

Alberta Provincial  
Achievement Testing

Assessment  
Highlights  
2010-2011

GRADE  
3

# Mathematics



Government  
of Alberta ■

Alberta ■

Freedom To Create. Spirit To Achieve.

This document contains assessment highlights from the 2011 Grade 3 Mathematics Achievement Test. 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 2011. Also provided is commentary on student performance at the *acceptable standard* and the *standard of excellence* on selected items from the 2011 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 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](http://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.

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The Alberta Education Internet address is [education.alberta.ca](http://education.alberta.ca).

This document was written primarily for:

Students	
Teachers	✓ of Grade 3 Mathematics
Administrators	✓
Parents	
General Audience	
Others	

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# The 2011 Grade 3 Mathematics Achievement Test

This report provides teachers, school administrators, and the public with an overview of the performance of those students who wrote the 2011 Grade 3 Mathematics Achievement Test. It complements the detailed school and jurisdiction reports.

## How Many Students Wrote the Test?

A total of 39 376 students wrote the 2011 Grade 3 Mathematics Achievement Test. The English form of the test was written by 35 764 students and the French form of the test was written by 3 612 students.

## What Was the Test Like?

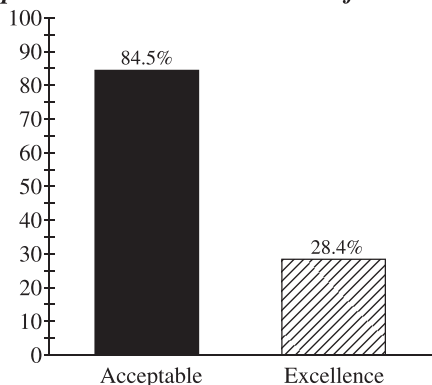
The 2011 Grade 3 Mathematics Achievement Test consisted of 40 multiple-choice questions based on four strands: Number, Patterns and Relations, Shape and Space, Statistics and Probability. In keeping with the intent of the 2007 Program of Studies, the questions on the test required students to apply their 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 2011 are shown in the graph below. Out of a total score of 40 on the test, the provincial average was 28.9/40 (72.3%). 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 3—2011 Mathematics Achievement Test		
	Acceptable (%)	Excellence (%)
2011	84.5	28.4

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



-  2011 Achievement Standards: The percentage of students in the province who met the *acceptable standard* on the 2011 Grade 3 Mathematics Achievement Test (based on those who wrote)
-  2011 Achievement Standards: The percentage of students in the province who met the *standard of excellence* on the 2011 Grade 3 Mathematics Achievement Test (based on those who wrote).

## 2011 Test Blueprint and Student Achievement

In 2011, 84.5% of students who wrote the test achieved the *acceptable standard* on the Grade 3 Mathematics Achievement Test, and 28.4% of students who wrote achieved the *standard of excellence*.

Students scored an average of 28.9/40 (72.3%) on the Mathematics Achievement Test. The blueprint below shows where the questions on the test were classified and includes the average raw score in each category for all grade three students who wrote this test.

Description	Level of Complexity*			Provincial Student Achievement (Raw Score and Percentage)
	Low	Moderate	High	
<b>Number</b> <ul style="list-style-type: none"> <li>Develop and demonstrate number sense for whole numbers 0 to 1 000, and understand fractions as part of a whole.</li> <li>Develop and demonstrate personal strategies when applying arithmetic operations (addition, subtraction, multiplication, or division) on whole numbers to create and solve problems.</li> <li>Justify the personal strategies used to solve problems.</li> </ul>	12	5	1	13.4/18 (74.4%)
<b>Patterns and Relations</b> <ul style="list-style-type: none"> <li>Investigate, identify, and communicate rules for numerical and non-numerical patterns, in order to describe the world and to solve problems.</li> <li>Represent, solve, and communicate an addition or subtraction equation with one unknown number.</li> </ul>	3	4	1	5.8/8 (72.5%)
<b>Shape and Space</b> <ul style="list-style-type: none"> <li>Estimate, measure, and compare, using personal referents and standards units of measurement to solve problems.</li> <li>Describe, classify, construct, and relate 3-D objects and 2-D shapes</li> </ul>	5	3	2	6.9/10 (69%)
<b>Statistics and Probability</b> <ul style="list-style-type: none"> <li>Collect, organize, and interpret data in a variety of ways to solve problems.</li> <li>Construct, label, and interpret bar graphs to solve problems.</li> </ul>	1	3	0	2.9/4 (72.5%)
<b>Provincial Student Achievement (Average Raw Score and Percentage)</b>	16.4/21 (78.1%)	10.7/18 (59.4%)	1.8/4 (45.0%)	<b>Total Test Raw Score</b> <b>28.9/40</b> <b>(72.3%)</b>

