

**Alberta Provincial
Achievement Testing**

**Assessment
Highlights
2011–2012**

**GRADE
6**

Mathematics

Alberta  Government

This document contains assessment highlights from the 2012 Grade 6 Mathematics Achievement Test (2007 Program of Studies). The examination statistics that are included in this document represent all writers: both French and English. If you would like to obtain English-only or French-only statistics that apply to your school, please refer to your detailed reports, which are available on the extranet.

Assessment highlights provide information about the overall test, test blueprints, and student performance on the achievement test that was administered in 2012. 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 will be 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 located at: education.alberta.ca/admin/testing/achievement/answerkeys.aspx These materials, along with the *Program of Studies* and subject bulletins, provide information that can be used to inform instructional practice.

For further information, contact Kelly Rota, Grade 6 and 9 Mathematics Assessment Standards Team Leader, at Kelly.Rota@gov.ab.ca; Delcy Rolheiser, Grade 6 and 9 Mathematics Examiner, at Delcy.Rolheiser@gov.ab.ca; or Ken Marcellus, Director, Achievement Testing, at Ken.Marcellus@gov.ab.ca in the Assessment Sector, or call (780) 427-0010. To call toll-free within Alberta, dial 310-0000.

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	

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The 2012 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 2012 Grade 6 Mathematics Achievement Test. It complements the detailed school and jurisdiction reports.

How Many Students Wrote the Test?

A total of 39 308 students wrote the 2012 Grade 6 Mathematics Achievement Test. The English form of the test was written by 36 320 students, and the French form of the test was written by 2 988 students.

What Was the Test Like?

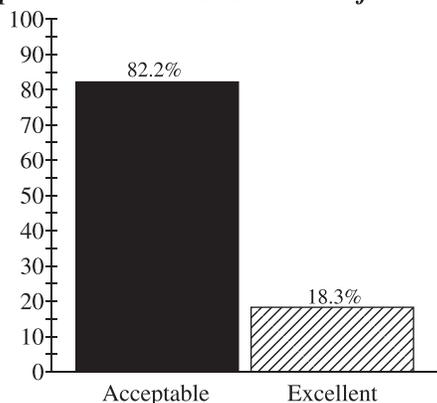
The 2012 Grade 6 Mathematics Achievement Test consisted of 40 multiple-choice and 10 numerical-response questions based on four strands: Number, Patterns and Relations, Shape and Space, Statistics and Probability. In keeping with the intent of the 2007 Program of Studies, the questions on the test required 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 2012 are shown in the graph below. Out of a total score of 50 on the test, the provincial average was 30.7/50 (61.3%). The results presented in this report are based on scores achieved by all students who wrote the test, including those in French Immersion and Francophone programs. Detailed provincial assessment results are provided in school and jurisdiction reports.

Grade 6—2012 Mathematics Achievement Test		
	Acceptable (%)	Excellence (%)
2012	82.2	18.3

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



-  2012 Achievement Standards: The percentage of students in the province who met the *acceptable standard* on the 2012 Grade 6 Mathematics Achievement Test (based on those who wrote).
-  2012 Achievement Standards: The percentage of students in the province who met the *standard of excellence* on the 2012 Grade 6 Mathematics Achievement Test (based on those who wrote).

2012 Test Blueprint and Student Achievement

In 2012, 82.2% of students who wrote the test achieved the *acceptable standard* on the Grade 6 Mathematics Achievement Test, and 18.3% of students who wrote achieved the *standard of excellence*.

Out of a total score of 50 on the test, the provincial average was 30.7/50 (61.3%). 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	10	2	10.1/17 (59.5%)
Patterns and Relations	2	9	3	9.0/14 (64.6%)
Shape and Space	8	4	2	8.5/14 (60.8%)
Statistics and Probability	3	2	0	2.9/5 (58.2%)
Provincial Student Achievement (Average Raw Score and Percentage)	11.8/18 (65.6%)	14.9/25 (59.8%)	3.9/7 (55.9%)	Total Test Raw Score 30.7/50 (61.3%)

*Each question is categorized according to its level of complexity (Low, Moderate, or High). Descriptions of the levels of complexity are in the [2012-2013 Mathematics 6 Subject Bulletin](#).

