

Alberta Provincial
Achievement Testing

Assessment
Highlights
2009-2010

GRADE
6

Mathematics



Government
of Alberta ■

Alberta ■

Freedom To Create. Spirit To Achieve.

This document contains assessment highlights from the 2010 Grade 6 Mathematics Achievement Test (1997 Program of Studies) as well as some observations about the 2010 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 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 6 Mathematics
Administrators	✓
Parents	
General Audience	
Others	

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The 2010 Grade 6 Mathematics Achievement Test (1997 Program of Studies)

This part of the report provides teachers, school administrators, and the public with an overview of the performance of students who wrote the 2010 Grade 6 Mathematics Achievement Test (1997 Program of Studies). It complements the detailed school and jurisdiction reports.

How Many Students Wrote the Test?

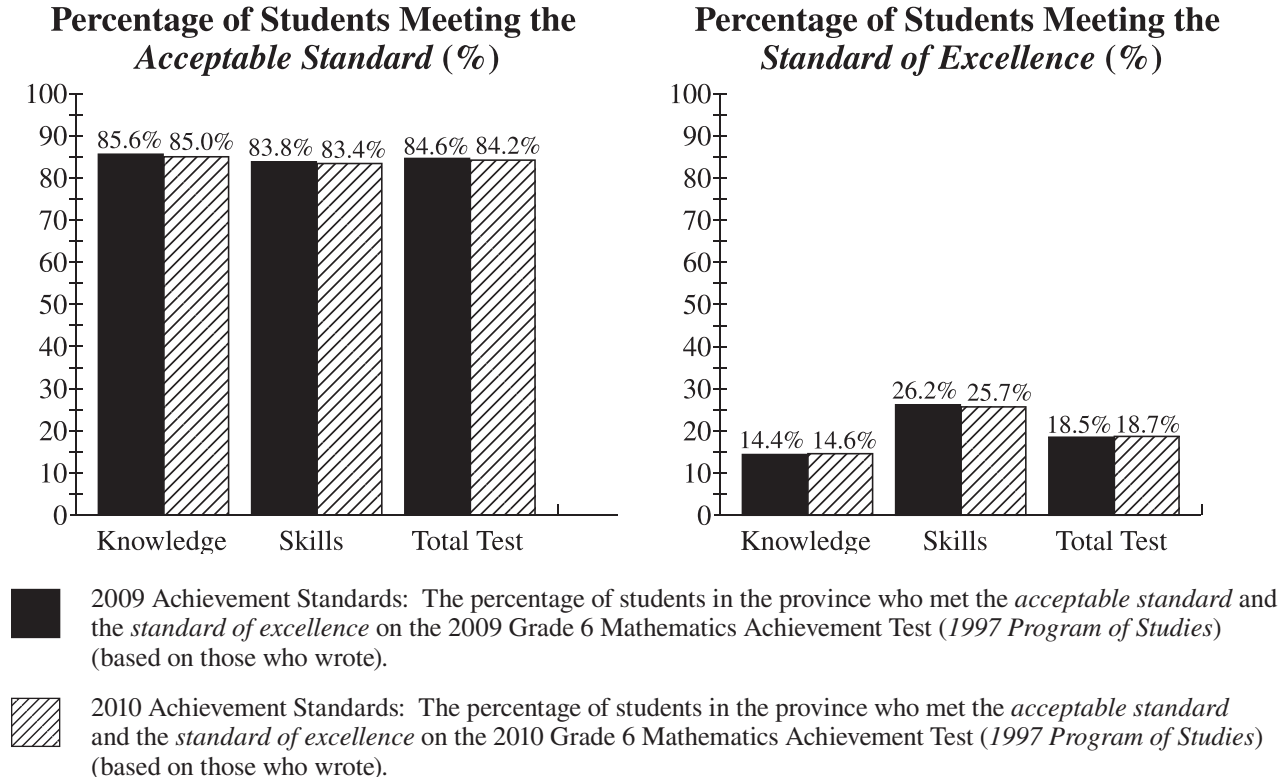
A total of 19 074 students wrote the 2010 Grade 6 Mathematics Achievement Test (1997 Program of Studies).

What Was the Test Like?

