



**pennsylvania**  
DEPARTMENT OF EDUCATION

**The Pennsylvania System of School  
Assessment  
Mathematics  
Item and Scoring Sampler  
2016–2017  
Grade 6**

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**PSSA MATHEMATICS GRADE 6**

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## INTRODUCTION

### General Introduction

The Pennsylvania Department of Education provides districts and schools with tools to assist in delivering focused instructional programs aligned with the Pennsylvania Core Standards (PCS). These tools include Academic Standards, Assessment Anchor documents, assessment handbooks, and content-based item and scoring samplers. This Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing local instructional programs. It can also be useful in preparing students for the statewide assessment.

### Pennsylvania Core Standards (PCS)

This sampler contains examples of test questions that are aligned to the new Pennsylvania Core Standards-based 2013 PSSA Assessment Anchors and Eligible Content. The Mathematics, Reading, and Writing PSSA transitioned to PCS-based operational Mathematics and English Language Arts assessments starting with the spring 2015 PSSA administration.

The 2013 PCS-aligned Assessment Anchor and Eligible Content documents are posted on this portal:

- [www.education.pa.gov](http://www.education.pa.gov) [Hover over “K–12,” select “Assessment and Accountability,” and select “Pennsylvania System of School Assessment (PSSA).” Then select “Assessment Anchors” from the “Other Materials” list on the right side of the screen.]

### What Is Included

This sampler contains test questions (items) that have been written to align to the Assessment Anchors that are based on the Pennsylvania Core Standards (PCS). The test questions provide an idea of the types of items that will appear on an operational, PCS-based PSSA. Each sample test question has been through a rigorous review process to ensure alignment with the Assessment Anchors.

### Purpose and Uses

The items in this sampler may be used as examples for creating assessment items at the classroom level, and they may also be copied and used as part of a local instructional program.<sup>1</sup> Classroom teachers may find it beneficial to have students respond to the open-ended item in this sampler. Educators can then use the sampler as a guide to score the responses either independently or together with colleagues within a school or district.

### Item Format and Scoring Guidelines

The multiple-choice (MC) items have four answer choices. Each correct response to an MC item is worth one point.

Each open-ended (OE) item is designed to take approximately ten to fifteen minutes to complete.

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<sup>1</sup> The permission to copy and/or use these materials does not extend to commercial purposes.

During the administration of the PSSA, students are given additional time as necessary to complete the test items. Each OE item in mathematics is scored using an item-specific scoring guideline based on a 0–4-point scale. In this sampler, every item-specific scoring guideline is combined with examples of student responses that represent each score point to form a practical, item-specific scoring guide.

This sampler also includes the *General Description of Scoring Guidelines for Mathematics Open-Ended Questions* that students will have access to during a PSSA mathematics administration. The general description of scoring guidelines can be distributed to students for use during local assessments and can also be used by educators when scoring local assessments.<sup>2</sup>

## Item Alignment

All PSSA items are aligned to statements and specifications included in the *Assessment Anchors and Eligible Content Aligned to the Pennsylvania Core Standards*. The mathematics content, process skills, directives, and action statements included in the PSSA mathematics questions align with the Assessment Anchor Content Standards. The Eligible Content statements represent the limits of the content of the mathematics questions.

## Testing Time and Mode of Testing Delivery for the PSSA

The PSSA is delivered in traditional paper-and-pencil format as well as in an online format. The estimated time to respond to a test question is the same for both methods of test delivery. During an official testing administration, students are given additional time as necessary to complete the test questions. The following table shows the estimated response time for each item type.

Mathematics Item Type	MC	OE
Estimated Response Time (minutes)	2	10 to 15

## Mathematics Reporting Categories

The Assessment Anchors are organized into four classifications as listed below.

A = Numbers and Operations

B = Algebraic Concepts

C = Geometry

D = Data Analysis and Probability

These four classifications are used throughout the grade levels. In addition to these classifications, there are five Reporting Categories for each grade level. The first letter of each Reporting Category represents the classification; the second letter represents the Domain as stated in the Common Core State Standards for Mathematics. Listed below are the Reporting Categories for Grade 6.

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A-N = The Number System

A-R = Ratios and Proportional Relationships

B-E = Expressions and Equations

C-G = Geometry

D-S = Statistics and Probability

Examples of multiple-choice and open-ended items assessing these categories are included in this booklet.

## General Description of Scoring Guidelines for Mathematics Open-Ended Questions

4: The response demonstrates a *thorough* understanding of mathematical concepts and procedures required by the task.

The response provides correct answer(s) with clear and complete mathematical procedures shown and a correct explanation, as required by the task. Response may contain a minor “blemish” or omission in work or explanation that does not detract from demonstrating a *thorough* understanding.

3: The response demonstrates a *general* understanding of the mathematical concepts and procedures required by the task.

The response and explanation (as required by the task) are mostly complete and correct. The response may have minor errors or omissions that do not detract from demonstrating a *general* understanding.

2: The response demonstrates a *partial* understanding of the mathematical concepts and procedures required by the task.