2012 Grade 6 Mathematics Achievement Test Design Commentary

The 2012 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 (i.e., complexity) and modified test design features (i.e., 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 regards 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 [*2012–2013 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 actually 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 less 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 of the item and not the ability of the student. The cognitive demands that an item requires of 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 instances in which this is not the case.

The following 8 items have been released to illustrate significant performance differences between two groups of students: (1) those students who achieved the *standard of excellence* as opposed to those who achieved the *acceptable standard*, and (2) those students who achieved the *acceptable standard* as opposed to those 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 2012 Grade 6 Mathematics Achievement Test

The following 4 items, from all 4 strands, illustrate significant performance differences between students who achieved the *standard of excellence* versus those who achieved the *acceptable standard*.

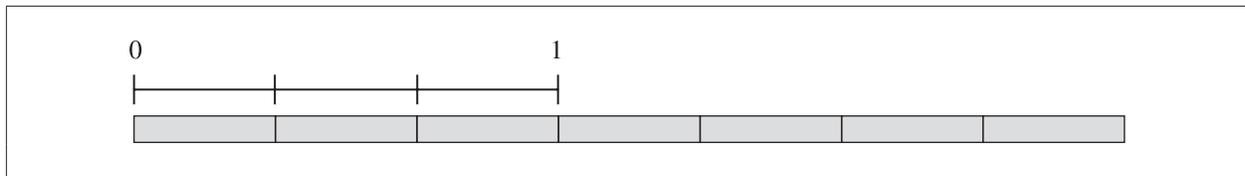
Item #	Strand	Specific Outcome	Item Complexity	Item Description
16	N	4	Moderate	Determine the mixed number that represents a set of congruent rectangles when 3 of the rectangles are shown to have a total value of 1 as represented on a number line.

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the <i>Standard of Excellence</i>	2.8	1.0	14.8	81.4
Students Achieving the <i>Acceptable Standard</i>	16.8	10.4	29.4	43.2

Commentary:

Of the students who achieved the *standard of excellence* and answered the item incorrectly, approximately 80% chose option C as their response. This suggests that these students interpreted the unit value of each shaded rectangle to be equal to $\frac{1}{7}$ instead of $\frac{1}{3}$. Likewise, of the students who achieved the *acceptable standard* and answered the item incorrectly, 52% made the same interpretation and selected option C. It is also interesting to observe that an additional 30% selected option A, which implies that these students also did not correctly understand the unit value of each rectangle.

Use the following information to answer question 16.



16. Which of the following mixed numbers represents all of the shaded rectangles shown in the diagram above?

- A. $1\frac{4}{7}$
- B. $1\frac{3}{4}$
- C. $2\frac{1}{7}$
- D. $2\frac{1}{3}$

Item #	Strand	Specific Outcome	Item Complexity	Item Description
13	SS	1	Low	Measure four different angles to determine the angle that is of a certain measurement.

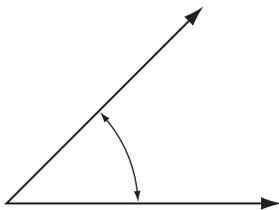
	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the <i>Standard of Excellence</i>	0.2	0.3	5.6	94.0
Students Achieving the <i>Acceptable Standard</i>	1.8	3.0	16.1	79.1

Commentary:

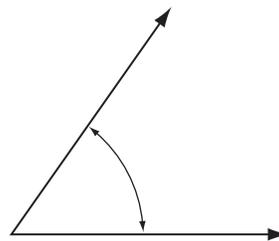
Of the students who achieved the *standard of excellence* and answered the item incorrectly, approximately 92% chose option C as their response. This suggests that these students may have estimated the measure of the angle without verifying their estimate with a protractor. Likewise, of the students who achieved the *acceptable standard* and answered the item incorrectly, 77% also selected option C.

13. Which of the following angles measures 75° ?

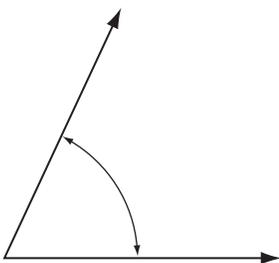
A.



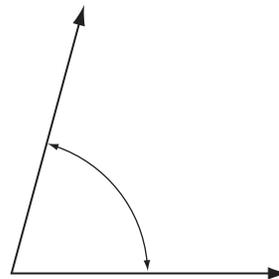
B.