\*Each question is categorized according to its level of complexity (Low, Moderate, or High). Descriptions of the levels of complexity are in the [2011-2012 Mathematics 3 Subject Bulletin](#) located at [http://education.alberta.ca/media/4870681/08%20math3%202011%20subject%20bulletin\\_signoff.pdf](http://education.alberta.ca/media/4870681/08%20math3%202011%20subject%20bulletin_signoff.pdf)

# Sample Questions from the 2011 Mathematics Achievement Test

The following sample questions from the 2011 Grade 3 Mathematics Achievement Test show how students responded to questions from the four reporting categories or strands (Number, Patterns and Relations, Space and Shape, and Statistics and Probability). For each sample question, the keyed answer is marked with an asterisk. There is a brief analysis of the question and statistics describing how students answered it. These questions are no longer secured and will not be used on future achievement tests.

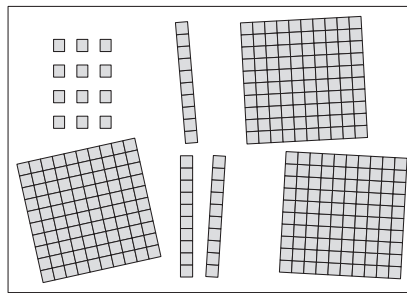
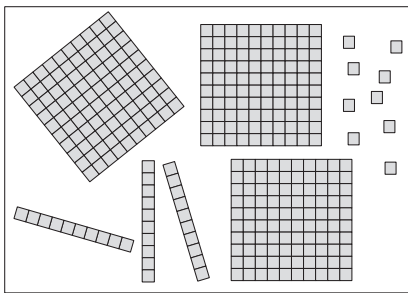
## Number Strand

Questions from the **Number** strand require students to demonstrate number sense for whole numbers (0 to 1 000) and understand fractions as part of a whole. Students also need to implement effective personal strategies when they use arithmetic operations (addition, subtraction, multiplication, or division) to solve problems.

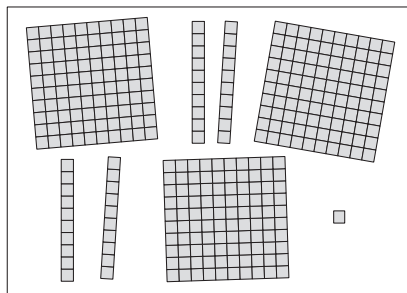
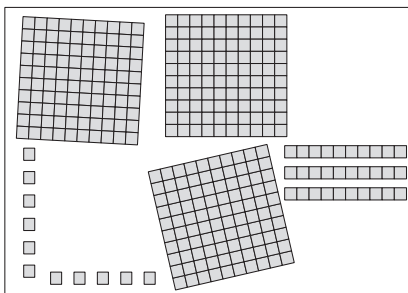
In multiple choice question 3, students must identify the greatest number that is represented by base-ten blocks. The question is based on Specific Outcome 2 and Specific Outcome 5 from the **Number** strand. It is classified as a Low Complexity question.

