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# GENERAL COMMENTS

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## Grade 12 Essential 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
59.9%	59.7%	57.0%	55.9%	57.1%	57.5%

### Unit: Home Finance (provincial mean: 61.5%)

#### Conceptual Knowledge

When calculating the interest portion of a monthly mortgage payment, many students used the interest rate as you would a sales tax instead of using the simple interest formula. The reference of being below 32% for the Gross Debt Service Ratio (GDSR) was confused with other values. When identifying energy efficient improvements available to a homeowner, many students provided energy conservation or cost saving solutions. For example, turning off the lights or finding an alternate energy source, be it solar power or wood burning, would be considered energy conservation and cost saving solutions. These do not satisfy the definition of energy efficiency which is an improvement that will result in “using less energy to provide the same service.”

### **Procedural Skill**

When calculating GDSR, some students did not change the annual salary to monthly for substitution into the formula. When calculating home insurance over \$200 000, some students applied the cost per \$1000 to each dollar of insurance.

### **Communication**

Some students did not show any work in questions that required calculations. When asked to state one energy efficient improvement, some students were too vague in their responses using one word answers such as “window.” Many students provided one correct and one incorrect response when asked only for one, which resulted in zero marks.

## **Unit: Vehicle Finance (provincial mean: 67.5%)**

### **Conceptual Knowledge**

Some students encountered difficulty when calculating the cost of a new vehicle, after taxes. They did not recognize the fact that taxes are to be calculated after the trade-in value is subtracted, not before. To calculate the total interest paid when financing a vehicle, some students mistakenly used the simple interest formula rather than subtracting the borrowed amount from the total amount paid. Other students correctly calculated the total amount paid, but then forgot to subtract the original loan amount.

### **Procedural Skill**

Although question-appropriate formulas were often identified, some students reversed the formulas, resulting in an incorrect answer. When given the fuel economy of a vehicle and asked to determine the total amount of fuel needed, students knew to use a ratio, but did not use the correct set-up. Some students did not know how to calculate tax correctly. Often, \$0.13 was added to the total instead of 13%.

### **Communication**

When asked to explain certain concepts, students’ answers were either too vague or were definitions of terms rather than explanations. For example, more information was needed when students were asked to provide one way to decrease insurance premiums. Many students suggested changing the insurance, but they did not indicate how.

## **Unit: Precision Measurement (provincial mean: 53.6%)**

### **Conceptual Knowledge**

Students seemed to understand that uncertainty is half of the precision, but often mistook precision for the numbered increments on a measuring tool. Students had a difficult time distinguishing between accuracy, precision, tolerance, and uncertainty. Many tried to use two or three concepts to explain one idea, and some used these terms interchangeably. Some students mistook precision for mean.

### **Procedural Skill**

Calculating the maximum and minimum length was relatively well done, although the given format (e.g.,  $15.5 \text{ cm}^{+0}_{-0.2 \text{ cm}}$ ) seemed unfamiliar to some, thus causing difficulty. When asked to find the combined width of numerous shapes, students knew to add the whole widths, but many added the fractional widths incorrectly.

## **Communication**

Vocabulary terms from this unit were used interchangeably (i.e., accuracy, precision, tolerance, uncertainty), oftentimes in the same sentence, thus nullifying any correct information given. When asked to choose a specific concept to explain a given situation, explanations were vague, using phrases like “wrong,” “a little bit off,” and “not accurate or not precise.” Many students did not include units with their final answer and some incorrectly converted measures within the metric system.

## **Unit: Probability (provincial mean: 59.2%)**

### **Conceptual Knowledge**

Many students gave odds against, not odds in favour of a particular event. When using expected value, many students found it hard to switch perspectives from player to owner of the game. When comparing theoretical probability to experimental probability, the wording of the question caused some confusion for students. When asked to explain the given statement, many students answered assuming that the given statement was true.

### **Procedural Skill**

When calculating a probability without replacement, many students did not remove one (1) from the total number of items. Students incorrectly reduced fractions. Although students knew when to calculate expected value, many were incapable of substituting correctly. When students calculated expected value using a T-chart, their work was hard to follow if their answer was incorrect, often resulting in a mark of zero.

## **Communication**

Many students indicated odds as fractions.

## **Unit: Geometry and Trigonometry (provincial mean: 49.7%)**

### **Conceptual Knowledge**

Many students used Pythagorean Theorem instead of cosine law to solve a non-right angle triangle. Students occasionally referred to flat edges and the notion of fitting together perfectly as properties of rectangles. Students struggled to clearly explain why an isosceles triangle would provide a steeper slope than an equilateral triangle. When asked to solve for the number of diagonals given the number of sides in a polygon, rather than using the formula, students simply wrote the number of sides down as the answer. Rather than calculating the sum of the interior angles of a given polygon, students often wrote down  $360^\circ$ , suggesting they confused interior and central angles.

### **Procedural Skill**

Students were able to substitute values correctly into the cosine law, however, when executing the calculations, order of operations was done incorrectly. Students also often missed the negative value for cosine and ended up subtracting instead of adding. Occasionally, students did not calculate the inverse of cosine, leaving the answer in decimal form.

## **Communication**

Students struggled to identify properties of rectangles and kites clearly and completely. Often times, answers were vague, referring just to equal sides, parallel sides or equal angles, without specifying which sides or angles using either a labelled diagram or an accurate, written explanation.

## **Unit: Statistics (provincial mean: 64.6%)**

### **Conceptual Knowledge**

When asked to explain what a given test score (as a percent) represents, students did not define the percentage properly; they just restated that it represents the score received on the test. Students could identify an outlier, but did not understand how an outlier affects the mean.

### **Procedural Skill**

Mistakes when determining the median were made by students who did not show the reordering of data from least to greatest. When calculating a trimmed mean, students either removed only the lowest score, or removed the first and last score in the list, not the highest and lowest scores.

### **Communication**

Students correctly calculated mean, median, and mode, but then wrote these correct answers on the incorrect line (e.g., the mean was written on the median line).

### **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, 45.8% of the test booklets sampled were given nearly identical total scores. In 42.5% of the cases, local marking resulted in a higher score than those given at the department; in 11.7% of the cases, local marking resulted in a lower score. On average, the difference was approximately 1.7% with local marking resulting in the slightly higher average score.

### **Survey Results**

Teachers who supervised the Grade 12 Essential Mathematics Achievement Test in June 2016 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:

- 95.8% of the teachers indicated that the test content was consistent with the learning outcomes as outlined in the curriculum document.
- 93.0% of teachers indicated that the reading level of the test was appropriate and 95.1% of them indicated the difficulty level of the test was appropriate.
- 93.1% of the teachers indicated that students were able to complete the entire test in the allotted time.
- 86.5% of the teachers indicated that their students used a study sheet throughout the semester and 91.8% of teachers indicated that their students used a study sheet during the test.