C.



D.



Item #	Strand	Specific Outcome	Item Complexity	Item Description
22	PR	2	High	Predict the value of an unknown term using the relationship in a given table of values. (Gr.5, PR.1)

	% of Student Responses (*Correct)			
	A*	B	C	D
Students Achieving the <i>Standard of Excellence</i>	94.1	4.1	1.2	0.6
Students Achieving the <i>Acceptable Standard</i>	65.2	22.7	7.8	4.2

Commentary:

Of the students who achieved the *standard of excellence* and answered the item incorrectly, approximately 69% chose option **B** as their response. This suggests that these students doubled the given value of 31 instead of identifying and applying the relationship between the columns in the table of values. Likewise, of the students who achieved the *acceptable standard* and answered the item incorrectly, 65% also selected option **B**. An additional 22% of the students achieving the *acceptable standard* selected option **C**, which suggests that they applied the pattern of adding 2 squares to the given value of 31 instead of identifying and applying the relationship between triangles and squares.

Use the following information to answer question 22.

Alexa is using triangles and squares to design some figures.

	Number of Triangles	Number of Squares
Figure 1	1	3
Figure 2	2	5
Figure 3	3	7
Figure 4	4	9
Figure 5	5	11

22. If Alexa continues the pattern, then how many squares will there be in figure 31?
- A. 63
 - B. 62
 - C. 33
 - D. 32

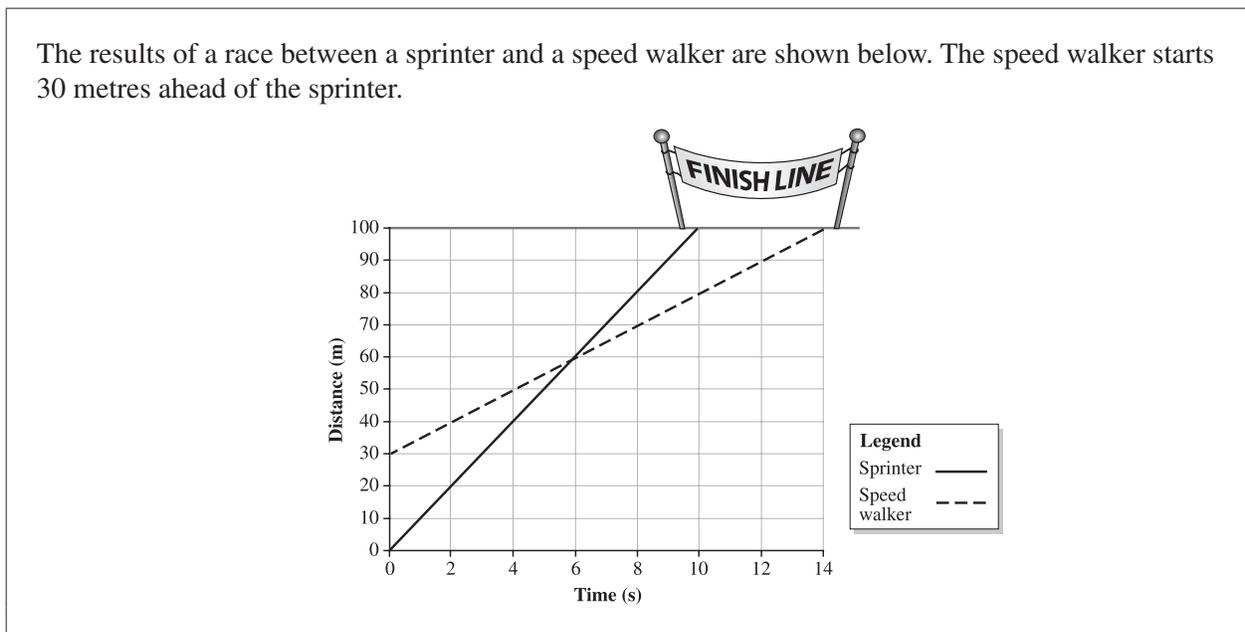
Item #	Strand	Specific Outcome	Item Complexity	Item Description
28	SP	1	Low	Read and interpret a line graph to draw a conclusion.