3. Students use base-ten blocks to represent numbers.

Which of the following sets of base-ten blocks shows the **GREATEST** number?



\*



Many students (75%) were able to answer this question correctly. To determine the answer students needed to identify a number that was represented pictorially (base-ten blocks) and understand the concept of place value to 1 000. They also had to know the meaning of the term “greatest.” Option **A** was chosen by about 3% of the students. Option **C** was selected by 6% of the students and option **D** was chosen by almost 16% of them. About 79% of the students who met the *acceptable standard* were able to correctly answer this question, and about 94% of students meeting the *standard of excellence* selected the correct response.

Students needed to identify the number expression that represents a three-digit number in order to accurately answer multiple choice question 13. This question is based on Specific Outcome 9 and Specific Outcome 2 from the **Number** strand. It is classified as a High Complexity question.

**13.** Mandy uses 791 blocks to build a bridge.

**The number 791 can be represented as**

- \*  829 – 38
- 803 – 22
- 779 + 32
- 758 + 43

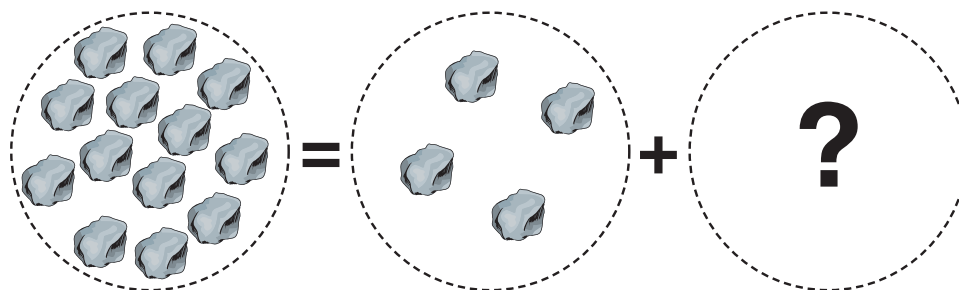
Students found this question to be significantly more challenging than the previous sample question (about 57% of students answered it correctly). To find a solution, they had to solve the addition and subtraction expressions using their personal strategies. Students also needed to apply their understanding of place value when adding and subtracting the numbers. Option **B** was chosen by 11% of the students. Option **C** was selected by 13% of the students and option **D** was chosen by 17% of them. About 88% of students who met the *standard of excellence* were able to correctly answer this question and about 56% of students meeting the *acceptable standard* selected the correct response.

### ***Patterns and Relations Strand***

When answering questions based on outcomes from the **Patterns and Relations** strand, students should be able to investigate, identify, and communicate rules for numerical and non-numerical patterns, in order to describe the world and to solve problems. They should also be able to sort items (symbols and pictures) in a variety of ways according to two or more attributes. Representing, solving, and communicating addition or subtraction equations (with one unknown number) are also outcomes in this strand.

Multiple choice question 9 is based on Specific Outcome 4 from the **Patterns and Relations** strand, and it is classified as a Low Complexity question. In order to answer this question correctly, students must solve an equation which contains a symbol that represents an unknown number.

9. Justin groups some rocks to show the equation  $13 = 4 + ?$



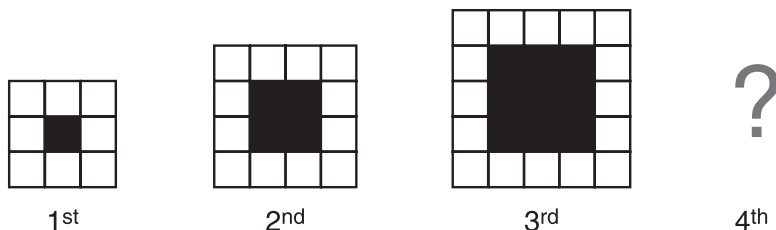
The number missing from Justin's equation is

- 5
- \*  9
- 13
- 17

The majority of students (76%) chose the correct response to this question. Students had to determine the number that could be used to balance the equation. They could use symbolic (numbers) and/or pictorial (rocks) information when finding the answer. Option A was selected by 3% of the children and option C was chosen by 2%. Option D was the response of 17% of the students. Over 90% of students meeting the *standard of excellence* answered this question correctly as did 80% of the students meeting the *acceptable standard*.