The 2010 Grade 6 Mathematics Achievement Test (1997 Program of Studies) consisted of two parts. *Part A: Number Operations and Number Sense* consisted of 30 multiple-choice items designed to assess the knowledge students have of number sense. *Part B: Multiple Choice* consisted of 50 multiple-choice items based on content from the four strands: Number; Patterns and Relations; Shape and Space; and Statistics and Probability.

How Well Did Students Do?

The percentages of students meeting the *acceptable standard* and the *standard of excellence* in 2010 are consistent with 2009, as shown in the graphs below. Out of a total possible score of 54, the provincial average on the test was 37.7 (69.8%). The results presented in this report are based on scores achieved by all students who wrote the English and French forms of the test.



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

In 2010, 84.2% of students achieved the *acceptable standard* on the Grade 6 Mathematics Achievement Test (*1997 Program of Studies*), and 18.7% of students achieved the *standard of excellence*. These results are very similar to results from 2009, in which 84.6% achieved the *acceptable standard* and 18.5% achieved the *standard of excellence*.

Student achievement on the 2010 Grade 6 Mathematics Achievement Test (*1997 Program of Studies*) averaged 37.7 out of a total score of 54 (69.8%).

The blueprint below shows the reporting categories and test sections (curricular content areas) by which 2010 summary data are reported to schools and school authorities, and the provincial average of student achievement by both raw score and percentage.

Test Sections	Reporting Category		Provincial Student Achievement Average (Raw Score and Percentage)
	Knowledge	Skills	
	Recall facts, concepts, procedures, and terminology	Apply facts, concepts, procedures, terminology, and relationships to solve problems in a variety of situations	
Part A: Operations and Number Sense			3.3/4 (82.5%)
Part B: Multiple Choice (See four categories below)			
Number • Number Concepts • Number Operations			11.9/17 (70.0%)
Patterns and Relations • Patterns • Variables and Equations • Relations and Functions			9.2/13 (70.8%)
Shape and Space • Measurement • 3-D Objects and 2-D Shapes • Transformations			8.0/12 (66.7%)
Statistics and Probability • Data Analysis • Chance and Uncertainty			5.3/8 (66.3%)
Provincial Student Achievement Average for Students Who Wrote the Test (Raw Score and Percentage)	15.2/21 (72.4%)	22.5/33 (68.2%)	Total Test 37.7/54 (69.8%)

2010 Mathematics 6 PAT Student Performance Commentary

The following table provides a brief synopsis of student performance demonstrated on the 2010 Grade 6 Mathematics Achievement Test. The observations have been categorized in terms of student performance strengths and challenges in relation to outcomes that were tested in each of the four strands from the 1997 Alberta Program of Studies for K–9 Mathematics.

Strand	Outcome Strengths	Outcome Challenges
Number	<ul style="list-style-type: none"> • Applying knowledge of multiples and/or factoring to solve a problem • Solving problems involving integers by extending counting numbers to less than zero • Solving problems involving ratios • Solving problems involving multi-step operations on decimals to thousandths 	<ul style="list-style-type: none"> • Using knowledge of least common multiples to solve a problem • Solving problems involving improper fractions and mixed numbers • Demonstrating the meaning of percentage pictorially and symbolically
Patterns and Relations	<ul style="list-style-type: none"> • Summarizing relationships using everyday language • Applying rules to describe, complete, and extend patterns and relationships • Finding approximate number values from a given graph • Demonstrating the preservation of equality by balancing objects represented in a model/ diagram 	<ul style="list-style-type: none"> • Determining relationships to verify predictions • Using pre-algebra strategies to solve equations with one unknown and with whole number coefficients and solutions
Shape and Space	<ul style="list-style-type: none"> • Converting commonly used SI units of length, mass, and capacity to solve problems • Determining the volume of an object by measuring the displacement of a liquid by that object • Estimating and measuring angles, using a circular protractor • Classifying triangles according to the measures of their angles • Identifying the ordered pairs of a design after it has undergone a translation and/or a reflection 	<ul style="list-style-type: none"> • Developing and applying rules or expressions for the perimeter of polygons • Constructing rectangles when given one or both of perimeter and area, using whole numbers • Demonstrating pictorially that many rectangles are possible for a given perimeter or a given area
Statistics and Probability	<ul style="list-style-type: none"> • Reading and interpreting graphs that are provided • Making the connection between the number of faces on a die and the probability of an event • Calculating theoretical probability, expressed as a fraction 	<ul style="list-style-type: none"> • Distinguishing between theoretical and experimental results • Determining how collected data are affected by the nature of the sample, the method of collection, the sample size and biases

The following four pairs of items appeared on both the 2009 and 2010 Grade 6 Mathematics Provincial Achievement Tests, and have been selected as examples of areas that students demonstrated varying degrees of mathematical knowledge and skill within each of the four strands.

