

Alberta Provincial
Achievement Testing

Subject
Bulletin
2015–2016

GRADE
9

Mathematics

Alberta  Government

This document was written primarily for

Students	
Teachers	✓ Grade 9 Mathematics
Administrators	✓
Parents	
General Audience	
Others	

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You can find [achievement test-related materials](#) on the Alberta Education website at education.alberta.ca.

Additional topics of interest are found in the [General Information Bulletin](#).

Grade 9 Mathematics Assessment

Special-format Practice Tests

To provide students an opportunity to practise provincial achievement test-style questions and content in Braille, audio, large print, or coloured print versions, Alberta Education is making special-format practice tests available. Tests are offered in all subjects with a corresponding provincial achievement test. Alberta schools with registered Alberta K-12 students may place orders for these tests. Braille tests are available in English, and by request in French. All tests are provided free of charge, but limits may be placed on order volumes to ensure access for everyone.

For more information or to place an order, contact

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General Description

The Grade 9 Mathematics Achievement Test consists of 40 multiple-choice and 10 numerical-response items that have been developed to be completed in 90 minutes; however, students may have an additional 30 minutes if necessary.

The following bullets briefly describe the two item formats:

- Multiple-choice items that provide students with four response options, of which only one is correct. Each item is worth one point.
- Numerical-response items that require students to generate a response (in symbolic form) to a particular problem rather than selecting a response from a list of four options. Each item is worth one point.

Test items are also categorized in terms of three levels of item complexity: low, moderate, and high. Low-complexity items require responses involving the simple recall and recognition of previously learned concepts and principles. Moderate-complexity items require responses that go beyond the habitual and may require more informal methods of reasoning and problem solving. High-complexity items require responses that are based on more abstract reasoning, planning, analysis, judgment, and creative thought. (See *Appendix 1* for a more detailed explanation of each complexity level.)

Use of Manipulatives and Calculators

Students are encouraged to use manipulative materials when completing the test. An acceptable manipulative is any mathematical tool that can be used by a student to help convert abstract ideas into concrete representations for the purpose of solving a problem (e.g., pattern blocks, tiles and cubes, geoboards, tangrams, counters, spinners, number lines, etc.). The manipulative cannot perform the mental conversion or provide the solution to a problem (e.g., multiplication table). Calculator use is encouraged but not required; however, graphing calculator use is prohibited. A calculator that has symbolic manipulation capabilities is also prohibited.

Local Marking of Test Multiple Choice and Numerical Response

A marking key will be provided to teachers for marking purposes. Teachers are expected to record and report the raw score achieved on the test by their students to parents.

Grade 9 Mathematics Achievement Test Blueprint

Multiple Choice (MC) and Numerical Response (NR)			
Item Type	Number of Items	Number of Marks	Percentage of Test
MC	40	40	80%
NR	10	10	20%
Total	50	50	100%

Content Domain of Test	
Strand	Percentage of Items on Test
Number	25 – 35%
Patterns and Relations	35 – 45%
Shape and Space	20 – 30%
Statistics and Probability	5 – 10%

Cognitive Domain of Test	
Complexity Level	Percentage of Items on Test
Low	30 – 40%
Moderate	45 – 55%
High	10 – 20%

Description of Mathematics Assessment Standards

The following statements describe what is expected of Grade 9 students at the acceptable standard and the standard of excellence based on outcomes in the [Program of Studies](#). These statements represent examples of the standards against which student achievement is measured. It is important to remember that one test cannot measure all the outcomes in the Program of Studies.

<i>Acceptable Standard</i>	<i>Standard of Excellence</i>
<p>Students who meet the acceptable standard in Grade 9 Mathematics are typically able to</p> <ul style="list-style-type: none"> • recall and apply a moderate number of mathematical properties to solve routine problems • utilize familiar problem-solving strategies to solve routine problems • connect and apply personal experiences and problem-solving strategies to solve routine problems • recall and apply mathematical concepts and operational terms to solve routine problems • apply computation skills and formal mathematics vocabularies to solve routine problems • recognize and describe numerical and non-numerical patterns • utilize semantic knowledge to construct correct mental representations of word problems • use logical processes to analyze and solve routine problems • recognize and use mathematical patterns to make predictions when solving routine problems • test generalizations from patterns to reach conclusions 	<p>Students who meet the standard of excellence in Grade 9 Mathematics are typically able to</p> <ul style="list-style-type: none"> • recall and apply a variety of mathematical properties to solve novel problems • utilize a variety of problem-solving strategies to solve novel problems • connect and apply personal experiences and strategies to check and verify solutions to novel problems • apply abstract thinking skills to reframe mathematical concepts to solve novel problems • generate linguistic and nonlinguistic representations of knowledge to solve novel problems • demonstrate fluency in working with patterns represented concretely, pictorially, or symbolically • utilize semantic knowledge to construct and reframe correct mental representations of word problems • use logical processes to analyze complex problems, reach conclusions, and justify or defend conclusions • recognize, extend, create, and use mathematical patterns to make and justify predictions when solving novel problems • make generalizations from patterns to reach conclusions