Multiple choice question 35 is based on Specific Outcome 4 from the **Patterns and Relations** strand as well as Specific Outcome 1 from the **Number** strand. It is classified as a Moderate Complexity question. To answer this question, students must recognize an increasing pattern illustrated by a set of three shapes and then extend the pattern by predicting the number of items in the fourth shape.

35.



How many white squares will be in the 4<sup>th</sup> shape if the pattern continues?

- 14
- 16
- 18
- \*  20

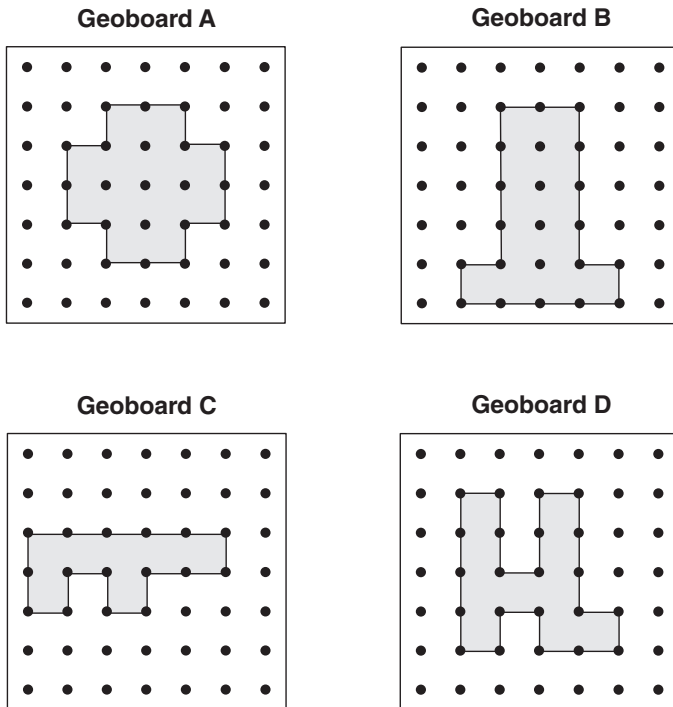
Students found this question slightly more challenging than question 9. About 73% answered it correctly. By analyzing the given shapes and identifying how the pattern was growing (by 4), students were able to calculate the number of squares that would be in the fourth shape. Option **A** was chosen by 5% of students and 6% chose Option **B**. About 13% of students selected Option **C**. Almost 78% of students meeting the *acceptable standard* answered this question correctly and over 92% of the students meeting the *standard of excellence* chose the right response.

## Space and Shape Strand

When answering questions based on outcomes from the **Space and Shape** strand, students should be able to estimate, measure, and compare, using personal referents, as well as non-standard and standards units of measurement to solve problems. They should also be able to describe, classify, construct, and relate 3-D objects and 2-D shapes.

When students answered multiple choice question 7, they had to measure and compare the perimeters of shapes illustrated on geoboards. This item is classified as a Moderate Complexity question, and it is based on Specific Outcome 5 in the **Space and Shape** strand.

7. Nola uses some elastic bands to make different shapes on four geoboards.



The shapes that have the same perimeter are found on geoboards

- A and B
- \*  A and C
- B and D
- C and D

Students found this item to be somewhat challenging (about 69% answered it correctly). In order to respond accurately, students needed to understand the meaning of the term “perimeter” and then apply that knowledge when calculating and comparing the perimeters of the four shapes. Option **A** was favoured by 13% of students and option **C** was selected by almost 11%. Option **D** was chosen by 6% of the children. Just over 90% of students who met the *standard of excellence* answered this question accurately and about 71% of students meeting the *acceptable standard* responded correctly.

