
GENERAL COMMENTS

Grade 12 Applied Mathematics Achievement Test (January 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.

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)

| January 2016 | June 2015 | January 2015 | June 2014 | January 2014 |
|--------------|-----------|--------------|-----------|--------------|
| 58.6% | 54.9% | 58.2% | 55.0% | 62.1% |

Relations and Functions (provincial mean: 64.1%)

Conceptual knowledge

No observations.

Procedural skill

Rounding: Students need to be careful when rounding values, particularly in questions with intermediate-step calculations. It is suggested that students keep the full value (mantissa) in their calculators or at least an additional decimal place for intermediate values.

Showing work: When asked to determine a sinusoidal regression equation, students must show appropriate work for marks. Appropriate work consists of a table of values based on the context or a graph illustrating the amplitude, shift, period, and intercept that was used to determine each coefficient.

Communication

Regression equations: Regression equations need to be complete, including a $y =$ (or the dependent variable used in the context of the question, if given). Students who omit this in their equations receive a (E1) communication error (notation).

Graphs: Clearly labelled graphs need to use as much of the graph area as possible, and have a smooth shape (not connecting-the-dots) and use appropriate interval values along the axes.

Probability (provincial mean: 57.9%)

Conceptual knowledge

Permutations with identical objects: When determining permutations, students did not consider the existence of repeated letters or, if they did, they did not include the use of parentheses in their calculations, both of which resulted in incorrect answers.

Permutations involving routes: For questions where students are asked to calculate probability based on possible routes through an intermediate location, students need to use the diagram twice, first to calculate the number of ways between the start and end points, and to calculate the number of ways between the start to the intermediate location, and then from the intermediate location to the end point. (The student may wish to use the blank space in the *Student Booklet* if there is insufficient space.)

Procedural skill

Confusing permutations with combinations: When calculating cases, students often added the numbers instead of multiplying them (e.g., calculating ${}_{18}C_2 + {}_{12}C_2$ instead of ${}_{18}C_2 \times {}_{12}C_2$).

Cases with conditions: If students are asked to calculate the total number of cases with conditions, it is important that students consider all possibilities (e.g., groups of four members with at least two girls means cases involving two, three, or four girls). The cases must then be added together.

Communication

Graphic organizers: Outcomes presented in graphic organizers need to be clearly communicated (e.g., sunny, not sunny).

Rounding when converting from decimal value to percentages: If the student opts to present his or her final answer as a percentage, the answer must be reported to two decimal places. For example, either 44.75% or 0.45 is a correct answer, but 45% is not.

Financial Mathematics (provincial mean: 56.6%)

Conceptual knowledge

Loan calculations: When students were asked how much was owed at the end of a term, students instead calculated the amount paid over the term.

Procedural skill

Rate of return: Students used the incorrect formula when calculating the overall rate of return. The formula is included in the Formula Sheet at the back of the *Student Booklet*.

Use of TVM calculator: Common errors included entering the wrong sign (using positive instead of negative), using a value as PMT (payment) instead of PV (present value), or using the PV as FV (future value).

Communication

Open-ended questions: Students also need to justify their answer to open-ended questions. Points are awarded for appropriate justification.

Design and Measurement (provincial mean: 55.4%)

Conceptual knowledge

Unit conversions: Incorrect conversion ratio for multidimensional units (e.g., converting from square feet to square yards).

Procedural skill

Calculating taxes: The addition of taxes should be calculated using the prices of the product, not the unit price. Students who included the taxes on the unit price (e.g., \$36.73 per square yard for unit price of \$32.50 per square yard) ended up with an incorrect answer.

Surface area calculations: Students used formulae incorrectly when determining volume of cone and/or cylinder, including not dividing by 3 for the cone or omitting to square the radius. When calculating surface area of the cone and cylinder structure, students also forgot to omit the surface area of circles from the cone and/or cylinder formulae.

Conic shapes: Slant height was also not correctly calculated when determining surface area of a cone. Students commonly used the original volume height instead of the Pythagorean Theorem to determine the hypotenuse.

Communication

Rounding: It is important that students preserve at least one extra decimal place in intermediate values to prevent rounding too soon in their final answers. If possible, students should use the π value on their calculator or computing software instead of the rounded value 3.14.

Logical Reasoning (provincial mean: 63.4%)

Conceptual knowledge

Venn diagram: Students forgot to consider the number of students outside of the Venn diagram.

Conditional statements: Students wrote the statement as a converse instead of providing a counterexample.

Procedural skill

Set theory: Students considered values in the universal as a separate set or added a full universal set outside of the circles, instead of the numbers outside of the given sets. Other common errors included the addition of elements that were not originally defined in the question and listing only two elements instead of three.

Communication

Venn diagrams: Students need to include a box around Venn diagrams. Otherwise, a communication error will be applied.

Puzzles: For puzzle questions, students must follow the rules presented in the question (e.g., using a number only once), and explain their strategy completely for full marks.

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 | Notation | 17.9% |
| E2 | Units | 24.1% |
| E3 | Transcription/Transposition | 18.9% |
| E4 | Final Answer | 20.4% |
| E5 | Rounding | 62.0% |
| E6 | Whole Units | 3.3% |

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.

These reports include a chart comparing the local marking results to the results from the departmental re-marking of sample test booklets. Provincially, 44.8% of the test booklets sampled were given nearly identical total scores. In 42.6% of the cases, local marking resulted in a higher score than those given at the department; in 12.6% of the cases, local marking resulted in a lower score. On average, the difference was approximately 1.5% with local marking resulting in the slightly higher average score.

Survey Results

Teachers who supervised the Grade 12 Applied Mathematics Achievement Test in January 2016 were invited to complete a feedback form regarding the test and its administration. A total of 78 forms were received. A summary of their comments is provided below.

After adjusting for non-responses:

- 80.8% of teachers indicated that all of the topics in the test were taught by the time the test was written.
- 93.6% of teachers thought that the test content was consistent with the learning outcomes outlined in the curriculum documents and 91.0% 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 82.1% of teachers indicated that all of their students used a study sheet during the test. 70.5% of teachers indicated that the study sheets were made during class.

- 80.8% of teachers indicated that their students used the formula sheet during the semester and 80.8% of teachers indicated that all of their students used the formula sheet during the test.
- During the test, 92.3% of the teachers indicated that all of their students used a graphing calculator, 9.0% of teachers indicated that at least some of their students used computer software, 7.6% indicated that at least some of their students used Internet tools, and 6.5% indicated that at least some of their students used apps on a mobile device.
- 98.6% of teachers indicated that students were able to complete the test in the time allowed.

