GENERAL COMMENTS

Grade 12 Essential 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).

Unit: Home Finance (provincial mean: 68.6%)

Conceptual Knowledge
Many students added the provincial tax credit when calculating the amount of property tax to be paid. Some students had difficulty calculating the unpaid balance in a mortgage amortization table. Some students were able to correctly identify a value from the Manitoba Homeowner's Insurance Rates table, but were unable to calculate the additional "per $1000 coverage" amount indicated at the bottom of the table.

Procedural Skill
Some students had difficulty converting monthly costs to annual costs. Students made errors when calculating a percentage reduction. For example, some students added instead of subtracted, while others did not subtract at all. Many order of operation errors were made.

Communication
Many rounding errors were committed when calculating the Gross Debt Service Ratio. When calculating monetary values, common errors included incorrect rounding and omitting units.

Unit: Vehicle Finance (provincial mean: 67.2%)

Conceptual Knowledge

Some students did not treat the cost of parts and labour as separate entities, thus they did not yield separate costs. Many students subtracted the down payment amount when asked to calculate the total cost of a lease. Some students had difficulty determining whether to use the book value or listed price when calculating taxes. Students struggled with the idea of depreciation; many treated each year's depreciation amount as a unique value.

Procedural Skill

Some students had difficulty identifying applicable taxes for given scenarios, while others continued to calculate PST at a rate of 8 %. Some students calculated taxes even though the question specifically indicated taxes were already included. Other students interpreted "after taxes" as simply adding $0.12 or $0.07 to the total amount, rather than multiplying by the tax rate. Many students did not correctly apply order of operations. Some students had difficulty substituting correct values into the given fuel economy formula, while other students who used the guess and check method, or estimation, had a difficult time determining the correct answer.

Communication

When monetary amounts yielded one-decimal answers, some students did not express the amount to two decimal places (i.e., $929.6). Incorrect units were often included with final answers. For example, some students expressed the price of gas in litres, while others expressed the amount of gas used to travel a given distance in L/100 km.

Unit: Precision Measurement (provincial mean: 46.4%)

Conceptual knowledge

Students had difficulty reading a measuring device to determine a measurement. They also had difficulty determining the uncertainty of a measuring device, as well as the uncertainty of a given measurement.

Procedural skill

Students did not recognize the need to add multiple uncertainties when a measuring device was used more than once. Many students did not divide tolerance by two when determining the minimum and maximum values.

Communication

Some students struggled to express measurements in the specified form.

Unit: Probability (provincial mean: 53.1%)

Conceptual knowledge

Some students did not know how to express a given probability as odds. Other students had difficulty using the expected value formula, especially when substituting the amounts for gain and loss.

Procedural skill

Students struggled with order of operations when calculating the expected value. Some students used the given experimental data when asked to calculate the theoretical probability.

Communication

Some students did not express discrete data as whole units. Some students did not express their final answer in the requested form.

Unit: Geometry and Trigonometry (provincial mean: 58.8%)

Conceptual knowledge

Some students used the Pythagorean Theorem or right angle trigonometric ratios to solve non-right angle triangles. When a required angle was not provided, many students did not calculate the measure of the missing angle and continued their calculations using incorrect values. A few students were unable to correctly identify corresponding angles and sides when substituting into the sine and cosine law formulas. Some students had difficulty identifying the appropriate formula when asked to calculate the measure of central and interior angles of regular polygons.

Procedural skill

When asked to calculate the measure of one interior angle, many students provided the correct answer, but did not show their mathematical process. Although most students knew how to solve for an interior angle using the formula, they were unable to make the connection between the formula and the provided diagram. When using the cosine law to calculate an unknown side, many students did not apply the square root to calculate the correct length. Often students did not correctly substitute the angle into the cosine law formula, leaving two variables in the equation. When solving for an unknown side, some students used the cosine law formula arranged for solving for an angle, which made the manipulation of the formula more difficult. Many students did not correctly apply order of operations, even when values were correctly substituted. Other students relied on their calculators to perform the correct order of operations, which at times produced erroneous answers.

Communication

Some students rounded too soon when evaluating trigonometric ratios. Many students forgot to include units in their final answer. Often students expressed answers to the correct decimal place, but then proceeded to round the final answer to the nearest whole number.

Unit: Statistics (provincial mean: 44.3%)

Conceptual knowledge

Students struggled to transfer their understanding of weighted mean to the given scenario when the question was expressed in an unfamiliar form. Students had difficulty understanding that a high percentage score could equate to a low percentile rank. Thus, they struggled to reach a conclusion regarding whether a given percentile rank was one of the best or worst scores. When calculating percentile rank, some students included the percent symbol with their final answer, indicating a lack of understanding between percentile rank and percentage.

Procedural skill

When calculating a weighed mean, some students had difficulty identifying the denominator (i.e., the entire data set).

Communication

Students continue to include decimals when expressing percentile rank. Students struggle to articulate their understanding of statistical topics when asked to justify or explain decisions.

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	21.4%
E2	Notation	13.4%
E3	Transcription/Transposition	18.3%
E4	Whole Units	16.5%
E5	Units	55.6%
E6	Rounding	66.6%

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, 59.3% of the test booklets sampled were given nearly identical total scores. In 23.9% 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 0.5% with local marking resulting in the slightly higher average score.

Survey Results

Teachers who supervised the Grade 12 Essential Mathematics Achievement Test in January 2020 were invited to provide comments regarding the test and its administration. A total of 201 teachers responded to the survey. A summary of their comments is provided below.

After adjusting for non-responses:

- 97.5% of the teachers indicated that the questions reflected the curriculum outcomes.
- 90.4% of the teachers indicated that the reading level of the test was appropriate and 95.5% of them indicated the difficulty level of the test was appropriate.
- 92.8% of the teachers indicated that the time allotted to write the test was adequate.
- 93.5% of the teachers indicated that their students used a study sheet throughout the semester and 96.0% of them indicated that their students used a study sheet during the test.