Brief Commentary on Number Strand

Students had success at solving problems involving integers. In Item 1, students were required to apply their understanding of integers to extend counting numbers to less than zero in the context of a board game. Students were less successful in solving real-life problems involving common fractions and percentage. In Item 2, students had to apply their knowledge of common fractions to determine the number of additional tiles needed to fill half the area of the rectangle.

Item	2010 PAT Item #	Strand	% of Student Responses			
			A	B	C	D
1	47	N	5.1	5.4	8.0	81.5*
2	28	N	14.8	29.7	51.2*	4.3

* Correct response

Item 1

Patrick and Samuel are playing a board game in which a player moves left if he draws a negative integer card and right if he draws a positive integer card. The object of the game is to reach exactly +10 or -10.

If Samuel won the game after 3 moves, then which of the following integer card sequences shows the order of the cards that Samuel drew?

A.

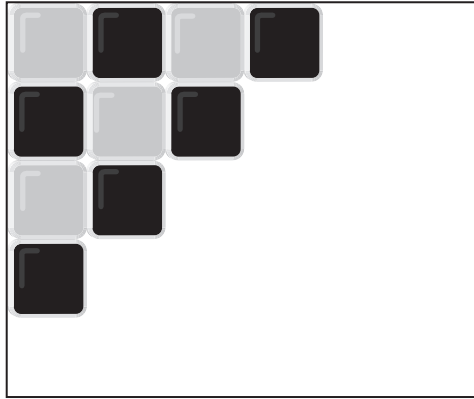
B.

C.

*D.

Item 2

Black and grey tiles are used to cover the area of the rectangle shown below.



How many more square tiles would it take to cover $\frac{1}{2}$ of the rectangular area?

- A. 7
- B. 6
- *C. 5
- D. 4

Brief Commentary on Patterns and Relations Strand

Students had success at summarizing relationships and extending patterns. In Item 3, students had to determine the statement that represents a relationship presented in a table of values. Students also had success working with representations of equality to solve problems. In Item 4, students had to determine that 1 hexagon is equivalent to 2 rectangles, and then use that information to solve equation 2.

Item	2010 PAT Item #	Strand	% of Student Responses			
			A	B	C	D
3	21	PR	5.6	3.7	9.3	81.4*
4	22	PR	67.6*	16.7	10.3	5.4

* Correct response

Item 3

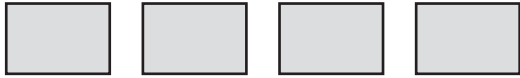

Figure Number	Number of Blocks
1	2
2	5
3	8
4	11

Which of the following statements describes the relationship between the figure number and the number of blocks?



- A. Multiply the figure number by 2 to get the number of blocks.
- B. Subtract 1 from the figure number to get the number of blocks.
- C. Double the figure number and then add 2 to get the number of blocks.
- *D. Multiply the figure number by 3 and then subtract 1 to get the number of blocks.

Item 4

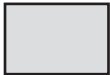



Equation 1

 = 

Equation 2

 = 

Based on the equations shown above, a triangle is equal to

- *A. 
- B. 
- C. 
- D. 