Preparing Students for the Mathematics Test

Suggestions for Preparing Students

The best way to prepare students for writing the achievement test is to teach the curriculum well and to ensure that students know what is expected. Many of the skills and attitudes that support test writing are, in fact, good skills and strategies for approaching all kinds of learning tasks.

Note that most of the questions on the mathematics test are placed in real-life contexts.

Teachers are encouraged to familiarize their students with the types of questions that will appear on the test. *Released items* from previously secured tests are available on the Alberta Education website.

Teachers are also encouraged to share the following information with their students to help them prepare for the Grade 9 Mathematics Achievement Test.

Suggestions for Answering Questions

- Before you begin, find out how much time you have.
- Ask questions if you are unsure of anything.
- Skim through the whole test before beginning. Find out how many questions there are and plan your time accordingly.
- Answer the easier questions first; then go back to the more difficult ones.
- Do not spend too much time on any one question. Make a mark (* or ?) beside any questions you have difficulty with and go back to them if you have time.
- Read each question carefully, underline or highlight key words, and try to determine an answer before looking at the choices.

- Read all the choices and see which one best fits the answer.
- When you are not sure which answer is correct, cross out any choices that are wrong, and then select the best of the remaining choices.
- If time permits, recheck your answers.
- Double-check to make sure that you have answered everything before handing in the test.
- Read the information given using the strategy that works best for you. You should either
 - look at all the information and think carefully about it before you try to answer the question

OR

- read the questions first and then look at the information, keeping in mind the question(s) you need to answer.
- Make sure that you look at all forms of the information given. Information may be given in words, charts, pictures, graphs, or maps.
- When information is given for more than one question, go back to the information before answering each question.
- Check your work when you calculate an answer, even when your answer is one of the choices.
- When answering “best answer” questions, be sure to carefully read all four alternatives (A, B, C, and D) before choosing the answer that you think is best. These questions will always include a bold-faced qualifier such as **best**, **most strongly**, or **most clearly** in their stems. All the alternatives (A, B, C, and D) are, to some degree, correct, but one of the alternatives will be “best” in that it takes more of the information into account or can be supported most strongly by reference to the information.

Opportunities to Participate in Test Development Activities

Field Testing

All Achievement Testing Program test questions are field tested before use. By “testing” the test questions, students who write field tests have an opportunity for a practice run at writing questions that could be used on future achievement tests. As well, the teachers have an opportunity to comment on the appropriateness and quality of the test questions.

Through the use of an online field test request system, teachers can create and modify field test requests and check the status of field test requests. Information regarding the field test process and the request system is available at <http://www.education.alberta.ca/admin/testing/forms.aspx>.

Once the completed requests are received by the Provincial Assessment Sector, classes will be selected to ensure that a representative and sufficiently large sample of students from across the province take part in the field test. Every effort will be made to place field tests as requested; however, because field tests are administered to a prescribed number of students, it may not be possible to fill all requests.

For further information about achievement field testing, see the Field Testing section of the [General Information Bulletin](#).

Working Groups

Teacher involvement in the development of provincial achievement tests is important because it helps to ensure the validity and appropriateness of the assessments.

To be selected to participate in a working group, a teacher must be nominated by a school administrator or superintendent, and that nomination must be approved by the superintendent. To ensure that selected working-group members have appropriate subject matter training and teaching experience, nominees are asked to provide their information to their school administrator so that it can be forwarded to the Provincial Assessment Sector at Alberta Education through the superintendent.

Test Development

Teacher working groups are used throughout the test development process to create raw forms of test questions, and to review and revise draft forms of provincial achievement tests. These working groups usually meet for one or two days, two or three times per year. Occasionally, these meetings are held on weekends or in the summer.

Teachers participating in test development and/or test review working groups are selected from the working-group nominees provided by superintendents of school jurisdictions.