The response is somewhat correct with *partial* understanding of the required mathematical concepts and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

1: The response demonstrates a *minimal* understanding of the mathematical concepts and procedures required by the task.

0: The response has no correct answer and *insufficient* evidence to demonstrate any understanding of the mathematical concepts and procedures required by the task for that grade level.

Response may show only information copied from the question.

Special Categories within zero reported separately:

BLK (blank) Blank, entirely erased, or written refusal to respond

OT Off task

LOE Response in a language other than English

IL Illegible

## Item and Scoring Sampler Format

This sampler includes the test directions and scoring guidelines that appear in the PSSA Mathematics assessments. Each multiple-choice item is followed by a table that includes the alignment, the answer key, the depth of knowledge (DOK) level, the percentage<sup>3</sup> of students who chose each answer option, and a brief answer option analysis or rationale. The open-ended item is followed by a table that includes the item alignment, DOK level, and mean student score. Additionally, each of the included item-specific scoring guidelines is combined with sample student responses representing each score point to form a practical, item-specific scoring guide. The *General Description of Scoring Guidelines for Mathematics Open-Ended Questions* used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs.

### Example Multiple-Choice Item Information Table

Item Information	
Alignment	Assigned AAEC
Answer Key	Correct Answer
Depth of Knowledge	Assigned DOK
p-value A	Percentage of students who selected each option
p-value B	Percentage of students who selected each option
p-value C	Percentage of students who selected each option
p-value D	Percentage of students who selected each option
Option Annotations	Brief answer option analysis or rationale

### Example Open-Ended Item Information Table

Alignment: Assigned AAEC

Depth of Knowledge: Assigned DOK

Mean Score

<sup>3</sup>All *p*-value percentages listed in the item information tables have been rounded.

## Grade 6 Formula Sheet

2016

Grade 6

Formulas that you may need to work questions on this test are found below. You may refer back to this page at any time during the mathematics test.

A graphic of a triangle with the base labeled B and the height labeled H.

$$A = \frac{1}{2} bh$$

A graphic of a rectangle with the length labeled L and the width labeled W.

$$A = lw$$

A graphic of a square with one side labeled S.

$$A = S \text{ squared}$$

A graphic of a parallelogram with the base labeled B and the height labeled H.

$$A = bh$$

A graphic of a trapezoid with the height labeled H, the top labeled B sub 1, and the bottom labeled B sub 2.

$$A = \frac{1}{2} h (b \text{ sub } 1 + b \text{ sub } 2)$$

A graphic of a rectangular prism with the length labeled L, the width labeled W, and the height labeled H.

$$V = lwh$$

$$SA = 2lw + 2lh + 2wh$$

A graphic of a cube with one edge labeled S.

$$V = s \times s \times s$$

$$SA = 6 s \text{ squared}$$

A graphic of a triangular prism with the width labeled W. The edges around the triangular face are labeled A, B, and C. The height of the triangular face is H.

$$SA = ah + aw + bw + cw$$

## MATHEMATICS TEST DIRECTIONS

On the following pages are the Mathematics questions.

You may not use a calculator for question 1. You may use a calculator for all other questions on this test.

### Directions for Multiple-Choice Questions:

Some questions will ask you to select an answer from among four choices.

For the multiple-choice questions:

First solve the problem on scratch paper.

Choose the correct answer and record your choice in the answer booklet.

If none of the choices matches your answer, go back and check your work for possible errors.

Only one of the answers provided is the correct response.

### Directions for Open-Ended Questions:

Some questions will require you to write your response.

For the open-ended questions:

These questions have more than one part. Be sure to read the directions carefully.

You cannot receive the highest score for an open-ended question without completing all tasks in the question. For example, if the question asks you to show your work or explain your reasoning, be sure to show your work or explain your reasoning in the space provided.

If the question does **not** ask you to show your work or explain your reasoning, you may use the space provided, but only those parts of your response that the question specifically asks for will be scored.

Write your response in the appropriate location within the response box in the answer booklet. Some answers may require graphing, plotting, labeling, drawing, or shading. If you use scratch paper, be sure to transfer your final response and any needed work or reasoning to the answer booklet.

Question 1 in this sampler is to be solved without the use of a calculator.

### MULTIPLE-CHOICE ITEMS

1. Divide:  $\frac{3}{4} \div \frac{2}{3}$

A.  $\frac{1}{2}$

B.  $\frac{8}{9}$

C.  $\frac{9}{8}$

D. 2

Item Information	
Alignment	A-N.1.1.1
Answer Key	C
Depth of Knowledge	1
p-value A	28%
p-value B	12%
p-value C	52% (correct answer)
p-value D	8%
Option Annotations	A. multiplies $\frac{3}{4} \times \frac{2}{3}$ B. inverts $\frac{3}{4}$ instead of $\frac{2}{3}$ prior to multiplying C. correct D. inverts both fractions prior to multiplying

A calculator is permitted for use in solving questions 2–17 in this sampler.

2. Greg’s social studies grade is based on two quizzes, two tests, and one project. The table below shows Greg’s scores on these items, as well as each item’s weight in determining his final grade.