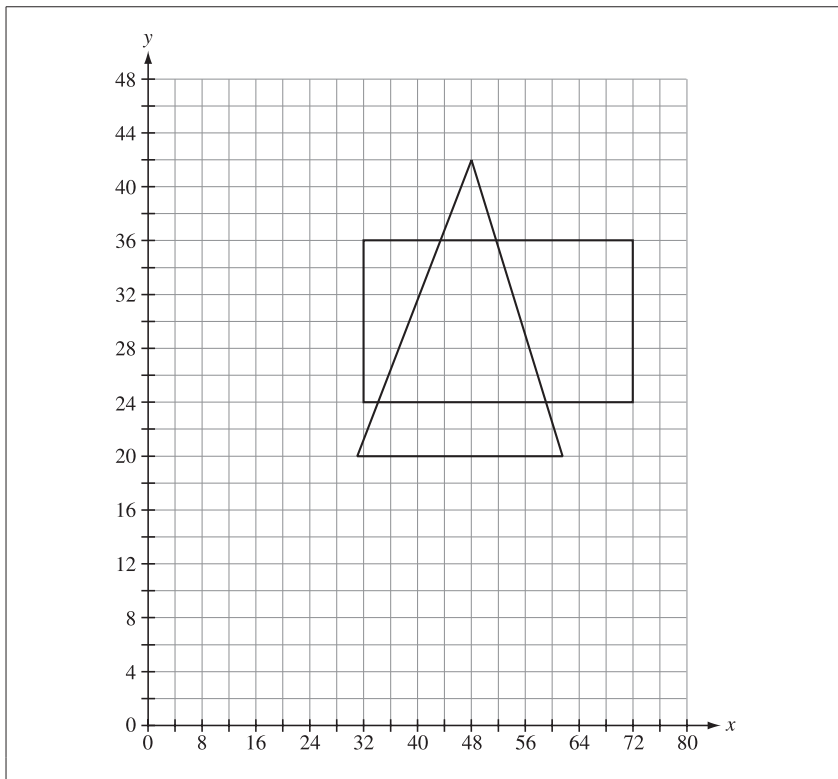
Brief Commentary on Shape and Space Strand

Students had success with tasks related to designs that incorporated symmetry and reflections. In Item 5, students had to identify the ordered pair that is contained within the two 2-D shapes in the first quadrant of the coordinate grid. Students were less successful solving real-life problems involving perimeter, area, and volume; however, students were quite successful at solving volume problems involving regular 3-D objects such as cubes. In Item 6, students had to determine the perimeter of the rectangle by using the dimensions of the contained square.

Item	2010 PAT Item #	Strand	% of Student Responses			
			A	B	C	D
5	18	SS	10.0	15.8	61.4*	12.8
6	6	SS	41.5	6.7	6.5	45.3*

* Correct response

Item 5

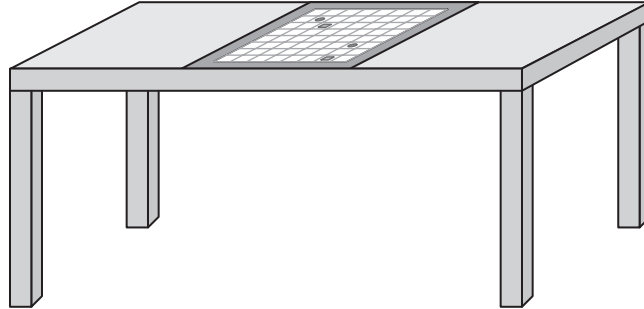


Which of the following ordered pairs represents a point that is located inside the triangle and the rectangle?

- A. (32, 30)
- B. (36, 30)
- *C. (40, 26)
- D. (48, 38)

Item 6

The illustration below shows a square game board that is 50 cm wide. Its width is equal to the width of the table, as shown below.



If the length of the table is 3 times its width, then what is the perimeter of the table?

- A. 150 cm
- B. 250 cm
- C. 300 cm
- *D. 400 cm

Brief Commentary on Statistics and Probability Strand

Students had greater success at determining the theoretical probability of an event when the probability was expressed as a fraction, as in Item 7, rather than when the probability was expressed as a decimal, as in Item 8.

Item	2010 PAT Item #	Strand	% of Student Responses			
			A	B	C	D
7	15	SP	5.9	83.5*	2.1	8.5
8	12	SP	25.9	11.6	16.7	45.8*

* Correct response

Item 7

A school debate team is made up of the members listed below. Each member's name is written on a piece of paper and put into a hat. One member's name is drawn to determine who will speak first in the debate.

Members
Omar
Eugene
Gilroy
Gilbert
Helga
Martha
Esther
Burton
Brian

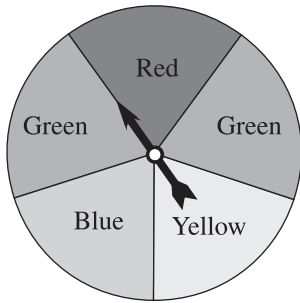
What is the probability that the name drawn from the hat will begin with the letter E?