In order to answer multiple-choice question 22 correctly, students counted the number of days that a common activity (walking the dog) occurred. Students needed to apply their understanding of a month, which was represented by a calendar page, when solving this problem. This item is classified as a Low Complexity question, and it is based on Specific Outcome 1 in the **Space and Shape** strand.

22. During the month of August, Jan walks her dog every Monday, Wednesday, and Saturday.

August						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

**On how many days does Jan walk her dog in the month of August?**

- 4 days
- 9 days
- \*  13 days
- 31 days

Most students (88%) were able to answer this question accurately. Option **A** was selected by 3% of students, option **B** was chosen by almost 5%, and option **D** was favoured by 3% of respondents. Almost 94% of students meeting the *acceptable standard* answered it correctly and 98% of students who met the *standard of excellence* responded accurately.

## Statistics and Probability Strand

When answering questions based on objectives from the **Statistics and Probability** strand, students should be able to collect, organize, and interpret data in a variety of ways to solve problems. They should also be able to construct, label, and interpret bar graphs to solve problems.

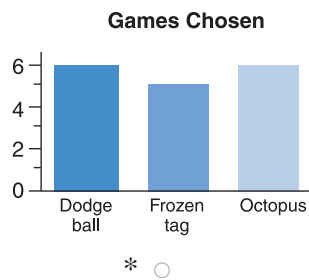
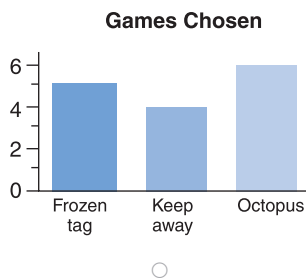
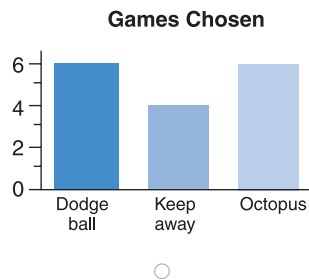
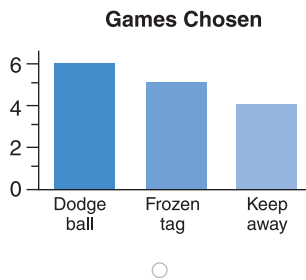
Multiple choice question 38 addresses Specific Outcome 1 and Specific Outcome 2 from the **Statistics and Probability** strand. When answering the question, students needed to analyze data from a list and identify the bar graph that corresponds to this data. It is classified as a Moderate Complexity question.

38. Some students vote for the game that they want to play.

Game Chosen	Number of Votes
Dodge ball	✓✓✓✓✓✓✓✓
Frozen tag	✓✓✓✓✓✓
Keep away	✓✓✓✓
Octopus	✓✓✓✓✓✓✓✓

✓ = 1 vote

Which of the following bar graphs shows the three games that have the MOST votes?



Students found this question somewhat challenging. About 66% of them were able to answer it correctly. Students needed to analyze information presented in a chart, and then they had to identify the bar graph that accurately represented the pertinent data from the chart. Option **A** attracted almost 16% of the students, option **B** was selected by over 13% of the students, and option **C** was favoured by 2% of them. Over 89% of students who met the *standard of excellence* answered this question correctly and about 68% of students meeting the *acceptable standard* answered it accurately.

# *Highlights from the 2011 Mathematics Achievement Test*

Overall, students performed as expected on the Mathematics Achievement Test. Comments from teachers and administrators indicated that the questions on the test reflected both the intent and the objectives of the program.

Teachers have expressed a desire for more assessment-related support materials. In response to this request, A [Guide for Teachers](http://education.alberta.ca/admin/testing/achievement/toolkit.aspx) has been developed and it is located at <http://education.alberta.ca/admin/testing/achievement/toolkit.aspx>. This document includes information about the PAT, sample questions, vocabulary lists, and answers to frequently asked questions. A number of released multiple-choice questions can also be located at <http://education.alberta.ca/admin/testing/achievement/answerkeys.aspx> and at <https://questaplus.alberta.ca/>.

