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# GENERAL COMMENTS

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## Grade 12 Essential Mathematics Achievement Test (January 2019)

### 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).

### Unit: Home Finance (provincial mean: 59.2%)

#### Conceptual Knowledge

Many students could read the Land Transfer Tax Table, but often did not understand what to do with the values. When calculating the Gross Debt Service Ratio (GDSR), several students did not calculate the monthly gross income, and instead used the annual gross income, which resulted in lost marks. In addition to this, many students did not understand that the maximum GDSR is 32% (many said that was the minimum). Often, students did not understand the concepts and terminology of regular home maintenance tasks vs. emergency home maintenance tasks.

#### Procedural Skill

Many students did not know that there are 52 weeks in a year. When using the Land Transfer Tax Table, several students did not correctly convert the given percent to a decimal ( $0.5\% \neq 0.5$ ). In addition, when calculating land transfer tax, students did not recognize that the given table values are graduated (i.e., each range of values does not start at \$0). Several students did not subtract the down payment when calculating the monthly mortgage payment. When there were multiple parts to a question, many students did not use calculations from previous parts in their new calculations (e.g., they did not use their answer from Part A in their calculation for Part B).

#### Communication

When a written response was required, many students gave answers that were vague and lacked detail. In addition, several students offered multiple responses when only one response was required. Often, one or more of these responses was incorrect, resulting in a mark deduction. Many times, monetary values lacked dollar signs and the correct number of decimals. Numerous times, GDSR final answers were missing a percentage symbol or were stated as monetary values.

## **Unit: Vehicle Finance (provincial mean: 61.8%)**

### **Conceptual Knowledge**

Generally, there seemed to be a lack of number sense when an unrealistic answer was attained. When calculating depreciation, rather than providing the value of the vehicle, students provided the depreciation amount. When determining tax on a used vehicle, students chose the book value rather than the higher vehicle price. Many students used incorrect tax rates on various questions. When asked to calculate the amount of interest paid on the first month's payment, students often incorrectly substituted time into the simple interest formula. Some students divided by the total number of months, other students multiplied by the number of years, while others divided by 1000. Some students added the trade-in value rather than subtracting it. Students often added or subtracted the residual value from the original price of the car, rather than simply multiplying by the residual rate.

### **Procedural Skill**

Some students substituted incorrectly into the fuel economy formula (e.g., km/L). Many students multiplied the cost of parts by the number of labour hours instead of adding them. Some students who added the labour hours did so incorrectly. Converting tax to a decimal was problematic (e.g.,  $8\% = 0.8$ ), or not done at all (e.g., substituting 5.25% into the simple interest formula as 5.25). Students often subtracted the trade-in value after the tax was calculated rather than before.

### **Communication**

Units were often incorrect (e.g., L or L/km). Students often rounded fuel economy to one decimal place. Many students did not round monetary values to two decimal places. For questions that required multiple steps, many student responses were unorganized, while some students seemed unsure of what their final answers represented.

## **Unit: Precision Measurement (provincial mean: 50.6%)**

### **Conceptual knowledge**

Many students had difficulty understanding the concept of precision. Rather than stating a numerical value, students tried to describe the precision, saying "it's good" or using other such descriptions. Quite a few students included " $\pm$ " with the correct numeric value, while others thought the precision was the maximum value. To calculate the total uncertainty when using a device repeatedly, many students correctly stated the uncertainty, but did not multiply to indicate repeated use. Other students used the maximum value of the device as the nominal value, stating a final answer of maximum value  $\pm$  uncertainty. To determine the uncertainty, some students divided the maximum value of the measuring device by 2 instead of the precision.

### **Procedural skill**

Some students stated the precision of a measuring device when asked for the uncertainty.

### **Communication**

When asked to justify which of two given measuring devices was more precise, some students simply stated their choice with no justification, while other students did not make any comparison between the two. In general, many justifications lacked clarity. When determining the maximum length given multiple measurements and their uncertainties, some students did not completely simplify their answer, while others made transcription errors.

