

Alberta Provincial
Achievement Testing

Assessment
Highlights
2009-2010

GRADE
3

Mathematics



Government
of Alberta ■

Alberta ■

Freedom To Create. Spirit To Achieve.

This document contains assessment highlights from the 2010 Grade 3 Mathematics Achievement Test (1997 Program of Studies) as well as some observations about the 2010 Pilot 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 2010. Also provided is commentary on student performance at the *acceptable standard* and the *standard of excellence* on selected items from the 2010 Mathematics Achievement Test (1997 Program of Studies). 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.

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The Alberta Education Internet address is 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 2010 Grade 3 Mathematics Achievement Test (1997 Program of Studies)

This report provides teachers, school administrators, and the public with an overview of the performance of those students who wrote the 2010 Grade 3 Mathematics Achievement Test (*1997 Program of Studies*). It complements the detailed school and jurisdiction reports.

How Many Students Wrote the Test?

A total of 17 127 students wrote the 2010 Grade 3 Mathematics Achievement Test (*1997 Program of Studies*). The English form of the test was written by 14 642 students and the French form of the test was written by 2 485 students.

What Was the Test Like?

The 2010 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, and a Timed Number Fact test, which accounts for 3 marks.

The strands were interspersed throughout the 40 questions. For example, questions on Number do not constitute the first section; rather, they were mixed with questions from the strands related to Patterns and Relations, Shape and Space, and Statistics and Probability. The knowledge and skills components were also integrated throughout the test.

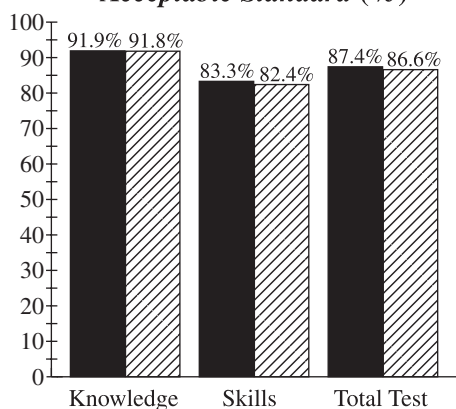
How Well Did Students Do?

The percentages of students meeting the *acceptable standard* and the *standard of excellence* in 2010 compared with 2009 are shown in the graphs below. Out of a total score of 43 on the test, the provincial average was 31.1/43 (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.

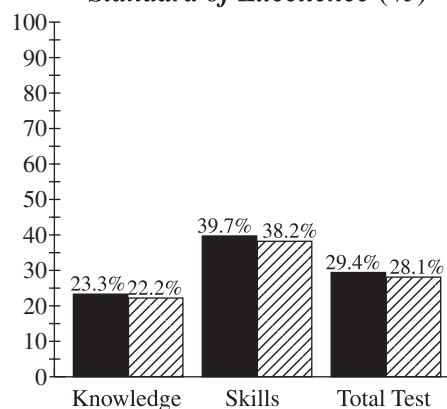
Grade 3—Acceptable (%)			
	Knowledge	Skills	Total
2009	91.9	83.3	87.4
2010	91.8	82.4	86.6

Grade 3—Excellence (%)			
	Knowledge	Skills	Total
2009	23.3	39.7	29.4
2010	22.2	38.2	28.1

Percentage of Students Meeting the Acceptable Standard (%)



Percentage of Students Meeting the Standard of Excellence (%)



- 2009 Achievement Standards: The percentage of students in the province who met the *acceptable standard* and the *standard of excellence* on the 2009 Grade 3 Mathematics Achievement Test (based on those who wrote).
- 2010 Achievement Standards: The percentage of students in the province who met the *acceptable standard* and the *standard of excellence* on the 2010 Grade 3 Mathematics Achievement Test (based on those who wrote).

2010 Test Blueprint and Student Achievement (1997 Program of Studies)

In 2010, 86.6% of students who wrote the test achieved the *acceptable standard* on the Grade 3 Mathematics Achievement Test, and 28.1% of students who wrote achieved the *standard of excellence*. These results are slightly lower at both the *acceptable standard* and the *standard of excellence* on the previous administration of the achievement test.