## **Areas of Strength**

Students successfully demonstrated their understanding in several areas on the test. These areas include:

**1. Identifying the sequence of numbers, both forward and backward, from 0 to 1000 (N.1)**

Students were able to accurately count by 3, 4, 5 and 100. They applied this understanding when solving problems.

**2. Demonstrating an understanding of increasing and decreasing patterns (PR. 1 and PR. 2)**

Students accurately identified numerical and non-numerical patterns that were presented in a variety of contexts (charts, pictures, number sequences, etc.).

**3. Solving addition and subtraction equations which have a symbol that represents an unknown number (PR. 4)**

One of the new objectives in the program of studies involves understanding and solving equations with one unknown number. Students demonstrated a good understanding of this concept when determining an unknown number in an equation that was represented both symbolically and pictorially.

**4. Measuring the length of objects using cm (SS. 3 and SS. 5)**

Students were able to measure objects correctly and compare these measurements to solve a problem. They were also able to accurately calculate the perimeter of a shape.

**5. Using collected data to answer questions (SP. 1)**

Students read and compared graphs accurately. For example, they accurately matched the data in a tally chart to the data in a bar graph. They also recognized the bar graph which displayed the same information given in a circle chart.

## ***Instructional Awareness***

Students' performance on the test highlighted some areas where students experienced less success. These areas include:

### **1. Mentally calculating basic facts and applying them in a problem solving situation (N. 10 and N. 11)**

Although students are not required to recall basic facts (addition and subtraction to 18; multiplication to  $5 \times 5$ ) on a timed number fact test, they still need to understand and be able to calculate those facts accurately and efficiently by using mental mathematics strategies. Many of the problems on the test involve the knowledge of basic facts and/or the efficient use of strategies to determine basic facts in order to find a solution.

### **2. Understanding the relationship between various time periods (seconds, minutes, days, weeks, months, years) and measurements (cm to m, g to kg) (SS.1, SS.2, SS. 3, and SS. 4)**

Questions which are at the moderate and high levels of complexity\* may require students to know and calculate the relationship between time periods (e.g. minutes to hours; days in a month) or between measurements (cm and m, g and kg). Students who understand these relationships can use this knowledge during the process of solving problems involving various measurements (e.g. time, length, mass).

### **3. Addition and Subtraction of 2- and 3-digit numerals up to 1 000 (N. 9)**

In the revised program of studies, students are encouraged to develop personal strategies for adding and subtracting numbers. Practicing these strategies in a meaningful way (e.g. when solving problems) is the most effective way to ensure that students are able to add and subtract efficiently and accurately. Students are expected to add and subtract numbers in which numbers may need to be rearranged (regrouped), based on their understanding of place value. For example, an addition question such as  $326 + 48$  may be solved as  $300 + 60 + 14$ . A subtraction question such as  $127 - 38$  may be solved as  $127 - 20 - 10 - 8$ .

### **4. Estimating quantities less than 1000, using referents (N. 4)**

Students are expected to understand and use referents (known quantities) when estimating quantities (concrete, pictorial, symbolic) of up to 1 000. The process of subitizing (recognizing at a glance), which is taught in Kindergarten and Grade 1, along with the introduction of referents, which can be used to estimate quantities to 100 in Grade 2 are foundational concepts on which the mathematical processes required to master this objective can be based.

\*For a full description of the levels of complexity see [Grade Three Mathematics Subject Bulletin 2011–2012](http://education.alberta.ca/admin/testing/achievement/bulletins.aspx) at [education.alberta.ca/admin/testing/achievement/bulletins.aspx](http://education.alberta.ca/admin/testing/achievement/bulletins.aspx).

# *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](http://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 Student 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.