- A. $\frac{2}{7}$
- *B. $\frac{2}{9}$
- C. $\frac{1}{8}$
- D. $\frac{1}{9}$

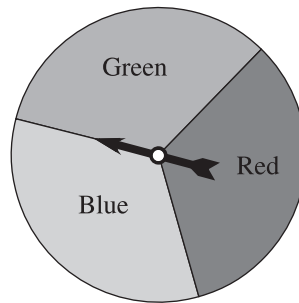
Item 8

For which of the following spinners would the probability of spinning green be 0.2?

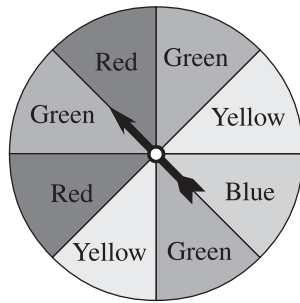
A.



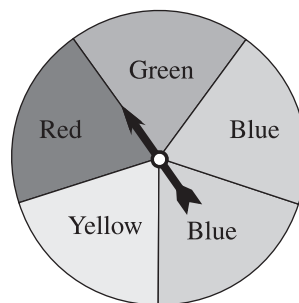
B.



C.



***D.**



The 2010 Grade 6 Pilot Mathematics Achievement Test (2007 Program of Studies)

This report, written by the Grade 6 & 9 Mathematics Examination Manager, is intended to provide classroom teachers with information about student performance at the provincial level, as demonstrated on the June 2010 Math 6 Provincial Achievement Test (*2007 Program of Studies*). Assessment Highlights is best used in conjunction with school and/or school authority report for this test, along with the classroom teacher's knowledge of their students' abilities.

How Many Students Wrote the Test?

A total of 20 523 students wrote the 2010 Grade 6 Pilot Mathematics Achievement Test (*2007 Program of Studies*), of which 19 991 students wrote the English test form and 532 students who wrote the French test form.

What Was the Test Like?

The 2010 Grade 6 Pilot Mathematics Achievement Test (*2007 Program of Studies*) consisted of one test booklet. There were 40 multiple-choice and 10 numerical-response questions based on the four strands: Number; Patterns and Relations; Shape and Space; and Statistics and Probability.

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

How Well Did Students Do?

Out of a total score of 50 on the test, the provincial average was 31.98/50 (63.96%), which is within the range of historic Math 6 test means. 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?

Cut-scores were not established for the 2010 Grade 6 Pilot Mathematics Achievement Test (*2007 Program of Studies*). Only the raw scores will be reported to school jurisdictions, schools, and students. Cut scores for the *acceptable standard* and *standard of excellence* will be developed and reported in 2011.

Student Strengths and Areas for Improvement

One of the challenges in identifying areas of student strength and areas for improvement according to specific learning outcomes is that not all outcomes have test-item representation, and for some outcomes, there may only be one or two items on the test. Another challenging aspect in classifying student performance is that success on any one item is influenced by two main factors of the test: content and item complexity. For example, item 4 and item 37 both assess Specific Outcome #4 from the Number strand; however, student performance on these two items was significantly different – a difference that is likely attributable to item complexity. 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 with the understanding that as item complexity increases, student performance typically decreases. The following 8 items have been released to help identify a select group of outcomes that illustrate areas of student strength and areas for improvement from each of the four strands.

Items 1–4 illustrate student strengths according to results from the 2010 Mathematics 6 Pilot Provincial Achievement Test (2007 Program of Studies)

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
1	N	7	High	3.4	5.1	75.4*	16.1

* Correct response

Ben is thinking about a certain integer that is:

- less than -5
- greater than -12
- closer to -12 than to -5

1. Which of the following integers could Ben be thinking about?

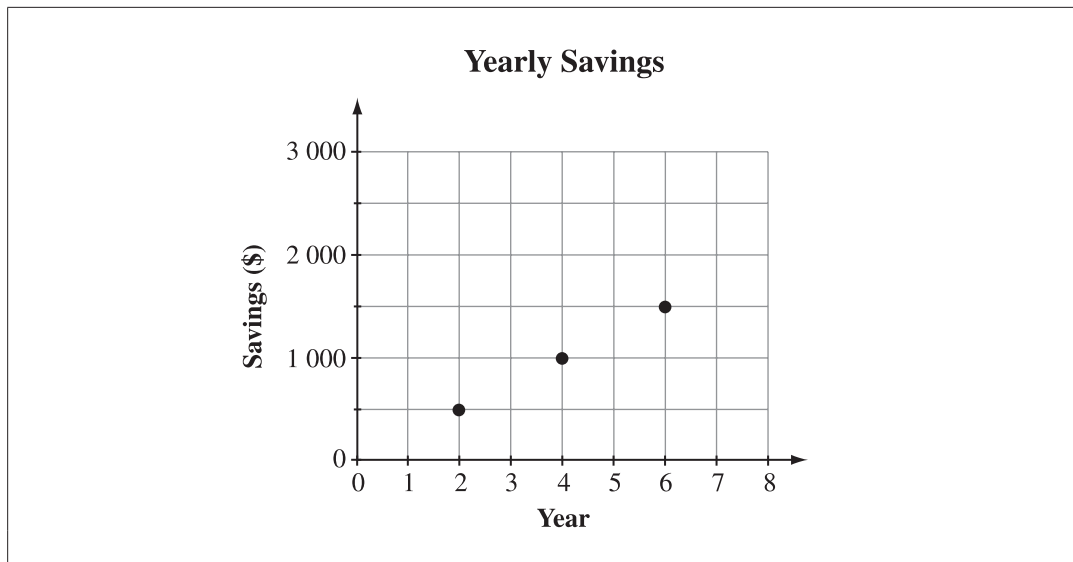
- A. -4
- B. -6
- *C. -10
- D. -14

To answer this item correctly, students had to determine the integer value that satisfies the given conditions.

The percentage of students answering the item correctly is above the expected range given the content being assessed and the complexity of the item.

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
2	PR	1	Low	1.6	1.1	77.5*	19.8

* Correct response



2. If the pattern in the graph continues, then how much money would be saved in year 8?
- A. \$1 500
 - B. \$1 750
 - *C. \$2 000
 - D. \$2 250

To answer this item correctly, students had to determine the relationship shown on a graph to make a prediction.

The percentage of students answering the item correctly is within the expected range given the content being assessed and the complexity of the item.

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option	
				Correct	Incorrect
3	SS	3	Moderate	62.4	37.6

A thank-you card and four envelopes are shown below.

Note: The diagrams shown above are not drawn to scale.

Numerical Response

3. How many of the envelopes are large enough to contain the thank-you card if the card is folded in half along the dotted line shown above?

Answer: _____ envelope(s)

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

To answer this item correctly, students had to compare the side lengths of an irregular polygon to the side lengths of four other irregular polygons to determine which of the four irregular polygons would fit within the given irregular polygon. The most common incorrect responses were: 1 (~6%); 3 (~15%); and 4 (~4%).

The percentage of students answering the item correctly is above the expected range given the content being assessed and the complexity of the item.

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
4	N	4	High	63.2*	14.3	13.2	9.1

* Correct response

Shannon makes 6 grilled-cheese sandwiches for her 4 children. Her oldest child eats 3 sandwiches, and her youngest child eats only $\frac{1}{4}$ of a sandwich.

4. How many sandwiches do Shannon's other 2 children eat if all the sandwiches are eaten?

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

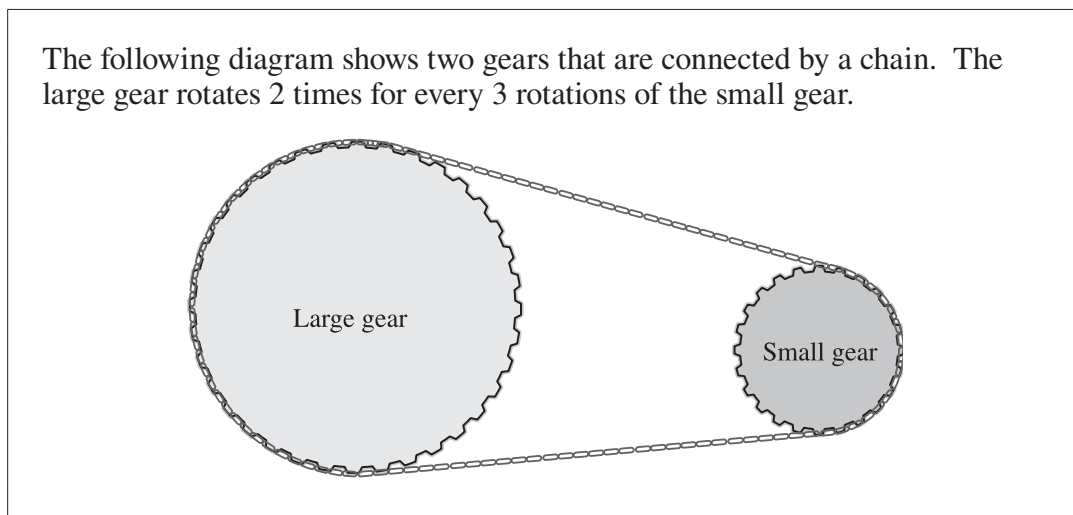
To answer this item correctly, students had to determine the mixed number that represents the given context.