Student achievement on the 2010 Grade 3 Mathematics Achievement Tests averaged 31.1 out of a total score of 43 (72.3%).

The blueprint below shows the general outcomes that the questions address as well as the reporting categories under which questions are classified. The number of questions in each category is approximate.

General Outcomes	Reporting Category		Provincial Student Achievement Average Raw Score and Percentage
	Knowledge	Skills	
Number <ul style="list-style-type: none"> Develop a number sense for whole numbers 0 to 1 000, and explore fractions (fifths and tenths) Apply an arithmetic operation (addition, subtraction, multiplication, or division) on whole numbers, and illustrate its use in creating and solving problems Use and justify an appropriate calculation strategy or technology to solve problems 			12.1/17 (71.2%)
Patterns and Relations <ul style="list-style-type: none"> Investigate, establish, and communicate rules for numerical and non-numerical patterns, including those found in the home, and use these rules to make predictions 			4.5/6 (75.0%)
Shape and Space <ul style="list-style-type: none"> Estimate, measure, and compare by using whole numbers and primarily standard units of measure Describe, classify, construct, and relate 3-D objects and 2-D shapes Use numbers and direction words to describe the relative positions of objects in one dimension using everyday contexts 			8.5/12 (70.8%)
Statistics and Probability <ul style="list-style-type: none"> Collect first- and second-hand data, display the results in more than one way, and interpret the data to make predictions Use simple probability experiments designed by others in order to explain outcomes 			6.0/8 (75.0%)
Provincial Student Achievement Average Raw Score and Percentage	12.3/17 (72.4%)	18.8/26 (72.3%)	Total Test Raw Score 31.1/43 (72.3%)

*Sample Questions from the 2010 Mathematics Achievement Test
(1997 Program of Studies)*

The following sample questions from the 2010 Grade 3 Mathematics Achievement Test (*1997 Program of Studies*) show how students responded to question 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; to understand fractions (up to fifths and tenths); to apply arithmetic operations (addition, subtraction, multiplication or division) to whole numbers and use these operations to create and solve problems; to select and justify an appropriate calculation strategy (including the use of technology) to solve problems.

In multiple choice question 9, students must determine which set of numbers is ordered from least to greatest. The question is based on an objective from the **Number** strand and it is classified as a **Knowledge** question.

9. Students collect pennies for a fun day at school. They put the pennies in cans and label how many are in each one.



Which of the following lists shows the numbers on the cans of pennies in order from the LEAST to the GREATEST?

- 335, 353, 355, 553, 533
- 355, 353, 335, 553, 533
- * 335, 353, 355, 533, 553
- 355, 353, 335, 533, 553

Many students (74.8%) were able to answer this question correctly. To determine the answer, students had to use both their knowledge of place value and their understanding of the terms “least” and “greatest.” Option **A** was chosen by 14.9% of the students. Option **B** was selected by 4.2% of the students and option **D** was chosen by 5.7% of them. About 79% of students who met the *acceptable standard* were able to correctly answer this question and about 93% of students meeting the *standard of excellence* selected the correct response.

Students had to solve a problem involving the multiplication of two one-digit numbers in order to answer multiple choice question 28 accurately. This question is based on an objective in the **Number** strand and it is classified as a **Skill** question.

- 28.** There are 5 people in Jen’s family. Each person in Jen’s family eats about 7 kg of bananas in one year.

About how many kilograms of bananas do all 5 people eat in one year?

- 12 kg
- 28 kg
- * 35 kg
- 42 kg

Students found this question to be more challenging than the previous sample question (62.9% of students answered it correctly). To find the answer, they had to determine which number operation(s) to use and then they had to accurately multiply and/or add the numbers given in the problem. Option **A** was chosen by 14% of the students. Option **B** was selected by 10.3% of the students and option **D** was chosen by 11.8% of them. About 92% of students who met the *standard of excellence* were able to correctly answer this question and about 66% of students meeting the *acceptable standard* selected the correct response.

Patterns and Relations Strand

When answering questions based on objectives from the **Patterns and Relations** strand, students should be able to investigate, establish, and communicate rules for numerical and non-numerical patterns and then use these rules to make predictions. They should also be able to sort items (symbols and pictures) according to two or more attributes.