## **Unit: Probability (provincial mean: 47.6%)**

### **Conceptual knowledge**

In general, students struggled to provide appropriate justifications for their answers. Some students had difficulty understanding the difference between “odds in favour” and “odds against.” Others did not convert between odds and probabilities correctly. Many students did not recognize the number of items that constitute a sample space and how to relate this to theoretical probability.

### **Procedural skill**

When calculating expected value, students were able to calculate the individual probabilities, but were unsure of how to use them. Where alternate solutions were possible, some students combined methods and veered away from the correct procedure.

### **Communication**

Some students did not clearly indicate the final answer. Rounding continues to be an issue, as well as using proper units.

## **Unit: Geometry and Trigonometry (provincial mean: 46.0%)**

### **Conceptual knowledge**

Many students did not know the characteristics of a kite (e.g., congruent sides and angles). Students also struggled with identifying corresponding sides and angles when substituting into trigonometric formulae. Some students had difficulty correctly drawing diagonals of polygons.

### **Procedural skill**

Students made many and varied computational and numerical errors when calculating using the sine and cosine law formulae. When solving for an angle using the cosine law, some students did not calculate the inverse of cosine. Instead, they multiplied the value of cosine A by 100 and assumed this was the final answer (e.g.,  $\cos A = 0.7472 \therefore A = 74.72^\circ$ ).

### **Communication**

Many students neglected to include units in their final answer. Some students rounded too early, especially when calculating angles. Others struggled with communicating the number of diagonals in a polygon using a diagram. To indicate lines were congruent, some students used chevron markings instead of tick marks. Others had difficulty understanding angle notation (e.g.,  $\angle ABC$  refers to the angle at point B).

## **Unit: Statistics (provincial mean: 47.3%)**

### **Conceptual knowledge**

Students had difficulty identifying percent when given a percentile rank scenario. Students continue to include a percent symbol when calculating percentile rank. When asked to determine the weighted mean of a data set that did not include percentages, students struggled to determine the correct weighting. They had difficulty understanding that the number of units was to be multiplied by the price per unit in order to calculate weighted mean. Instead, they divided by the number of groups.

### **Procedural skill**

When asked to determine the missing data point of a data set given a specific mean, students used “guess and check” in order to avoid algebraic manipulation. Unfortunately, for many students this did not result in correct final answers. Other students calculated the arithmetic mean of the given data set without considering what the question was asking.

## Communication

Some students did not express percentile rank as a whole number. Students had difficulty communicating their choice between median and mean when asked which was a better fit for the given scenario, even though they calculated the two values correctly.

## 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 compare the local marking results to the results from the departmental re-marking of sample test booklets. Provincially, 64.8% of the test booklets sampled were given nearly identical total scores. In 22.9% of the cases, local marking resulted in a higher score than those given at the department; in 12.4% of the cases, local marking resulted in a lower score. On average, the difference was approximately 0.6% with local marking resulting in the slightly higher average score.

## 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>	Final Answer	28.2%
<b>E2</b>	Notation	15.0%
<b>E3</b>	Transcription/Transposition	14.5%
<b>E4</b>	Whole Units	16.9%
<b>E5</b>	Units	53.3%
<b>E6</b>	Rounding	57.8%

## Survey Results

Teachers who supervised the Grade 12 Essential Mathematics Achievement Test in January 2019 were invited to provide comments regarding the test and its administration. A total of 207 teachers responded to the survey. A summary of their comments is provided below.

After adjusting for non-responses:

- 96.3% of the teachers indicated that the questions reflected the curriculum outcomes.
- 88.9% of teachers indicated that the reading level of the test was appropriate and 87.4% of them indicated the difficulty level of the test was appropriate.
- 87.3% of the teachers indicated that the time allotted to write the test was adequate.
- 89.1% of the teachers indicated that their students used a study sheet throughout the semester and 98.5% of teachers indicated that their students used a study sheet during the test.