most students could not determine $\sim p \leftrightarrow q$.

Procedural skill

Some students incorrectly labelled their Venn diagram, which lead to calculating the incorrect region.

Communication

Students often forgot to include a box when solving using a Venn diagram. Some students had correct Venn diagrams but did not indicate a final answer.

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	34.6%
E2	Notation	14.6%
E3	Transcription/Transposition	30.8%
E4	Whole Units	45.5%
E5	Units	49.1%
E6	Rounding	66.2%

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, 56.0% of the test booklets sampled were given nearly identical total scores. In 33.0% of the cases, local marking resulted in a higher score than those given at the department; in 10.9% of the cases, local marking resulted in a lower score. On average, the difference was approximately 1.0% with local marking resulting in the slightly higher average score.

Survey Results

Teachers who supervised the Grade 12 Applied Mathematics Achievement Test in June 2018 were invited to complete a feedback form regarding the test and its administration. A total of 140 forms were received. A summary of their comments is provided below.

After adjusting for non-responses:

- 91.1% of teachers indicated that all of the topics in the test were taught by the time the test was written.
- 95.5% of teachers thought that the test content was consistent with the learning outcomes outlined in the curriculum documents and 91.1% thought that the difficulty of the test was appropriate.
- 91.4% of teachers indicated that their students used a study sheet on classroom assessments and 83.7% of teachers indicated that all of their students used a study sheet during the test. 74.3% of teachers indicated that students were given time to make their study sheets during class.
- 75.7% of teachers indicated that their students used the *Formula Sheet* on classroom assessments and 81.3% of teachers indicated that all of their students used the *Formula Sheet* during the test.
- During the test, 84.4% of teachers indicated that all of their students used a graphing calculator, 23.7% indicated that at least some of their students used computer software, 21.1% indicated that at least some of their students used Internet applets, and 21.8% indicated that at least some of their students used apps on a mobile device.
- 91.4% of teachers indicated that students were able to complete the test in the time allowed.