Multiple choice question 21 is based on an objective from the **Patterns and Relations** strand and is classified as a **Skill** question. In order to answer this question correctly, students must sort a group of pictures based on four attributes.

21. Shay chooses two shirts, according to the following attributes.

1 st shirt	<ul style="list-style-type: none"> • 4 buttons • collar 	<ul style="list-style-type: none"> • flowers • short sleeves
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2 nd shirt	<ul style="list-style-type: none"> • 3 buttons • no collar 	<ul style="list-style-type: none"> • stripes • long sleeves
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Which of the following shirts does Shay choose?

- *  and 
-  and 
-  and 
-  and 

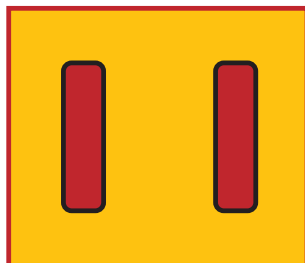
Most students (81.9%) chose the correct response to this question. Students had to determine the attributes of the items from the information provided in two charts. Using this information, students needed to locate the items that represented the given attributes. Option **B** was selected by 6.2% of the children and option **C** was chosen by 4.6%. Option **D** was the response of 6.7% of the students. Over 96% of students meeting the *standard of excellence* answered this question correctly as did almost 86% of the students meeting the *acceptable standard*.

Space and Shape Strand

When answering questions based on objectives from the Space and Shape strand, students should be able to estimate, measure, and compare objects by using whole numbers and non-standard and standard units of measure; describe, classify, construct, and relate 3-D objects and 2-D shapes; use numbers and direction words to describe the relative positions of objects in one dimension using everyday contexts.

When students answered multiple choice question 16, they had to know some specific mathematical terms and then they had to apply this knowledge when describing two shapes. This item is classified as a **Skill** question and it is based on objectives in the **Space and Shape** strand.

16. Beth puts two red sticks on a mat.



The two red sticks on the mat are

- * parallel and congruent
- parallel and perpendicular
- intersecting and congruent
- intersecting and perpendicular

Students found this item to be somewhat challenging (65.8% answered it correctly). In order to respond accurately, students needed to understand the meaning of the terms “parallel” and “congruent” and then apply that knowledge when describing the two shapes. Option **B** was favoured by 17.2% of students and option **C** was selected by 9.9%. Option **D** was chosen by 6.4% of the children. Just over 86% of students who met the *standard of excellence* answered this question accurately and about 67% of students meeting the *acceptable standard* responded correctly.

In order to answer multiple choice question 23 correctly, students had to know the number of days in one year. This item is classified as a **Knowledge** question and it is based on objectives in the **Space and Shape** strand.

23. The number of days in 3 years can be shown as

- $12 + 12 + 12$
- $52 + 52 + 52$
- $300 + 300 + 300$
- * $365 + 365 + 365$

This question was similar in difficulty to multiple choice question 16 (64.7% of students answered it correctly). Students had to know both the number of days in a year (as opposed to the number of weeks or months in a year—which were included in the alternatives) and they had to be able to recognize a number expression (addition), which showed how the number of days in three years could be determined. Option **A** was selected by 10.3% of students, option **B** was chosen by 9.6% and option **C** was favoured by 13.8% of respondents. Just over 68% of students meeting the acceptable standard answered it correctly and 93% 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 first- and second-hand data, display the results in more than one way, as well as interpret the data to solve problems and make predictions. They should also be able to understand and explain the outcomes of simple probability experiments.

Multiple choice question 26 is based on an objective from the **Statistics and Probability** strand and is classified as a **Knowledge** question. In order to answer this question correctly, students must match the data from a tally chart to a bar graph which displays the same data.