The percentage of students answering the item correctly is above the expected range given the content being assessed and the complexity of the item.

Items 5–8 illustrate areas for improvement according to results from the 2010 Mathematics 6 Pilot Provincial Achievement Test (2007 Program of Studies)

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
5	N	5	High	27.9	8.3	38.2	25.4*

* Correct response



5. What is the total number of rotations of **both** gears when the large gear rotates 36 times?
- A. 54 rotations
 - B. 60 rotations
 - C. 72 rotations
 - *D. 90 rotations

To answer this item correctly, students had to determine the ratio for the given context, and then use the solution to solve the problem.

The percentage of students answering the item correctly is below the expected range given the content being assessed and the complexity of the item.

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
6	N	9	Moderate	16.5	36.8	35.1*	11.6

* Correct response

Louise charges \$5 per hour for babysitting one child and \$1.25 per hour for each additional child.

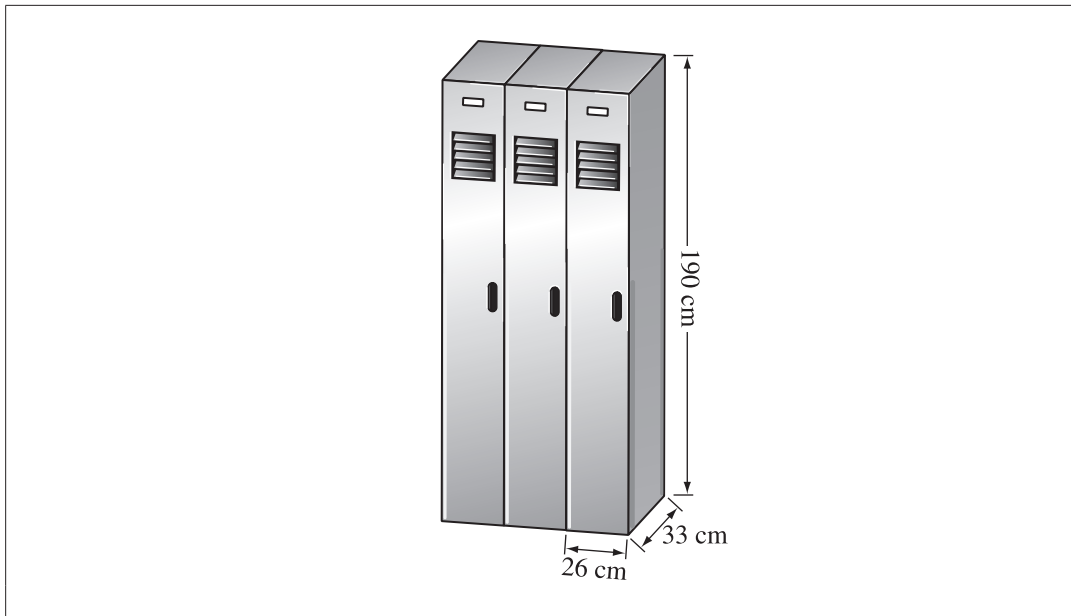
6. How much would Louise charge to babysit 4 children for 6 hours?
- A. \$30.00
 - B. \$37.50
 - *C. \$52.50
 - D. \$60.00

To answer this item correctly, students had to apply the order of operations to solve a multistep problem involving whole numbers and decimal numbers.

The percentage of students answering the item correctly is below the expected range given the content being assessed and the complexity of the item.

