Alberta Provincial Achievement Testing

Assessment Highlights 2015–2016

GRADE 6

Mathematics

This document contains assessment highlights from the 2016 Grade 6 Mathematics Achievement Test. The examination statistics included in this document represent writers in English. To obtain French-only statistics which may apply to your school, please refer to the French version of this document.

Assessment Highlights provides information about the overall test, the test blueprint, and student performance on the achievement test that was administered in 2016. Also provided is information on student performance at the acceptable standard and the standard of excellence on selected items from the 2016 Grade 6 Mathematics Achievement Test. This information is intended for teachers and is best used in conjunction with multi-year and detailed school reports that are available in schools via the extranet. *Assessment Highlights* reports for all achievement test subjects and grades are posted on the Alberta Education website every year in the fall.

All released achievement tests, including test blueprints, answer keys with the item difficulty, reporting category, test section, and item description for each test item, are posted on the Alberta Education website (see Achievement Documents).

These materials, along with the program of studies and subject bulletins, provide information that can be used to inform instructional practice.

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The Alberta Education Internet address is education.alberta.ca.

This document was written primarily for:

Students	
Teachers	✓ of Grade 6 Mathematics
Administrators	✓
Parents	
General Audience	
Others	

Contents

The 2016 Grade 6 Mathematics Achievement Test

This report provides teachers, school administrators, and the public with an overview of the performance of those students who wrote the 2016 Grade 6 Mathematics Achievement Test. It complements the detailed school and jurisdiction reports.

How Many Students Wrote the Test?

A total of 43 210 students wrote the 2016 Grade 6 Mathematics Achievement Test. The English form of the test was written by 39 855 students, and the French form of the test was written by 3 355 students.

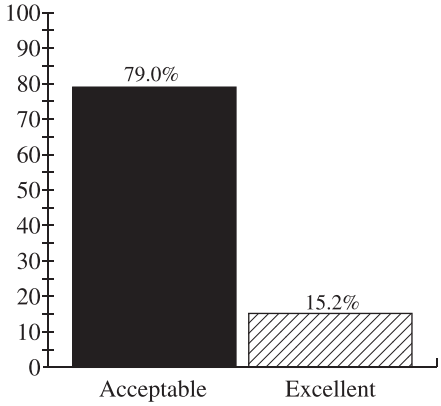
What Was the Test Like?

The 2016 Grade 6 Mathematics Achievement Test consisted of 40 multiple-choice and 10 numerical-response questions based on four strands: Number, Patterns and Relations, Shape and Space, and Statistics and Probability. In keeping with the intent of the 2007 Program of Studies, the questions on the test required students to apply their understanding of one or more mathematical concepts from within and/or across the four strands. As they solved the mathematical problems, students were expected to use the interrelated mathematical processes of Communication, Connections, Mental Mathematics and Estimation, Problem Solving, Reasoning, and Visualization. A detailed explanation of these mathematical processes is in the Alberta K–9 Mathematics Program of Studies.

How Well Did Students Do?

The percentages of students meeting the acceptable standard and the standard of excellence in 2016 are shown in the graph below. Out of a total score of 50 on the test, the provincial average was 32.0/50 (64.0%). The results presented in this report are based on scores of students who wrote the English version of the test. Detailed provincial assessment results are provided in school and jurisdiction reports.

Percentage of Students Meeting the Acceptable Standard & Standard of Excellence (%)



2016 Achievement Standards: The percentage of students in the province who met the acceptable standard on the 2016 Grade 6 Mathematics Achievement Test (based on those who wrote)

2016 Achievement Standards: The percentage of students in the province who met the standard of excellence on the 2016 Grade 6 Mathematics Achievement Test (based on those who wrote)

2016 Test Blueprint and Student Achievement

In 2016, 79.0% of students who wrote the English version of the Grade 6 Mathematics Achievement Test achieved the acceptable standard, and 15.2% of students who wrote achieved the standard of excellence.

Out of a total score of 50 on the test, the provincial average was 32.0/50 (64.0%). The blueprint below shows how the questions on the test were classified and includes the average raw score in each category for all Grade 6 students who wrote this test.

Strand	Level of Complexity*			Provincial Student Achievement (Raw Score and Percentage)
	Low	Moderate	High	
Number	**5**	**8**	**3**	**10/16 (62.5%)**
Patterns and Relations	**2**	**9**	**2**	**8.5/13 (65.4%)**
Shape and Space	**8**	**2**	**2**	**7.9/12 (65.8%)**
Statistics and Probability	**1**	**6**	**2**	**5.6/9 (62.2%)**
Provincial Student Achievement (Average Raw Score and Percentage)	**10.9/16 (68.1%)**	**16.2/25 (64.8%)**	**4.9/9 (54.4%)**	**Total Test Raw Score 32.0/50 (64.0%)**

*Each question is categorized according to its level of complexity (low, moderate, or high). Descriptions of the levels of complexity are in the *2016–2017 Mathematics 6 Subject Bulletin*.