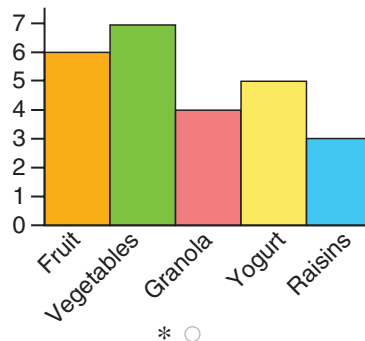
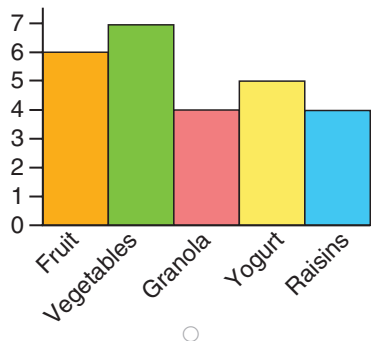
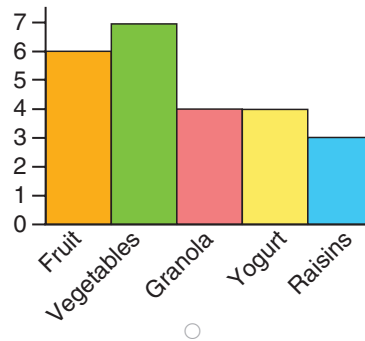
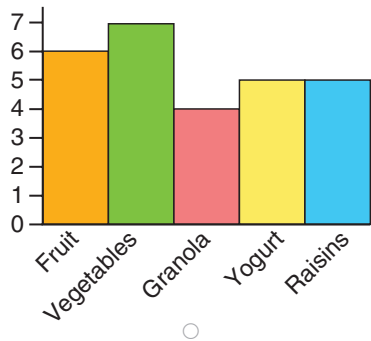
Helen asks the students in her class to name their favourite healthy snack.

She records the information on the tally chart below.

Favourite Healthy Snacks

Fruit	Vegetables	Granola	Yogurt	Raisins

26. Which of the following bar graphs shows the same information as the tally chart?



Most of the students (82.5%) were able to answer this question correctly. Students needed to know how to calculate the number of tally marks and then they had to identify the bar graph that accurately represented the entire tally chart. Option **A** attracted 4.3% of the students, option **B** was selected by 7.1% of the students, and option **C** was favoured by 5.5% of them. Over 96% of students who met the *standard of excellence* answered this question correctly and about 88% of students meeting the *acceptable standard* answered it accurately.

The 2010 Pilot Mathematics Achievement Test (2007 Program of Studies)

This part of the report provides teachers, school administrators, and the public with some highlights from the 2010 Grade 3 Pilot Mathematics Achievement Test (*2007 Program of Studies*). It complements the detailed school and jurisdiction reports.

How Many Students Wrote the Test?

A total of 21 289 students wrote the 2010 Grade 3 Pilot Mathematics Achievement Test (*2007 Program of Studies*). There were 20 346 students who wrote the English form of the test and 943 students who wrote the French form of the test.

What Was the Test Like?

The 2010 Grade 3 Pilot Mathematics Achievement Test (*2007 Program of Studies*) consisted of one test booklet. There were 36 multiple-choice questions based on four strands: Number, Patterns and Relations, Shape and Space, Statistics and Probability.

Each question addressed at least one objective from a strand. The intent of the revised program of studies is to ensure that students learn how to apply their mathematical understanding across the objectives and the mathematical strands. In order to reflect this intent, students had to apply their understanding of more than one objective when answering many of the questions.

Unlike the Achievement Tests based on the *1997 Program of Studies*, students were not allowed to use calculators during the test.

How Well Did Students Do?

Out of a total score of 36 on the test, the provincial average was 25.3/36 (70.3%). The results presented in this report are based on scores achieved by all students who wrote the test. Detailed provincial assessment results are provided in school and jurisdiction reports.

What are the cut-scores for the Acceptable and Excellence standards on the test?

The brief answer to this question is that no cut-scores have been established for the 2010 Grade 3 Pilot Mathematics Achievement Test. Only the raw scores will be reported to school jurisdictions, schools, and students.

The 2010 Grade 3 Pilot Mathematics Achievement Test was a pilot test. Just over half of the province's grade three students wrote it. The main purpose of a pilot test is to find out which questions accurately reflect students' understanding of the objectives. The 2010 Grade 3 Pilot Mathematics Achievement Test enabled us to discover which items were the most effective, fair, and valid. These questions, along with other field-tested questions, will be used on the 2011 Mathematics 3 PAT.

