Sample Questions from the 2011 Grade 9 Mathematics Achievement Test

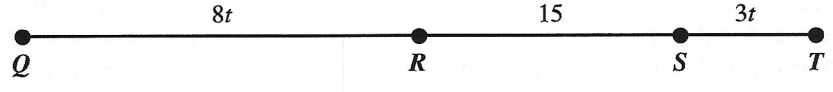
Items 1–4 Illustrate Student Strengths

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	% of Student Responses			
					A	B*	C	D
1	1	PR	1	Moderate	8.2	84.2	5.2	2.1

*** Correct response**

Use the following information to answer question 1.

Line segment QT is 48 units.



1. Which of the following linear equations represents the length of line segment QT?

A. $5t + 15 = 48$
B. $11t + 15 = 48$
C. $5t - 15 = 48$
D. $11t - 15 = 48$

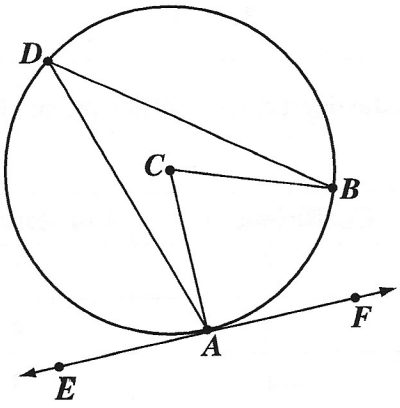
To answer this item correctly, students had to correctly identify and combine like terms in a given polynomial representation.

The most common incorrect response (A) suggests that students were able to set up the equation and identify the like terms; however, they subtracted the like terms instead of combining them.

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	% of Student Responses			
					A	B*	C	D
2	12	SS	1	Low	8.6	80.1	4.1	7.2

*** Correct response**

Use the following information to answer question 12.



In this diagram, point *C* represents the centre of the circle.

12. Which of the following rows of terms correctly labels the parts of the diagram above?

Row	$\angle ADB$	$\overline{AD}$	$\angle ACB$	$\overleftrightarrow{EF}$
A.	Inscribed angle	Tangent line	Central angle	Chord
B.	Inscribed angle	Chord	Central angle	Tangent line
C.	Central angle	Tangent line	Inscribed angle	Chord
D.	Central angle	Chord	Inscribed angle	Tangent line

To answer this item correctly, students had to correctly identify parts of a circle-geometry diagram. This is the first step in being able to understand and apply circle properties to solve problems.

The most common incorrect response (A) suggests that some students confused the concepts of chords and tangent lines.

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	% of Student Responses			
					A*	B	C	D
3	18	PR	5	Low	86.9	6.5	4.9	1.5

*** Correct response**

Use the following information to answer question 18.

$3x^2 - 4$

18. Which row correctly shows the degree, the coefficient, and the constant term in the expression shown above?

Row	Degree	Coefficient of x^2	Constant Term
A.	2	3	−4
B.	3	2	4
C.	2	−4	3
D.	3	4	2

To answer this item correctly, students had to correctly identify the degree, the coefficient, and constant of a given polynomial expression.

The most common incorrect response (B) suggests that some students confused the degree with the coefficient on the x^2 term.

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	% of Student Responses			
					A	B	C	D*
4	32	N	3	Moderate	7.0	5.2	12.9	74.7

*** Correct response**

Use the following information to answer question 32.

The following list shows Rick's yearly vehicle expenses.

- Insurance: $1 200
- Gasoline: $1 300
- Repairs: $850

32. If Rick works 8 hours/day, 5 days/week, and takes home $10/hour, then what is the **least** number of complete weeks he must work in order to pay for all his yearly vehicle expenses?

A. 6 weeks
B. 7 weeks
C. 8 weeks
D. 9 weeks

To answer this item correctly, students had to correctly solve a contextual problem involving money by applying arithmetic operations on rational numbers.

The most common incorrect response (C) suggests that some students completed the required arithmetic operations correctly but simply applied rounding rules instead of applying mathematical reasoning to make sense of their solution.

Items 5–8 Illustrate Areas for Improvement

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	% of Student Responses			
					A*	B	C	D
5	6	PR	5	Low	60.1	24.3	8.7	6.8

*** Correct response**

6. Which of the following expressions is equivalent to $-(3x-2)$?

A. $-3x+2$
B. $-3x-2$
C. $3x+2$
D. $3x-2$

To answer this item correctly, students had to correctly multiply a monomial and a polynomial expression. Not being able to perform this relatively simple operation would hinder a student's ability to solve more complex equations.