2016 Grade 6 Mathematics Achievement Test Design Commentary

The 2016 Mathematics Provincial Achievement Test for Grade 6 was based on the 2007 Alberta K–9 Mathematics Program of Studies that was implemented in the 2011–2012 school year. The test blueprint provides information about new test design features (e.g., complexity) and modified test design features (e.g., item format and strand). Items now are selected not only in terms of the knowledge and skills that they assess, but also in terms of their complexity with regard to content and cognition. The introduction of item complexity will provide more information about the depth to which students have mastered particular learning outcomes, as well as provide one more control in the selection of test items to better ensure that tests are equivalent from year to year. Please refer to the *2016–2017 Mathematics 6 Subject Bulletin* for more-detailed information about item complexity.

The selection of test items within each of the four strands is now based on two primary factors: item difficulty and item complexity.

> **Item difficulty** refers to the percentage of students who chose the correct answer. Items for which the correct answer is selected by more than 70% of the students are generally considered easy. Items for which the correct answer is selected by 50–70% of the students are about average in difficulty. Items for which the correct answer is selected by fewer than 50% of the students are regarded as challenging.
>
> **Item complexity** refers to the cognitive and content demands associated with an item. The rationale for classifying items by their level of complexity is to focus on the expectations underlying the item and not the ability of the student. The cognitive demands that an item makes on a student (i.e., what an item requires the student to recall, understand, analyze, and do) are made with the assumption that the student is familiar with the basic concepts of the task.

The categories—low complexity, moderate complexity, and high complexity—form an ordered description of the demands an item may make on a student. For example, low-complexity items may require a student to solve a one-step problem. Moderate-complexity items may require multiple steps. High-complexity items go even further and require a student to analyze and synthesize information. It is therefore important to consider both the content being assessed by an item and the item complexity when making inferences about student performance on any one outcome. Although there is a logical and predictable relationship between item difficulty and item complexity (i.e., items that are of high complexity tend to be more challenging), there are exceptions.

The following ten items have been released to illustrate significant performance differences between three groups of students: those students who achieved the standard of excellence, those who achieved the acceptable standard, and those students who were below the acceptable standard. The purpose of these comparisons is to provide additional information that may be used for instructional purposes.

Sample Questions from the 2016 Grade 6 Mathematics Achievement Test

The following ten items illustrate significant performance differences between students who obtained the standard of excellence, the acceptable standard, or below the acceptable standard.

Item #	Strand	Specific Outcome	Item Complexity	Item Description
3	PR	3	Moderate	Identify which mathematical equation in a list of given equations can be used to describe the relationship displayed in a given table of values. (Gr. 5, PR.2)

	% of Student Responses (*Correct)			
	A*	**B**	**C**	**D**
Students Achieving Standard of Excellence	97.6	1.3	0.5	0.5
Students Achieving Acceptable Standard	76.4	13.2	5.6	4.4
Students Below Acceptable Standard	39.2	30.9	16.8	11.9

Eric uses a pattern of circles and squares to create four designs. The number of circles and the number of squares used in the four designs are shown in the table below.

Design	Number of Circles (x)	Number of Squares (y)
1	2	5
2	3	6
3	6	9
4	8	11

3. Which of the following equations represents the relationship between the number of circles (x) and the number of squares (y) in the table above?