	% of Student Responses (*Correct)			
	A*	B	C	D
Students Achieving the <i>Standard of Excellence</i>	94.4	2.7	2.5	0.4
Students Achieving the <i>Acceptable Standard</i>	77.4	10.3	9.1	3.1

Commentary:

Of the students who achieved the *standard of excellence* and answered the item incorrectly, approximately 48% chose option **B** as their answer. This suggests that these students incorrectly interpreted the legend by assuming the speed walker was represented by the solid line instead of the dotted line. Approximately 45% of the students in this group selected option **C**, which suggests that these students used the difference between y-axis values instead of the difference between x-axis values to solve the problem. Likewise, of the students who achieved the *acceptable standard* and answered the item incorrectly, 46% selected option **B** and 40% selected option **C**, which suggests that the students in this population made errors similar to those of the *standard of excellence* cohort of students.

Use the following information to answer question 28.



28. Who won the race and by how many seconds?

- A. The sprinter by 4 seconds
- B. The speed walker by 4 seconds
- C. The sprinter by 20 seconds
- D. The speed walker by 20 seconds

The following 4 items, from all 4 strands, illustrate significant performance differences between students who achieved the *acceptable standard* versus those who were below the *acceptable standard*.

Item #	Strand	Specific Outcome	Item Complexity	Item Description
8	N	6	Moderate	Match a given ratio to its pictorial representation.

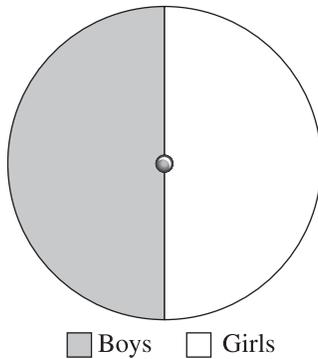
	% of Student Responses (*Correct)			
	A	B	C*	D
Students Achieving the <i>Acceptable Standard</i>	7.8	19.1	70.3	2.7
Students Below the <i>Acceptable Standard</i>	31.0	40.6	23.4	4.5

Commentary:

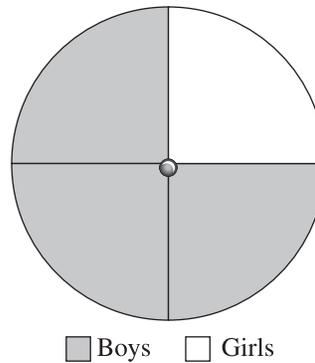
Of the students who achieved the *acceptable standard* and answered the item incorrectly, approximately 65% chose option **B** as their response. This suggests that these students may have confused the concept of ratio with the concept of sum. Likewise, of the students who were below the *acceptable standard* and answered the item incorrectly, 53% selected option **B** and 41% selected option **A**, which further implies that these students have additional difficulties in interpreting pictorial representations of ratios.

8. Which of the following circles represents a ratio of 2 boys to 1 girl?

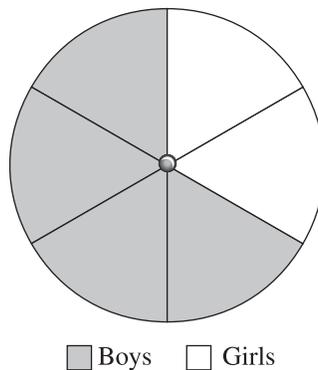
A.



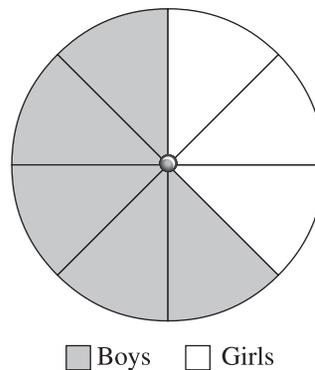
B.



C.



D.