After students write the June 2011 Mathematics PAT, a group of teachers from across Alberta will be invited to participate in a Standard Setting Working Group. This group will determine the appropriate cut-scores at the *acceptable standard* and at the *standard of excellence* for the Grade 3 Mathematics Achievement Test (*2007 Program of Studies*). These decisions will be based on statistical evidence as well as the professional judgment of experienced grade 3 teachers.

2010 Proposed Test Blueprint and Student Achievement (2007 Program of Studies)

In 2010, there were 20 289 students who wrote the Pilot Mathematics Achievement Test (2007 Program of Studies). This test was a Pilot test, therefore the cut-scores to determine the *acceptable standard* and the *standard of excellence* have not yet been set. All results have been reported as raw scores.

Student scored an average of 25.3/36 (70.3%) on the Pilot 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
	Low	Moderate	High	
Number <ul style="list-style-type: none"> Develop and demonstrate number sense for whole numbers 0 to 1 000, and understand fractions as part of a whole. Develop and demonstrate personal strategies when applying arithmetic operations (addition, subtraction, multiplication, or division) on whole numbers to create and solve problems. Justify the personal strategies used to solve problems. 				11/16 (68.8%)
Patterns and Relations <ul style="list-style-type: none"> Investigate, identify, and communicate rules for numerical and non-numerical patterns, in order to describe the world and to solve problems. Represent, solve, and communicate an addition or subtraction equation with one unknown number. 				5.3/8 (66.8%)
Shape and Space <ul style="list-style-type: none"> Estimate, measure, and compare, using personal referents and standards units of measurement to solve problems. Describe, classify, construct, and relate 3-D objects and 2-D shapes 				5.8/8 (72.5%)
Statistics and Probability <ul style="list-style-type: none"> Collect, organize, and interpret data in a variety of ways to solve problems. Construct, label, and interpret bar graphs to solve problems. 				3.1/4 (77.5%)
Provincial Student Achievement (Average Raw Score and Percentage)	13.9/18 (77.2%)	11.4/18 (63.3%)	N/A	Total Test Raw Score 25.3/36 (70.3%)

Highlights from the Pilot Mathematics Achievement Test (2007 Program of Studies)

Overall, students performed as expected on the Pilot test. Comments from teachers and administrators indicated that most of the questions on the test reflected both the intent and the objectives of the program. Some concerns were expressed with regard to the balance of low, moderate, and high complexity questions* and this balance will be re-examined by our teacher advisory groups and revised based on their suggestions.

Teachers also expressed a need for more assessment-related support materials. In response to this request, A Guide for Teachers has been developed and it is located at education.alberta.ca/admin/testing/achievement.aspx.

This document includes information about the PAT, sample questions, vocabulary lists, and answers to frequently asked questions.

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 pie chart.

Instructional Awareness

Students' performance on the pilot 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 5×5) 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 (ex. 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 (ex. 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 re-arranged (re-grouped), 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.

*See Grade Three Mathematics Subject Bulletin 2010–2011 at education.alberta.ca/admin/testing/achievement/bulletins.aspx for a full description of the levels of complexity.

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. On the home page, click on the tab Teachers, then click on the link Provincial Testing. Next click on the link 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 and directives; test accommodations; field testing; resources and web documents; calculator and computer policies; test marking and results; samples, forms, and letters; and Learner Assessment 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 (for grades 3, 6, and 9 English Language Arts and Français/French Language Arts) as well as suggestions for preparing students to write the tests and information about how teachers can participate in test development activities.

Examples of 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 posted and can 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 *Part A: Writing* achievement tests. The writing samples documents contain actual students' written responses to previous picture prompts along with their scoring rationales

Scoring Guides

The English Language Arts (Narrative) Scoring Guide can be used by classroom teachers to support their instructional and assessment practices.

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; descriptions of and sample questions for each achievement test subject; and excerpts from the *Curriculum Handbook for Parents* identifying what students should know and be able to do in each subject by the end of grades 3, 6, and 9

Involvement of Teachers

Teachers of Grades 3, 6, and 9 are encouraged to take part in a variety of activities related to the achievement testing program. These activities include item development, test validation, field testing, and marking. In addition, regional consortia can make arrangements for teacher in-service workshops on topics such as Interpreting Achievement Test Results to Improve Student Learning.