A. $y = x + 3$

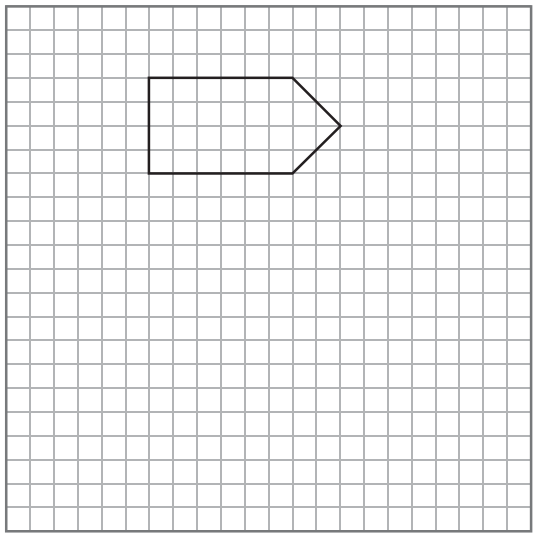
B. $y = 2x + 1$

C. $y = 3x - 1$

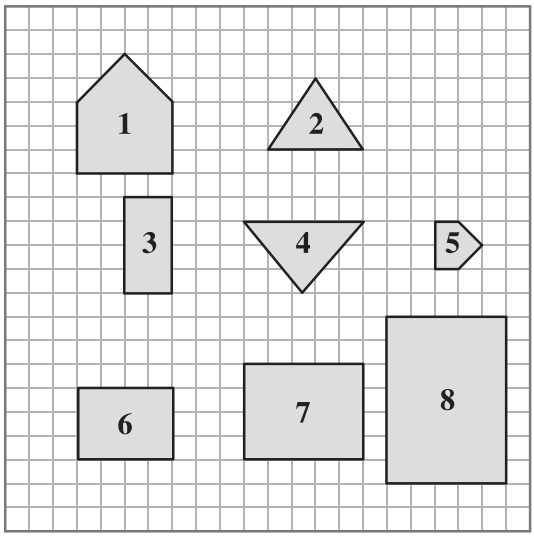
D. $y = 2x - 3$

Item #	Strand	Specific Outcome	Item Complexity	Item Description
8	SS	5	Low	Apply knowledge of congruence to identify which 2-D shapes in a given set of 2-D shapes can be combined to create a given 2-D shape.

	% of Student Responses (*Correct)			
	A*	B	C	D
Students Achieving Standard of Excellence	94.6	3.7	0.4	1.3
Students Achieving Acceptable Standard	79.1	11.1	2.7	7.1
Students Below Acceptable Standard	60.2	15.4	10.3	13.8



Box **A**



Box **B**

8. Which of the following 2-D shapes from Box B could be used to make a pentagon congruent to the one shown in Box A?

A. 1 and 6

B. 2 and 7

C. 3 and 5

D. 4 and 8

Item #	Strand	Specific Outcome	Item Complexity	Item Description
9	N	8	Moderate	Determine the total cost of items purchased at a store by multiplying decimals by single-digit multipliers. (Gr. 5, N.11)

	% of Student Responses (*Correct)			
	A	**B**	**C**	**D***
Students Achieving Standard of Excellence	0.2	1.6	0.6	97.6
Students Achieving Acceptable Standard	1.6	10.7	6.5	81.1
Students Below Acceptable Standard	7.8	31.1	17.5	43.0

At a grocery store, Tara bought 3 apples for $0.45 each, 2 bagels for $0.70 each, and a bottle of juice for $1.85. Monica bought 2 oranges for $0.55 each, a muffin for $1.25, and 2 packages of chewing gum for $0.85 each.

9. In total, how much did the girls spend at the grocery store?

A. $4.60

B. $5.65

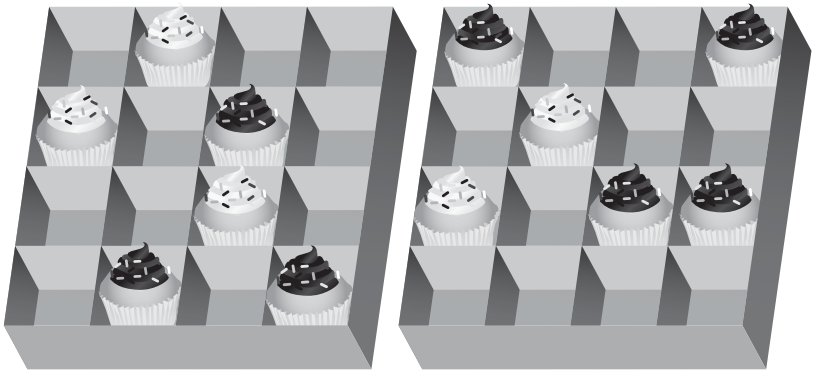
C. $7.25

D. $8.65

Item #	Strand	Specific Outcome	Item Complexity	Item Description
15	PR	4	Moderate	Determine the meaning of the variable in a given single-variable equation that represents a given context. (Gr. 5, PR.2)

	% of Student Responses (*Correct)			
	A	B	C*	D
Students Achieving Standard of Excellence	7.2	0.8	90.0	2.0
Students Achieving Acceptable Standard	22.2	5.2	60.6	12.0
Students Below Acceptable Standard	26.9	14.3	28.2	29.9

Billie arrived at school with two full trays of cupcakes to give to her class. At the end of the day, the two trays were partially full, as shown in the diagram below.