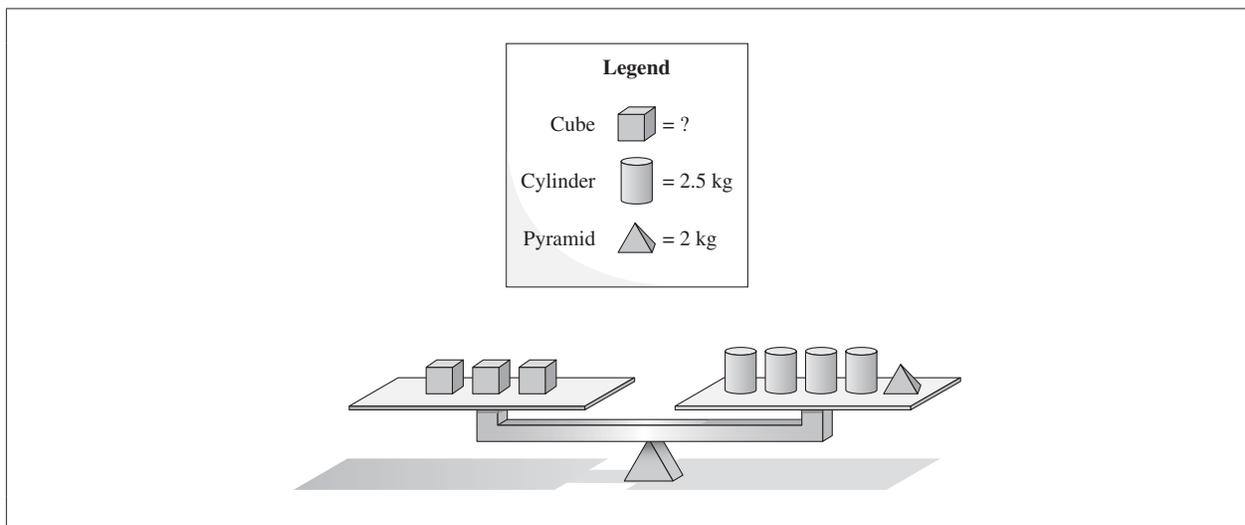
Item #	Strand	Specific Outcome	Item Complexity	Item Description
9	PR	5	Moderate	Apply knowledge of preservation of equality to determine the value of one unknown object presented on a balanced scale.

	% of Student Responses (*Correct)			
	A	B	C*	D
Students Achieving the <i>Acceptable Standard</i>	2.5	9.1	85.2	3.1
Students Below the <i>Acceptable Standard</i>	13.3	31.0	41.4	13.9

Commentary:

Of the students who achieved the *acceptable standard* and answered the item incorrectly, approximately 62% chose option **B** as their response. This suggests that these students may not have included the mass of the pyramid when calculating the total mass on the right side of the scale balance. This error will result in each cube having a mass of $3.\bar{3}$ kg which students would probably round down to 3 kg. Likewise, of the students who were below the *acceptable standard* and answered the item incorrectly, 53% selected option B, which suggests that they made a similar mistake in their calculations. The remaining 47% of these students selected the other two options almost equally, which suggests that they may lack knowledge regarding the concept of preservation of equality.

Use the following diagram to answer question 9.



9. What is the mass of one cube?

- A. 2 kg
- B. 3 kg
- C. 4 kg
- D. 5 kg

Item #	Strand	Specific Outcome	Item Complexity	Item Description
NR 7	SS	5	Low	Sort a given set of polygons into regular and irregular polygons.

Performance of Students Achieving the <i>Acceptable Standard</i>				
Responses	2	3	4*	5
% of Student Responses (*Correct)	11.3	23.5	36.9	10.7

Commentary:

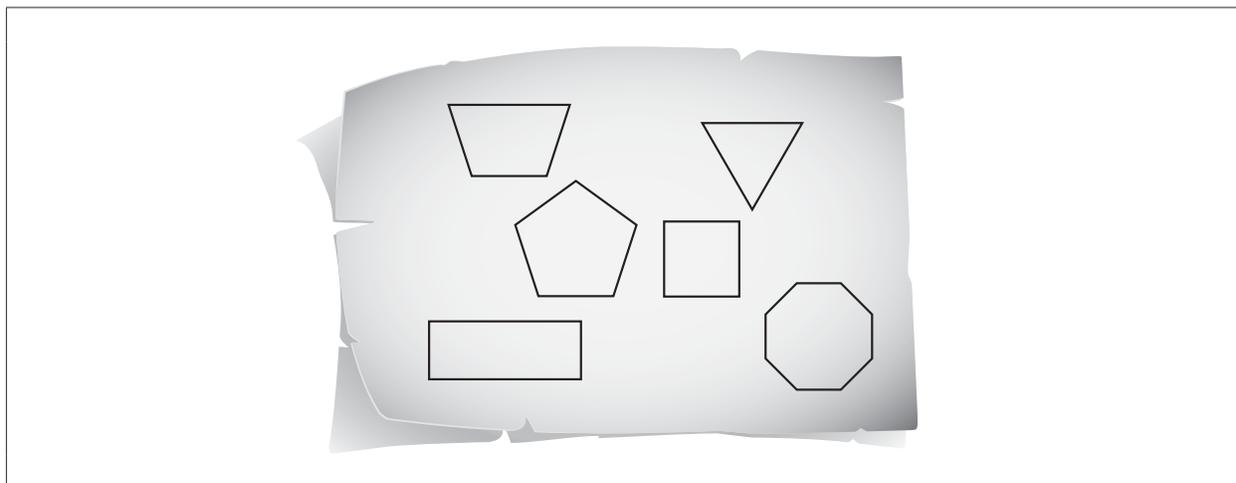
Of the students who achieved the *acceptable standard* and answered the item incorrectly, approximately 37% answered 3, 18% answered 2, and 17% answered 5. This suggests that these students may not recall the fact that the side lengths and the internal angles of a regular polygon must be the same.

Performance of Students Below the <i>Acceptable Standard</i>				
Responses	1	2	3	4*
% of Student Responses (*Correct)	11.8	20.5	27.3	17.0

Commentary:

Of the students who were below the *acceptable standard* and answered the item incorrectly, 33% answered 3, 25% answered 2, and 14% answered 1. The data suggests that this population of students had difficulty recalling the properties of a regular polygon.

Use the following information to answer numerical-response question 7.



Numerical Response

7. How many of the 2-D shapes shown above are regular polygons?

Answer: _____ polygons

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

Item #	Strand	Specific Outcome	Item Complexity	Item Description
NR 10	SP	3	Moderate	Read and interpret a broken-line graph to solve a given problem.

Performance of Students Achieving the <i>Acceptable Standard</i>				
Responses	0.30	0.35*	30	35
% of Student Responses (*Correct)	5.1	43.1	2.5	11.2

Commentary:

Of the students who achieved the *acceptable standard* and answered the item incorrectly, approximately 20% answered 30. This suggests that these students understood what the problem was asking them to do and were able to interpret the line graph correctly and they did not pay enough attention to the required units for the answer.

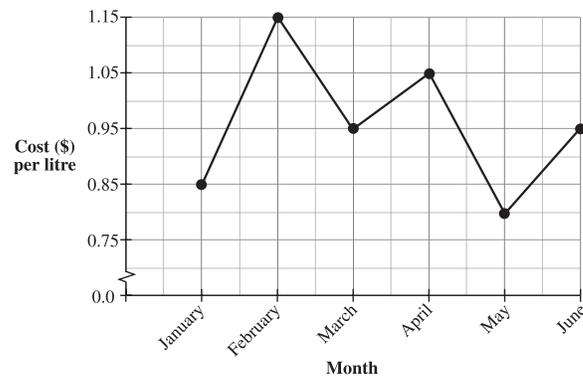
Performance of Students Below the <i>Acceptable Standard</i>				
Responses	0.35*	0.95	1.15	35
% of Student Responses (*Correct)	6.0	6.0	9.0	3.8

Commentary:

Of the students who were below the *acceptable standard* and answered the item incorrectly, 10% answered 1.15 and 6% answered 0.95. This suggests that these students did not fully understand the problem and used values on the line graph as their responses.

Use the following information to answer numerical-response question 10.

The following line graph shows the cost of gasoline from January to June.



Numerical Response

10. The difference between the **highest** and the **lowest** plotted values on the graph is \$ _____/L.

(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 at education.alberta.ca. From the home page, follow this path: *Teachers > Provincial Testing > Achievement Tests*, and then click on one of the specific links under the *Achievement Tests* heading 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 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 3, 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 3, 6, and 9 English Language Arts and Français/French Language Arts, writing samples have been designed to be used by 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 3, 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 [*Parent Guide to Provincial Achievement Testing*](#) for grades 3, 6, and 9 are posted on the Alberta Education website. Each guide presents answers to frequently asked questions about the achievement testing program as well as descriptions of and sample questions for each achievement test subject.

Involvement of Teachers

Teachers of grades 3, 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.