Appendix 1

Levels of Item Complexity

Low Complexity

Items in this category require students to rely heavily on recalling and recognizing previously learned concepts and principles. Items typically specify what students are to do, which is often to carry out some procedure that can be performed mechanically. Students would not be expected to come up with original methods for finding a particular solution. The following list illustrates some of the demands that items categorized low complexity may require of students:

- Recall or recognize a fact, term, or property
- Recognize an example of a concept
- Perform a specified procedure
- Evaluate an expression in an equation or formula for a single variable
- Solve a one-step word problem
- Draw or measure simple 2-D shapes or 3-D objects
- Retrieve information from a graph, table, or figure

Moderate Complexity

Items in this category involve more flexibility of thinking and choice among alternatives than do those in the low-complexity category. They require a response that goes beyond the habitual, is not specified, and may require more than a single step. The student is expected to decide what to do, using informal methods of reasoning and problem-solving strategies, and to bring together skill and knowledge from various domains. The following list illustrates some of the demands that items of moderate complexity may require of students:

- Solve a word problem requiring multiple steps
- Compare figures or statements
- Provide a justification for steps in a solution process
- Interpret a visual representation
- Retrieve information from a graph, table, or figure and use it to solve a problem requiring multiple steps
- Interpret a simple argument
- Generalize a pattern

High Complexity

Items in this category make heavy demands on students by requiring them to engage in more-abstract reasoning, planning, analysis, judgment, and creative thought. The following list illustrates some of the demands that items of high complexity may require of students:

- Perform a procedure having multiple steps and multiple decision points
- Analyze similarities and differences between procedures and concepts
- Formulate an original problem, given a situation
- Solve a problem in more than one way
- Explain and justify a solution to a problem
- Describe, compare, and contrast solution methods
- Formulate a mathematical model for a complex situation
- Analyze the assumptions made in a mathematical model
- Analyze or produce a deductive argument
- Provide a mathematical justification

Adapted from Norman L. Webb, Wisconsin Center for Educational Research, "Depth-of-Knowledge Levels for Four Content Areas," March 28, 2002.

Appendix 2

Grade 9 Mathematics Formula Sheet

The following information may be useful in writing this test.

Area (A)

Circle $A = \pi r^2$

Rectangle $A = lw$

Triangle $A = \frac{bh}{2}$

Volume (V)

Right Cylinder $V = \pi r^2 h$

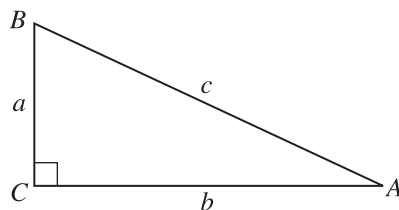
Prism $V = (\text{Base Area})(h)$

Circumference (C)

Circle $C = \pi d$ or $2\pi r$

Pythagorean Theorem

$c^2 = a^2 + b^2$ where c is the hypotenuse



Fold and tear along perforation.

GENERAL PURPOSE ANSWER SHEET

MULTIPLE CHOICE					NUMERICAL RESPONSE				
1	A B C D	21	A B C D	41	A B C D	81	A B C D	1	0 0 0 0
2	A B C D	22	A B C D	42	A B C D	82	A B C D	2	0 0 0 0
3	A B C D	23	A B C D	43	A B C D	83	A B C D	3	0 0 0 0
4	A B C D	24	A B C D	44	A B C D	84	A B C D	4	0 0 0 0
5	A B C D	25	A B C D	45	A B C D	85	A B C D	5	0 0 0 0
6	A B C D	26	A B C D	46	A B C D	86	A B C D	6	0 0 0 0
7	A B C D	27	A B C D	47	A B C D	87	A B C D	7	0 0 0 0
8	A B C D	28	A B C D	48	A B C D	88	A B C D	8	0 0 0 0
9	A B C D	29	A B C D	49	A B C D	89	A B C D	9	0 0 0 0
10	A B C D	30	A B C D	50	A B C D	90	A B C D	10	0 0 0 0
11	A B C D	31	A B C D	51	A B C D	91	A B C D	11	0 0 0 0
12	A B C D	32	A B C D	52	A B C D	92	A B C D	12	0 0 0 0
13	A B C D	33	A B C D	53	A B C D	93	A B C D		
14	A B C D	34	A B C D	54	A B C D	94	A B C D		
15	A B C D	35	A B C D	55	A B C D	95	A B C D		
16	A B C D	36	A B C D	56	A B C D	96	A B C D		
17	A B C D	37	A B C D	57	A B C D	97	A B C D		
18	A B C D	38	A B C D	58	A B C D	98	A B C D		
19	A B C D	39	A B C D	59	A B C D	99	A B C D		
20	A B C D	40	A B C D	60	A B C D	100	A B C D		

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