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# GENERAL COMMENTS

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## Grade 12 Applied Mathematics Achievement Test (June 2016)

### 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](http://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)

June 2016	January 2016	June 2015	January 2015	June 2014	January 2014
55.3%	58.6%	54.9%	58.2%	55.0%	62.1%

### Relations and Functions (provincial mean: 61.5%)

#### Conceptual knowledge

When students are creating regression equation graphs, the curve should be smooth, not necessarily connecting the points.

When considering the domain or range of a function, one common error committed by students is to use round brackets instead of square ones, or using “greater than” instead of “greater than or equal to”.

#### Procedural skill

Students should check that their calculators are set to radian mode when working with sinusoidal functions.

Students should consider the context when drawing graphs, particularly the use of arrows (which indicate continuation) and extending the graph outside of Quadrant I.

**Communication**

Students should use the contextual variable of a function when expressing a domain or range, instead of  $x$  and  $y$ . Otherwise, a communication error (E4) is added.

**Probability (provincial mean: 57.5%)****Conceptual knowledge**

Some students confused mutually exclusive events with non-mutually exclusive events, while others were confused between dependent events and mutually exclusive events.

In a permutation problem where all objects are distinguishable with conditions, students did not consider the grouped objects in the permutation (e.g., calculating  $3! \times 5!$  instead of  $3! \times 6!$ ).

In combination problems involving cases, the number of each case should be added together to obtain the total number.

In calculating non-mutually exclusive events, students need to multiply the probabilities of each event.

**Procedural skill**

Students forgot to subtract the “overlap” when calculating probability (i.e., satisfies both conditions of non-mutually exclusive events).

**Communication**

Rounding should be done to the hundredths place or higher precision, whether it is expressed as a percentage or as a decimal (e.g., 0.33 or 33.33%, not 33%). Some students also added a percent sign to their decimal value ( $0.33 \rightarrow 0.33\%$ ).

**Financial Mathematics (provincial mean: 54.9%)****Conceptual knowledge**

Students falsely thought that a car lease has no maintenance costs or can be terminated at any time without penalties.

When calculating biweekly (every two weeks) payments, students should remember there are 26 payments in one year (not 24, which is semi-monthly payments).

**Procedural skill**

When students calculate the gross debt service ratio (GDSR), all costs (e.g., heating, mortgage, property taxes) must be calculated on a monthly basis.

When calculating appreciation over a 10-year period, students incorrectly used the simple interest formula or calculated the appreciation for one year and then multiplied this value by 10.

Students sometimes used incorrect signs (e.g., addition or removal of negative sign) in their TVM solver, resulting in an incorrect answer.

Students failed to consider the interest gained on remaining balance over time while a fixed amount is being withdrawn regularly.

**Communication**

Students must reference 32% when justifying a financial decision based on GDSR.

## Design and Measurement (provincial mean: 50.7%)

### Conceptual knowledge

When a two-dimensional object is said to be three times larger, some students did not multiply each dimension by three (i.e., factor of 9).

### Procedural skill

Students had difficulty converting multidimensional units (e.g.,  $\text{cm}^2$  or  $\text{m}^2$ ).

Students did not account for waste when calculating the material required for a project.

### Communication

No observations.

## Logical Reasoning (provincial mean: 52.2%)

### Conceptual knowledge

A large proportion of students did not demonstrate an understanding of truth tables (i.e., the connection between  $p$  and  $q$  in a given statement).

### Procedural skill

Students should be explicit when asked to explain how they solved a puzzle. For example, parts of a diagram can be labelled if referred to in their explanation.

Students forgot to subtract the overlap when calculating a value for a specific region within a Venn diagram.

### Communication

Students should always include a box around a Venn diagram. Otherwise, a communication error **E1** is added.

## 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.

<b>E1</b>	Notation	19.9%
<b>E2</b>	Units	17.3%
<b>E3</b>	Transcription/Transposition	15.7%
<b>E4</b>	Final Answer	26.9%
<b>E5</b>	Rounding	49.2%
<b>E6</b>	Whole Units	6.3%

## 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](http://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, 44.6% of the test booklets sampled were given nearly identical total scores. In 46.7% of the cases, local marking resulted in a higher score than those given at the department; in 8.8% 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 June 2016 were invited to complete a feedback form regarding the test and its administration. A total of 126 forms were received. A summary of their comments is provided below.

After adjusting for non-responses:

- 92.7% of teachers indicated that all of the topics in the test were taught by the time the test was written.
- 93.0% of teachers thought that the test content was consistent with the learning outcomes outlined in the curriculum documents and 90.3% thought that the difficulty of the test was appropriate.
- 93.6% of teachers indicated that their students used a study sheet during the semester and 86.8% of teachers indicated that all of their students used a study sheet during the test. 81.4% of teachers indicated that the study sheets were made during class.
- 82.2% of teachers indicated that their students used the formula sheet during the semester and 80.0% of teachers indicated that all of their students used the formula sheet during the test.
- During the test, 87.8% of the teachers indicated that all of their students used a graphing calculator, 17.7% of teachers indicated that at least some of their students used computer software, 13.2% indicated that at least some of their students used Internet tools, and 7.9% indicated that at least some of their students used apps on a mobile device.
- 91.3% of teachers indicated that students were able to complete the test in the time allowed.