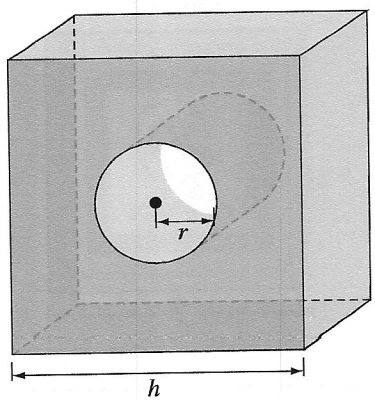
The most common incorrect response (B) suggests that some students applied the negative monomial only to the first term of the polynomial expression. The second most common incorrect response (C) suggests that some students applied the negative monomial only to the second term of the polynomial, or applied it to both terms but forgot to include the negative sign on the first term.

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	% of Student Responses			
					A*	B	C	D
6	13	SS	2	High	51.3	15.1	22.3	11.0

*** Correct response**

Use the following information to answer question 13.

The 3-D object below is a **cube** with a right cylinder cut out.



13. Which expression represents the surface area of the 3-D object?

A. $6h^2 - 2\pi r^2 + 2\pi rh$

B. $4h^2 - 2\pi r^2 + 2\pi rh$

C. $6h^2 + 2\pi r^2 - 2\pi rh$

D. $4h^2 + 2\pi r^2 - 2\pi rh$

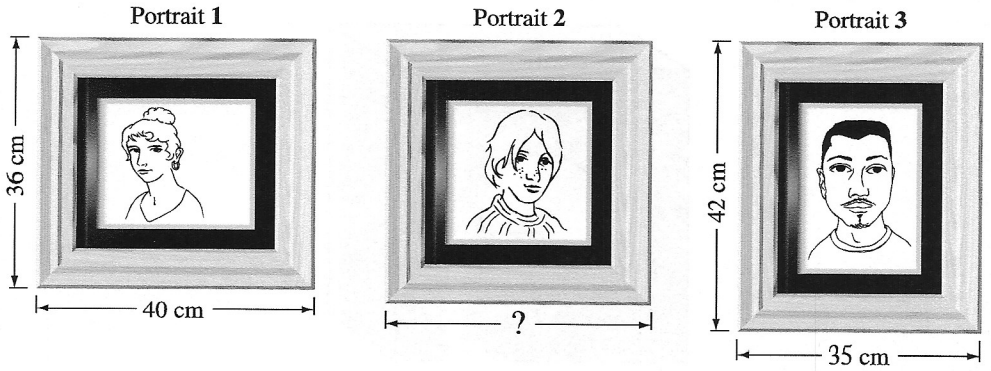
To answer this item correctly, students had to correctly develop a formula to calculate the surface area of a composite object.

The most common incorrect response (C) suggests that some students subtracted the area of the circles from the area of the curved surface instead of adding them together. These students were able, however, to correctly identify all the surface areas. The second most common incorrect response (B) suggests that some students did not include the required front and back areas; however, they did correctly subtract the circle areas and add this to the curved surface area.

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option	
					Correct	Incorrect
7	NR 6	N	6	High	53.7	46.3

Use the following information to answer numerical-response question 6.

Pat arranges three portraits from smallest to largest based on area. Portrait 2 is square, and its side length, measured in centimetres, is a whole number.



Numerical Response

6. The side length of portrait 2 is _____ cm.

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

To answer this item correctly, students had to correctly find the perfect square between two non-perfect squares.

Of incorrect student responses, 73.8% provided answers between 35 and 40, suggesting that they did not understand that the portraits were arranged in order according to area.

Item	Question # on PAT	Strand	Primary Outcome Number	Item Complexity	Percentage of Students Selecting Each Option	
					Correct	Incorrect
8	NR 10	N	5	Low	53.0	47.0

Numerical Response

10. The number of perfect squares that are whole numbers between 2 and 20 is _____.

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

To answer this item correctly, students had determine the total number of perfect squares between two non-perfect squares.

The most common set of incorrect responses (i.e., 4, 9, or 16), suggests that some students may have missed the fact that the question asked for the total number of perfect squares between 2 and 20, and not just one perfect square. Another common incorrect response of 4, suggests that some students may have inadvertently included the value of 1 in the range.