GENERAL COMMENTS

Grade 12 Applied Mathematics Achievement Test (January 2017)

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).

Summary of Test Results (Province)

January 2017	June 2016	January 2016	June 2015	January 2015	June 2014
55.2%	55.3%	58.6%	54.9%	58.2%	55.0%

Relations and Functions (provincial mean: 59.3%)

Conceptual knowledge

Students struggled with determining domain and range within the context of a question. They were more inclined to focus on the domain and range of the related function. Bracket errors were made by some students when representing domain and range in interval notation.

Some students were unable to identify which type of function modelled the context of a question and/or the scatter plot they produced. When using technology to determine the sinusoidal regression equation, some students did not recognize that the calculated c value (horizontal shift) of $-3.71\ E^{-13}$ should have been interpreted as a value of 0.

Procedural skill

When graphing data, some students mixed up the location of the dependent and independent variable on the Cartesian plane. Students created a scale by using the given values in the table rather than equally spaced intervals. Some students had difficulty manipulating part of a sinusoidal function when asked to decrease the period.

Communication

Some students found it difficult to give a contextual explanation that also involved the properties of a function. When asked to determine the regression equation that best models the data, some students mentioned only the regression model and not the equation itself.

Probability (provincial mean: 46.5%)

Conceptual knowledge

When calculating the probability of dependent events, some students found the probability of only one event. Some students, who considered both events, only reduced the probability of the numerator or denominator of the second event, instead of reducing both. Some students added probabilities of dependent events instead of multiplying them. When using probabilities of dependent events to find the sample space, some students averaged the percentages instead of multiplying them. Many students were able to explain the definition of dependent events, but they were unable to choose the scenario that matched the explanation.

When adding the probabilities of repeated trials, some students added the numerators and the denominators. When asked to determine the numeric count based on a percentage of a population, some students kept the percent as a whole number and divided, rather than multiplying by the decimal form of the percent. When solving a Venn diagram problem, many students did not calculate the overlap. Many students used combinations instead of permutations to solve a counting problem using order.

Procedural skill

When students were asked to find the probability of a situation with repeated trials, they identified only part of the necessary sample space. Some students showed multiplication of probabilities in fraction form, but added them instead. Many students did not refer to their Venn diagram when asked to identify a probability using the diagram.

Communication

Students experienced difficulty with rounding their answers and using whole units appropriately.

Financial Mathematics (provincial mean: 62.8%)

Conceptual knowledge

Students used a monthly compounding period instead of a semi-annual one for mortgages. Instead of subtracting the down payment on a mortgage and using that value as the present value, some students used the down payment amount as the present value and the total amount of the mortgage as the future value. When asked to find the maximum affordable car price, students solved for the future value (thinking of the question as an investment) as opposed to the present value. Instead of adding the down payment to find the maximum affordable car price, many students subtracted it.

Procedural skill

Students incorrectly used a negative payment (e.g., –2500) in a question that involved annuities. Some students mixed up the N-value (months) with age, while others took the N-value and represented it as the number of years. When students were asked to calculate the total amount paid on a house over a prescribed time period, they did not add the down payment of the house. Alternately, some other students tried using the TVM solver for this problem.

Communication

When asked for an advantage of a certain investment type, explanations were vague. Some students gave an advantage of all investments (e.g., "make money") as opposed to the investment type they chose. When asked to justify whether they would rent a house, students were vague in their response saying it "was cheaper."

Design and Measurement (provincial mean: 48.1%)

Conceptual knowledge

Instead of using the circumference of a cup to calculate the radius/diameter, students divided the rectangular area of a tray by the circumference to find the number of cups. Students mixed up volume and surface area formulas. Many students had difficulty with this problem, not knowing what to do with the numbers provided to them.

When asked to find the number of items that could be made for a fixed cost, some students multiplied the total cost by the unit cost instead of dividing. Instead of adding the price of a logo to the cost of the rubber needed to make a hockey puck, students multiplied.

Procedural skill

Students experienced difficulty converting volume in cubic feet to volume in cubic yards. When given a rectangular prism and asked to find the volume, some students multiplied all three dimensions together without converting them to the same units of measure. Many students had trouble using the $V = Bh$ formula, while others correctly substituted the values but had difficulty using their calculator.

Communication

Students did not always include units with their answers. Students experienced difficulty with rounding their answers and using whole units appropriately.

Logical Reasoning (provincial mean: 69.1%)

Conceptual knowledge

Students confused the converse statement and the inverse statement. When asked to determine if a statement was biconditional and to provide a counterexample if needed, some students correctly identified that the statement was biconditional but did not provide a counterexample.

Procedural skill

Many students did not include the word "then" in "if-then" statements.

Communication

Some students did not write biconditional statements using the correct structure.

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	Notation	12.4%
E2	Units	18.3%
E3	Transcription/Transposition	17.4%
E4	Final Answer	21.6%
E5	Rounding	41.9%
E6	Whole Units	18.0%

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 include a chart comparing the local marking results to the results from the departmental re-marking of sample test booklets. Provincially, 42.1% of the test booklets sampled were given nearly identical total scores. In 46.0% of the cases, local marking resulted in a higher score than those given at the department; in 11.9% of the cases, local marking resulted in a lower score. On average, the difference was approximately 2.0% with local marking resulting in the slightly higher average score.

Survey Results

Teachers who supervised the Grade 12 Applied Mathematics Achievement Test in January 2017 were invited to complete a feedback form regarding the test and its administration. A total of 78 forms were received. A summary of their comments is provided below.

After adjusting for non-responses:

- 80.8% of teachers indicated that all of the topics in the test were taught by the time the test was written.
- 96.1% of teachers thought that the test content was consistent with the learning outcomes outlined in the curriculum documents and 91.0% thought that the difficulty of the test was appropriate.
- 89.7% of teachers indicated that their students used a study sheet during the semester and 80.8% of teachers indicated that all of their students used a study sheet during the test. 65.4% of teachers indicated that the study sheets were made during class.

- 67.9% of teachers indicated that their students used the formula sheet during the semester and 75.6% of teachers indicated that all of their students used the formula sheet during the test.

- During the test, 88.5% of the teachers indicated that all of their students used a graphing calculator, 10.6% of teachers indicated that at least some of their students used computer software, 16.0% indicated that at least some of their students used Internet applets, and 13.1% indicated that at least some of their students used apps on a mobile device.

- 89.0% of teachers indicated that students were able to complete the test in the time allowed.