

## Sample Questions from the 2013 Grade 9 Mathematics Achievement Test

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

Item #	Strand	Specific Outcome	Item Complexity	Item Description
15	N	5	Low	Identify a rational number with a square root that is between two numbers on a number line (Gr.8, N.1).

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the Standard of Excellence	1.5	1.9	1.1	95.5
Students Achieving the Acceptable Standard	7.1	7.6	6.0	79.3

Use the following information to answer question 15.

The square roots of two rational numbers are represented on the number line shown below.

15. If  $Q$  is located between points  $P$  and  $R$  on the number line above, then which of the following square roots could not represent  $Q$ ?

- A.  $\sqrt{\frac{324}{81}}$
- B.  $\sqrt{\frac{256}{9}}$
- C.  $\sqrt{\frac{225}{64}}$
- D.  $\sqrt{\frac{169}{4}}$

### Commentary:

Of the students who achieved the standard of excellence but answered the item incorrectly, approximately 42.2% chose option B as their response. This suggests that these students may have incorrectly calculated the value of each square root by finding the square root of only the numerator instead of both the numerator and denominator. Likewise, of the students who achieved the acceptable standard but answered the item incorrectly, 36.7% made the same error and also selected option B. It is also interesting to observe that an additional 34.3% selected option A, which implies that these students may have misunderstood the question and selected the first square root that would be located between points  $P$  and  $R$  instead of selecting a square root that would be located to the left of point  $P$  or to the right of point  $R$ .

Item #	Strand	Specific Outcome	Item Complexity	Item Description
9	PR	3	Moderate	Model the solution of a given linear equation using a pictorial representation of the equation (Gr.8, PR.2).

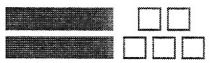
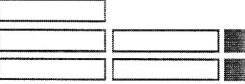
	% of Student Responses (*Correct)			
	A*	B	C	D
Students Achieving the Standard of Excellence	84.4	3.4	6	6.1
Students Achieving the Acceptable Standard	40.3	16.4	16.5	26.4

Use the following information to answer question 9.

**Legend**

■ = 1	▬ = $x$	■ = $x^2$
□ = -1	▬ = $-x$	□ = $-x^2$

The left and right sides of an equation are represented below.

Left side	Right side
	

9. The left and right sides of an equation are represented below.

A.  = 

B.  = 

C.  = 

D.  = 

**Commentary:**

Of the students who achieved the standard of excellence but answered the item incorrectly, approximately 39.4% chose option D as their response. This suggests that these students may have difficulties solving equations represented in pictorial form and/or in symbolic form. Likewise, of the students who achieved the acceptable standard but answered the item incorrectly, 44.5% also selected option D.

Item #	Strand	Specific Outcome	Item Complexity	Item Description
21	PR	1	Moderate	Write a linear equation that represents the pattern described in a given context (Gr.8, PR.2; Gr.7, PR.7).

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the Standard of Excellence	12.1	1.7	3.4	82.7
Students Achieving the Acceptable Standard	41.6	11.3	7	39.9

Use the following information to answer question 21.

Nathan completed a 5 km run on his first day of training for a cross-country race. He increased the length of his next training runs by 1.5 km each time.

21. Which of the following equations could be used to determine the distance ( $d$ ) that Nathan ran on each training run ( $r$ )?
- A.  $d = 1.5r$
  - B.  $d = 5r$
  - C.  $d = 1.5 + 3.5r$
  - D.  $d = 3.5 + 1.5r$

**Commentary:**

Of the students who achieved the standard of excellence but answered the item incorrectly, approximately 70.3% chose option A as their response. This response indicates an incomplete representation of the context, (i.e., only the additional distance being run on training days following the first day of training). Likewise, of the students who achieved the acceptable standard but answered the item incorrectly, 69.4% also selected option A. An additional 18.9% of the students achieving the acceptable standard selected option B, which suggests that they incorrectly focused on the length of the first training run and did not account for the increase of 1.5 km in subsequent training runs.

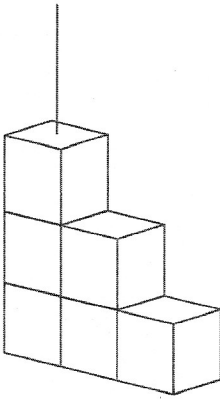
Item #	Strand	Specific Outcome	Item Complexity	Item Description
18	SS	2	Moderate	Determine the area of overlap in a given composite 3-D object (Gr.8, SS.3; Gr.8, SS.5; Gr.6, SS.3).