15. Based on the information above, the variable x in the equation $x + 12 = 32$ represents the

A. total number of cupcakes brought to school

B. number of cupcakes in each tray

C. cupcakes that were given away

D. cupcakes that are left over

Item #	Strand	Specific Outcome	Item Complexity	Item Description
33	SP	4	Moderate	Identify a change to a probability experiment that would result in the experimental and theoretical probabilities of a particular outcome occurring being close to equal.

	% of Student Responses (*Correct)			
	A	B	C*	D
Students Achieving Standard of Excellence	1.1	4.5	92.1	2.3
Students Achieving Acceptable Standard	5.1	11.9	74.2	8.4
Students Below Acceptable Standard	14.0	22.2	43.1	17.1

During a probability experiment, Sanjeet tosses a coin 10 times and it lands heads-side up 2 times.

33. How could Sanjeet change the experiment so that the probability of the coin landing heads-side up is closer to 0.5?

A. Flip a larger coin.

B. Switch hands after each coin toss.

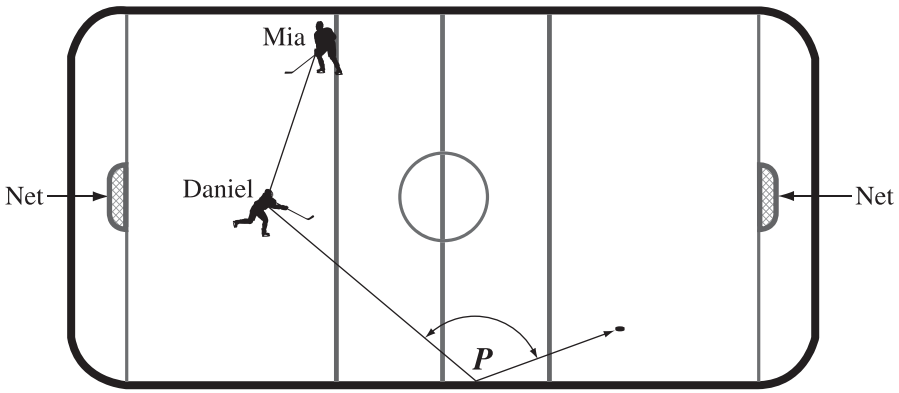
C. Increase the number of coin tosses.

D. Use a different coin for each coin toss.

Item #	Strand	Specific Outcome	Item Complexity	Item Description
34	SS	1	Low	Classify a given angle according to its measure.

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving Standard of Excellence	0.1	1.0	0.6	98.2
Students Achieving Acceptable Standard	1.8	7.7	4.8	85.3
Students Below Acceptable Standard	9.4	19.4	17.3	50.2

During hockey practice, Mia passes the puck to Daniel. Daniel shoots the puck off the boards as shown in the diagram below.



34. Angle *P* can be classified as

A. right

B. acute

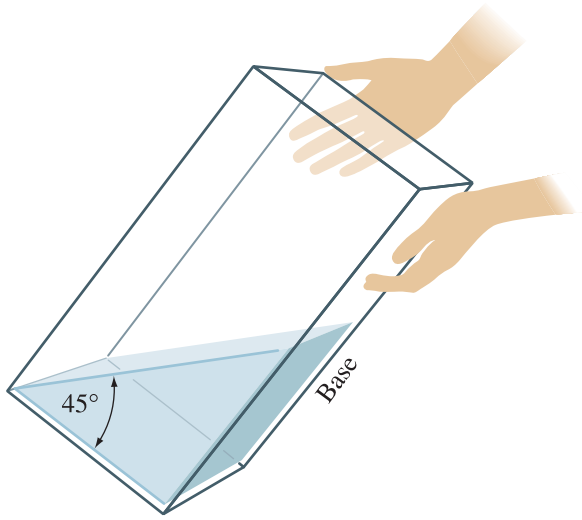
C. reflex

D. obtuse

Item #	Strand	Specific Outcome	Item Complexity	Item Description
36	N	6	High	Identify the symbolic representation of percent displayed in a real-life context.

	% of Student Responses (*Correct)			
	A	B*	C	D
Students Achieving Standard of Excellence	4.3	80.9	12.2	2.6
Students Achieving Acceptable Standard	12.5	54.2	24.5	8.3
Students Below Acceptable Standard	15.9	31.7	30.1	18.2

The fish tank shown below is a right rectangular prism. The tank is tilted so that water reaches halfway up the base.



36. What percentage of the tank is occupied by water?

A. 20%

B. 25%

C. 33%

D. 50%

Item #	Strand	Specific Outcome	Item Complexity	Item Description
NR 1	PR	5	Moderate	Apply knowledge of preservation of equality to determine the number of objects on one digital scale that equal the mass of one object on a second digital scale.

