GENERAL COMMENTS

Grade 12 Applied Mathematics Achievement Test (January 2020)

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/.

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: 64.8%)

Conceptual knowledge

Many students incorrectly identified the range of a sinusoidal regression function. Some students struggled with finding the lower bound of the range. Many students struggled to use a value from a graph, in this case an intersection point, and apply it to the context of the question.

Procedural skill

Many students struggled with calculating the difference of points. They often determined the value at one point. Some students struggled with creating a table of values based on the given situation. Many students had difficulty finding a minimum value when given an equation. Some students struggled with finding the period of a sinusoidal regression from the graph when using Desmos.

Communication

Some students forgot "$y =$" when writing equations. A few students forgot x values in their functions. Some students used an incorrect range from their graphs. Many students struggled with where to start their range when graphing, and started at a very large number. Many students rounded incorrectly.

Probability (provincial mean: 53.1%)

Conceptual knowledge

Many students found it hard to count the total number of outcomes or remove overlaps in a question that involved mutually exclusive events. Many students used permutations when they were supposed to use combinations in a counting question. When working with permutations of distinct objects, some students treated the situation as if there were identical objects. Many students could not recognize the useful parts of Pascal's triangles and use them appropriately. Some students stated that two events were not mutually exclusive but then explained why they were mutually exclusive. Students wrote odds against an event occurring when they were supposed to write odds in favour of the event occurring.

Procedural skill

Many students did not count all the outcomes in a tree diagram. When using Pascal's triangle, some students did not know when they should stop. When asked whether two events are mutually exclusive and to justify their reasoning, some students used the Venn diagram to show that the events were mutually exclusive, but did not justify their answer.

Communication

When drawing a Venn diagram, many students did not enclose it in a box. Some students confused terminology when discussing mutually exclusive events. Students did not round probabilities to the appropriate number of decimal places. When writing probabilities as decimals and changing them to percents, some students forgot to round them to two decimal places.

Financial Mathematics (provincial mean: 58.9%)

Conceptual knowledge

Many students had the misconception that buying a house would require a 25-year mortgage. When using the TVM solver, some students did not know the differences between purchasing a house and treating the purchase of the house as an investment. Some students did not know the rule of 72. Many students had difficulty understanding the terminology "asset" and "renovation". Some students did not understand if their answers were reasonable within the context of the question. Some students did not understand how to apply the down payment when determining maximum house values and confused present value and future value. Some students could not find the outstanding balance of a house mortgage after a period of time. They also did not understand that monthly payments on a mortgage include interest as well as principal. When calculating the number of payments, many students wrongly assumed that the loans were investments. Many students struggled with calculating the rate of appreciation for a house when given its present value and its previous value.

Procedural skill

Some students manipulated algebraic operations incorrectly and found it difficult to work with the 10th root of a number. Some students did not read questions carefully and did not understand terminology. Many students provided average appreciation rate, which did not include compounding over the years. Some students treated a down payment as the present value and treated the present value as the future value. When using TVM, many students committed errors in the process of inputting data, for example, the total number of payments, compounds per year, and the number of payments per year. Some students entered correct inputs but did not get the answer consistent with their inputs.

Communication

Many students did not round percentages to two decimal places. Some students did not include units in the final answer. When explaining why they would select an option, some students restated the information in the question, but provided no additional information. Some students had difficulty using terminology correctly.

Design and Measurement (provincial mean: 66.4%)

Conceptual knowledge

Many students could find the volume of a sphere, but they struggled to find the volume of a hemisphere. Some students provided perimeter rather than area.

Procedural skill

Many students had difficulty converting the unit ft^2 into in^2 or vice versa. Instead of using the given tax rates where PST is 7%, some students multiplied the amount by 1.13 due to the misconception that PST was still 8%.

Communication

Some students rounded incorrectly or did not use whole units. Some students changed the number of payments into the number of years.

Logical Reasoning (provincial mean: 62.7%)

Conceptual knowledge

Many students found it difficult to identify the proper symbols (e.g., $\leftrightarrow$) in truth tables. Some students could not write the contrapositive of a conditional statement and provided either the inverse or the converse of the conditional statement.

Procedural skill

No procedural issues were noted.

Communication

Some students had difficulty communicating when using permutations and combinations. Some students gave an answer but did not provide the justification as required.

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	20.4%
E2	Notation	14.3%
E3	Transcription/Transposition	19.8%
E4	Whole Units	13.1%
E5	Units	22.9%
E6	Rounding	67.2%

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/.

These reports compare the local marking results to the results from the departmental re-marking of sample test booklets. Provincially, 45.2% of the test booklets sampled were given nearly identical total scores. In 38.0% of the cases, local marking resulted in a higher score than those given at the department; in 16.8% of the cases, local marking resulted in a lower score. On average, the difference was approximately 1.3% with local marking resulting in the slightly higher average score.

Survey Results

Teachers who supervised the Grade 12 Applied Mathematics Achievement Test in January 2020 were invited to complete a feedback form regarding the test and its administration. A total of 80 forms were received. A summary of their comments is provided below.

After adjusting for non-responses:

- 88.2% of teachers indicated that all of the topics in the test were taught by the time the test was written.
- 99.3% of teachers thought that the test content was consistent with the learning outcomes outlined in the curriculum documents and 94.4% thought that the difficulty of the test was appropriate.

- 93.8% of teachers indicated that their students used a study sheet on classroom assessments and 80.8% of teachers indicated that all of their students used a study sheet during the test. 79.0% of teachers indicated that students were given time to make their study sheets during class.

- 77.1% of teachers indicated that their students used the *Formula Sheet* on classroom assessments and 88.8% of teachers indicated that all of their students used the *Formula Sheet* during the test.

- During the test, 75.9% of teachers indicated that all of their students used a graphing calculator, 13.1% indicated that at least some of their students used computer software, 21.0% indicated that at least some of their students used websites, and 19.7% indicated that at least some of their students used apps on a mobile device.

- 91.0% of teachers indicated that students were able to complete the test in the time allowed.