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the Standard of Excellence	7.5	25.6	2.9	64.0
Students Achieving the Acceptable Standard	23.6	32.2	9.8	34.3

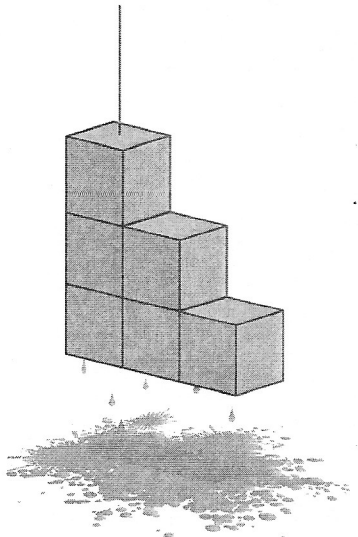
Use the following information to answer question 18.

A 3-D object made of  $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$  cubes is dipped in paint.

**Unpainted Object**



**Painted Object**



18. If the painted object is separated into individual cubes, then the total area of the **unpainted** surfaces will be
- A.  $12\text{ cm}^2$
  - B.  $24\text{ cm}^2$
  - C.  $32\text{ cm}^2$
  - D.  $48\text{ cm}^2$

**Commentary:**

Of the students who achieved the standard of excellence but answered the item incorrectly, approximately 71.1% chose option B as their answer. This suggests that these students calculated the area of overlap for the composite 3-D figure instead of determining the unpainted surface area. Approximately 20.8% of the students in this group selected option A, which suggests that these students counted the number of unpainted sides instead of calculating the area of the unpainted sides. Likewise, of the students who achieved the acceptable standard but answered the item incorrectly, 49.1% selected option B and 36.0% selected option A, which suggests that the students who achieved the acceptable standard made errors similar to those made by the students who achieved the standard of excellence.

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

Item #	Strand	Specific Outcome	Item Complexity	Item Description
22	PR	1	Low	Identify a written context that could be represented using a given linear equation (Gr.8, PR.2; Gr.7, PR.7; Gr.6, PR.4).

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the Acceptable Standard	25.5	6.2	5.1	63.2
Students Below the Acceptable Standard	35.1	25.0	17.5	22.0

Use the following information to answer question 22.

The relationship between two variables is given in the equation  $35 + 15n = A$ .

22. Which of the following situations could be represented using the equation above?
- A. The price of a caterer for a party is \$35 for each dinner ordered and \$15 for each dessert ordered.
  - B. The bill for framing a painting is \$35 for each square meter of glass required and \$15 for the wooden frame.
  - C. The fee for a computer consultant is \$15 for an administration charge and \$35 for each hour worked.
  - D. The cost of silk screening a design on T-shirts is \$15 for each shirt created and a \$35 design fee.