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
7	SS	8	Moderate	64.5*	20.8	10.3	3.8

* Correct response



7. Which of the following expressions can be used to find the total volume of the 3 lockers?

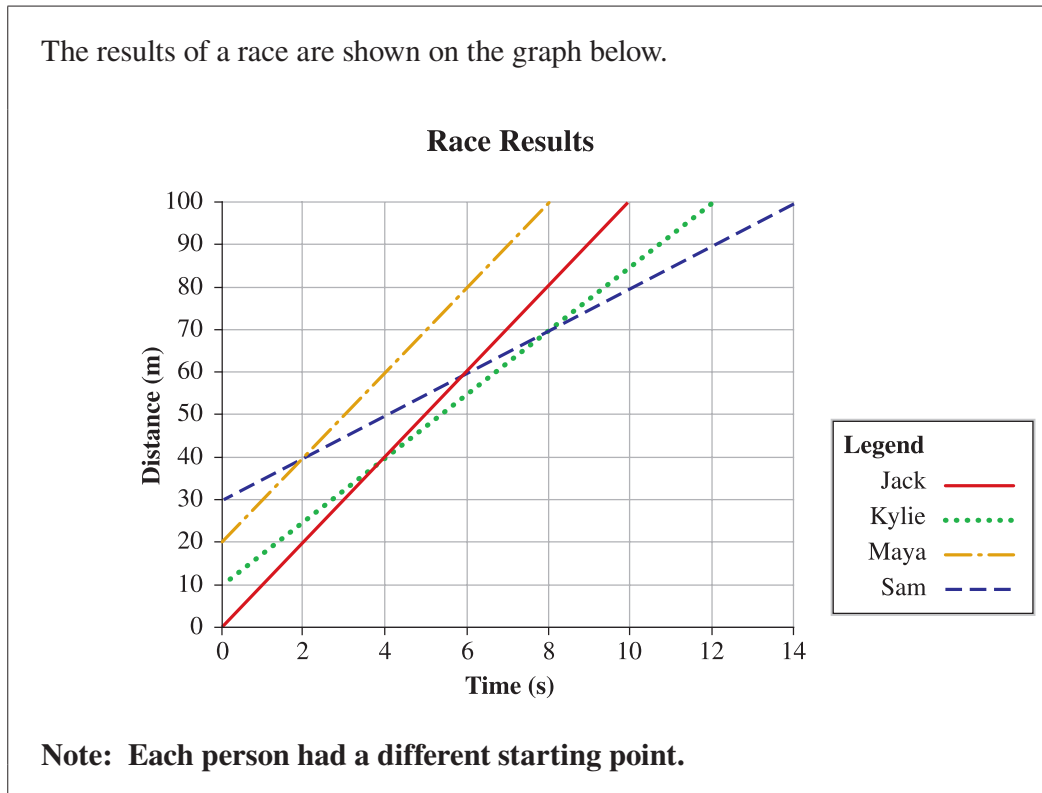
- *A. $(26 \text{ cm} \times 33 \text{ cm} \times 190 \text{ cm}) \times 3$
- B. $(26 \text{ cm} + 33 \text{ cm} + 190 \text{ cm}) \times 3$
- C. $(26 \text{ cm} \times 33 \text{ cm} \times 190 \text{ cm}) \div 3$
- D. $(26 \text{ cm} + 33 \text{ cm} + 190 \text{ cm}) \div 3$

To answer this item correctly, students had to generalize a rule or formula for determining the volume of three identical right rectangular prisms.

The percentage of students answering the item correctly is below the expected range given the content being assessed and the complexity of the item.

Item Number	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option			
				A	B	C	D
8	SP	1	High	3.9	69.5	16.8*	9.8

* Correct response



8. Which two people each ran 40 metres in 4 seconds?
- A. Sam and Kylie
 - B. Kylie and Jack
 - *C. Jack and Maya
 - D. Maya and Sam

To answer this item correctly, students had to read and interpret a multiple line graph to draw a conclusion. Based on the results, it is clear that the majority of students misinterpreted the graph.

The percentage of students answering the item correctly is below the expected range given the content being assessed and the complexity of the item.

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 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 as well as suggestions for preparing students to write the tests and information about how teachers can participate in test development activities.

Writing Samples

For achievement tests in grades 3, 6, and 9 English Language Arts and Français/French Language Arts, and grades 6 and 9 Mathematics, 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 writing samples documents contain sample responses with scoring rationales that relate student work to the scoring categories and scoring criteria for the writing assignments.

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.