	% of Student Responses	
	Correct	Incorrect
Students Achieving Standard of Excellence	97.2	2.8
Students Achieving Acceptable Standard	83.8	16.2
Students Below Acceptable Standard	42.5	57.5

Digital Scales

Numerical Response

1. The mass of 1 eraser is equivalent to the mass of how many pencils?

Answer: _____ pencils

(Record your answer in the numerical-response section on the answer sheet.)

Item #	Strand	Specific Outcome	Item Complexity	Item Description
NR 3	N	3	Moderate	Determine if a given number is a prime number, a composite number, or a factor or multiple of given numbers.

	% of Student Responses	
	Correct	**Incorrect**
Students Achieving Standard of Excellence	92.0	8.0
Students Achieving Acceptable Standard	61.2	38.8
Students Below Acceptable Standard	22.1	77.9

Stephanie and Lauren use different methods to sort numbers.

Stephanie's Sorting Method	
Group 1 Numbers	Composite numbers that are smaller than 40
Group 2 Numbers	Prime numbers that are smaller than 40

Lauren's Sorting Method	
Group 1 Numbers	Numbers that are factors of 74
Group 2 Numbers	Numbers that are multiples of 7

Numerical Response

3. In which group would each student place the number 37?

Answer: _____ and _____
Stephanie **Lauren**

(Record **both digits** of your answer in the numerical-response section on the answer sheet.)

Item #	Strand	Specific Outcome	Item Complexity	Item Description
NR 4	SP	4	High	Determine the required number of sections on a spinner that would result in a given probability. (Gr. 5, SP. 4)

	% of Student Responses	
	Correct	Incorrect
Students Achieving Standard of Excellence	93.1	6.9
Students Achieving Acceptable Standard	55.3	44.7
Students Below Acceptable Standard	14.3	85.7

Hui creates a spinner with a certain number of equally sized sections. There are 2 grey sections on the spinner. There is a 40% chance of the spinner stopping on a grey section.

Numerical Response

4. In **total**, how many sections are on the spinner?

Answer: _____ sections

(Record your answer in the numerical-response section on the answer sheet.)

Achievement Testing Program Support Documents

The Alberta Education website contains several documents that provide valuable information about various aspects of the achievement testing program. To access these documents, go to the Alberta Education website. Click on one of the specific links to access the following documents.

Achievement Testing Program *General Information Bulletin*
The *General Information Bulletin* is a compilation of several documents produced by Alberta Education and is intended to provide superintendents, principals, and teachers with easy access to information about all aspects of the achievement testing program. Sections in the bulletin contain information pertaining to schedules and significant dates; security and test rules; test administration directives, guidelines, and procedures; calculator and computer policies; test accommodations; test marking and results; field testing; resources and web documents; forms and samples; and Provincial Assessment Sector contacts.

Subject Bulletins
At the beginning of each school year, subject bulletins are posted on the Alberta Education website for all achievement test subjects for grades 6 and 9. Each bulletin provides descriptions of assessment standards, test design and blueprinting, and scoring guides (where applicable) as well as suggestions for preparing students to write the tests and information about how teachers can participate in test development activities.

Examples of the Standards for Students' Writing
For achievement tests in grades 6 and 9 English Language Arts and Français/French Language Arts, writing samples are designed for teachers and students to enhance students' writing and to assess this writing relative to the standards inherent in the scoring guides for the achievement tests. The exemplars documents contain sample responses with scoring rationales that relate student work to the scoring categories and scoring criteria.

Previous Achievement Tests and Answer Keys
All January achievement tests (parts A and B) for Grade 9 semestered students are secured and must be returned to Alberta Education. All May/June achievement tests are secured except Part A of grades 6 and 9 English Language Arts and Français/French Language Arts. Unused or extra copies of only these Part A tests may be kept at the school after administration. Teachers may also use the released items and/or tests that are posted on the Alberta Education website.

Parent Guides
Each school year, versions of the *Alberta Provincial Achievement Testing Parent Guide* for grades 6 and 9 are posted on the Alberta Education website. Each guide answers frequently asked questions about the achievement testing program and provides descriptions of and sample questions for each achievement test subject.

Involvement of Teachers
Teachers of grades 6 and 9 are encouraged to take part in activities related to the achievement testing program. These activities include item development, test validation, field testing, and marking. In addition, arrangements can be made through the Alberta Regional Professional Development Consortia for teacher in-service workshops on topics such as interpreting achievement test results to improve student learning.