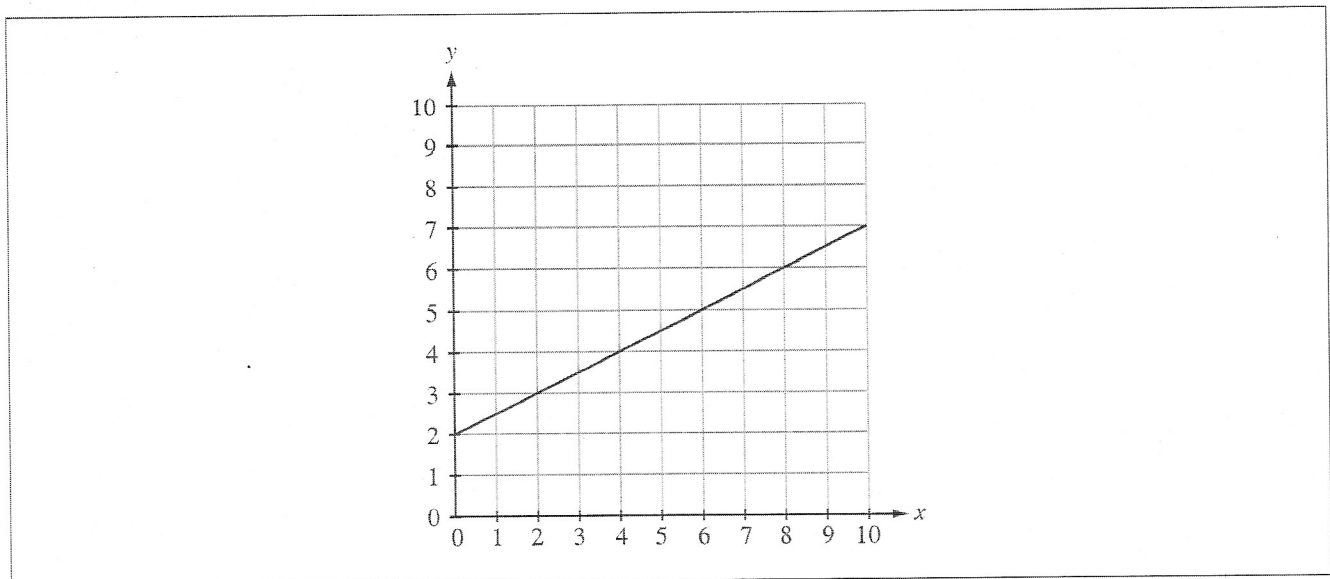
**Commentary:**

Of the students who achieved the acceptable standard but answered the item incorrectly, approximately 69.3% chose option A as their response. This suggests that these students may have difficulty understanding the role of the variable in an algebraic equation. Likewise, of the students who achieved below the acceptable standard but answered the item incorrectly, 45.2% selected option A and 32.2% selected option B, which further suggests that these students have additional difficulties in representing real-life contextual problems with linear equations.

Item #	Strand	Specific Outcome	Item Complexity	Item Description
38	PR	2	Low	Match the given graph of a linear relation with its corresponding linear equation (Gr.8, PR.1).

	% of Student Responses (*Correct)			
	A*	B	C	D
Students Achieving the Acceptable Standard	69.1	6.1	20.4	4.1
Students Below the Acceptable Standard	29.7	16.2	44.2	8.7

Use the following information to answer question 38.



38. The equation representing the linear relation on the graph shown above is

- A.  $y = 0.5x + 2$
- B.  $y = 0.5x - 2$
- C.  $y = 2x + 4$
- D.  $y = 2x - 4$

**Commentary:**

Of the students who achieved the acceptable standard but answered the item incorrectly, approximately 66.7% chose option C as their response. This suggests that these students may have difficulty relating a list of ordered pairs (given in the form of a linear graph) to an equation that can be used to create the list of ordered pairs. Likewise, of the students who achieved below the acceptable standard but answered the item incorrectly, 64.0% selected option C and 23.4% selected option B, which further implies that these students had additional difficulties with matching a graph of a linear relation with its corresponding linear equation.

Item #	Strand	Specific Outcome	Item Complexity	Item Description
27	N	4	Moderate	Solve a given problem by applying the order of operations on positive rational numbers (Gr.6, N.9).

	% of Student Responses (*Correct)			
	A	B*	C	D
Students Achieving the Acceptable Standard	17.2	77.2	3.4	2.0
Students Below the Acceptable Standard	38.3	38.2	14.5	8.4

Use the following information to answer question 27.

Connie buys a horse for \$750 (including GST). She considers the two payment plans shown below.

**Plan 1** Pay \$150 now and \$25 each month

**Plan 2** Pay \$200 now and \$55 each month

27. How many **fewer** monthly payments could Connie make if she selects Plan 2?

- A. 10
- B. 14
- C. 20
- D. 24

**Commentary:**

Of the students who achieved the acceptable standard but answered the item incorrectly, approximately 76.1% chose option A as their response. This suggests that these students may have misunderstood the question and determined the number of monthly payments that need to be made if Plan 2 was selected instead of comparing the two plans to determine how many fewer monthly payments would be made with Plan 2. Likewise, of the students who achieved below the acceptable standard but answered the item incorrectly, 62.6% selected option A for reasons likely similar to those students who achieved the acceptable standard.



Item #	Strand	Specific Outcome	Item Complexity	Item Description
33	SS	5	High	Identify the location of the vertices of a 2-D shape after completing a combination of transformations on the Cartesian plane (Gr.7, SS.4; Gr.7, SS.5).

	% of Student Responses (*Correct)			
	A	B	C	D*
Students Achieving the Acceptable Standard	15.0	7.5	13.6	63.8
Students Below the Acceptable Standard	21.5	20.6	28.9	28.1

Use the following information to answer question 33.

Triangle  $JKL$ , shown below, undergoes the following transformations:

- a  $90^\circ$  clockwise rotation about vertex  $L$
- a translation of 3 units right and 4 units up

33. Which of the following rows represents the ordered pair for each vertex after **both** the transformations described above have been completed?

Row	$J''$	$K''$	$L''$
A.	(1, 1)	(1, 4)	(3, 4)
B.	(1, 1)	(1, -2)	(-1, -2)
C.	(4, 3)	(2, 3)	(2, 0)
D.	(3, 4)	(1, 4)	(1, 1)

**Commentary:**

Of the students who achieved the acceptable standard but answered the item incorrectly, approximately 41.6% chose option A as their response. This suggests that these students may have completed the two transformations correctly but had difficulties in maintaining the correct labels on each vertex in order to correctly identify the corresponding coordinates. Students who achieved below the acceptable standard but selected option A or C further suggest that these students had additional difficulties in completing successive transformations on the Cartesian plane. Students that selected option C likely completed the  $90^\circ$  clockwise rotation correctly but incorrectly translated the image 4 units to the right and 3 units up instead of translating it 3 units to the right and 4 units up.