Greg’s Social Studies Scores

Item	Score	Weight
quiz 1	78	1
quiz 2	90	1
test 1	85	2
test 2	89	2
project	92	4

To determine his final grade, Greg’s teacher multiplies each score by its weight, adds the products together, and then divides the sum by 10. What is Greg’s final grade?

- A. 79.9
- B. 86.8
- C. 88.4
- D. 92.0

Item Information	
Alignment	A-N.2.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	8%
p-value B	13%
p-value C	69% (correct answer)
p-value D	10%
Option Annotations	A. enters $(78 + 90 \times 1) + (85 + 89 \times 2) + (92 \times 4)$ ; order of operations error B. finds the average of the scores C. correct D. thinks project grade is final grade because it has greatest weight

3. Kiah plotted the locations of her home and the city of Huntingdon on the number line shown below.

A number line is shown. The numbers below the number line are negative 9, negative 6, negative 3, 0, 3, 6, 9. The point at 0 is labeled Kiah’s Home. The point at 6.75 is labeled Huntingdon.

Williamsburg is the same distance from Kiah’s home as Huntingdon, but it is in the opposite direction. Which statement best describes how to find the location of Williamsburg on the number line?

- A. The opposite of 6.75 is  $-6.75$ , so Williamsburg is at  $-6.75$ .
- B. The sum of 6.75 and 6.75 is 13.5, so Williamsburg is at 13.5.
- C. The numbers 6.75 and  $-6.75$  are the same, so Williamsburg is at 6.75.
- D. Opposites, such as 6.75 and  $-6.75$ , sum to zero, so Williamsburg is at 0.

Item Information	
Alignment	A-N.3.1
Answer Key	A
Depth of Knowledge	2
p-value A	76% (correct answer)
p-value B	8%
p-value C	8%
p-value D	8%
Option Annotations	A. correct B. sums the measurements together C. thinks of absolute values D. wrong property, fails to identify Kiah’s home as 0

4. James measures the water level from the top of a dock twice a day. The water level in the morning is  $-2$  feet. The water level in the afternoon is  $-6.5$  feet. Which statement about the relationship between the two measurements is true?
- A. A water level of  $-6.5$  feet is higher than a water level of  $-2$  feet, as  $-6.5 > -2$ .
  - B. A water level of  $-2$  feet is lower than a water level of  $-6.5$  feet, as  $-2 > -6.5$ .
  - C. A water level of  $-6.5$  feet is the same as a water level of  $-2$  feet, as  $-6.5 = -2$ .
  - D. A water level of  $-2$  feet is higher than a water level of  $-6.5$  feet, as  $-2 > -6.5$ .

Item Information	
Alignment	A-N.3.2.1
Answer Key	D
Depth of Knowledge	1
p-value A	15%
p-value B	11%
p-value C	6%
p-value D	68% (correct answer)
Option Annotations	<p>A. thinks <math>-6.5</math> feet is higher than <math>-2</math> feet because <math>-6.5</math> is “more” negative than <math>-2</math></p> <p>B. thinks <math>-2</math> is lower than <math>-6.5</math> in terms of water level, but inequality is correct</p> <p>C. thinks measurements are the same since they are both negative</p> <p>D. correct</p>

5. The ratio of the number of boys to the number of girls in the cast of a school play is 1 : 5. Which statement **must** describe the cast of the play?
- A. There are exactly 6 students in the cast.
  - B. There is 1 boy for every 5 girls in the cast.
  - C. There are 4 more girls than boys in the cast.
  - D. There is 1 boy out of the 5 students in the cast.

Item Information	
Alignment	A-R.1.1.1
Answer Key	B
Depth of Knowledge	1
p-value A	15%
p-value B	64% (correct answer)
p-value C	8%
p-value D	13%
Option Annotations	A. thinks ratio shows total number B. correct C. thinks 5 – 1 D. mistakes ratio of boys to girls for ratio of boys to all students in the cast

6. For a recipe, Harris uses 2 cups of white sugar for each cup of brown sugar. How many cups of brown sugar does Harris use when he uses 1 cup of white sugar?
- A.  $\frac{1}{2}$
  - B. 1
  - C.  $1\frac{1}{2}$
  - D. 2

Item Information	
Alignment	A-R.1.1.2
Answer Key	A
Depth of Knowledge	2
p-value A	71% (correct answer)
p-value B	10%
p-value C	10%
p-value D	9%
Option Annotations	A. correct B. thinks the cups of brown sugar is a constant C. subtracts $\frac{1}{2}$ from 2 D. reverses the original ratio

7. Jasmine earns \$36 for 4 hours of baby-sitting. She charges a constant hourly rate. Which table correctly shows the amount Jasmine earns baby-sitting for different numbers of hours?

A. Jasmine’s Baby-Sitting Earnings

Number of Hours	Amount Earned (\$)
2	18
4	36
6	54
8	72

B. Jasmine’s Baby-Sitting Earnings

Number of Hours	Amount Earned (\$)
2	34
4	36
6	38
8	40

C. Jasmine’s Baby-Sitting Earnings

Number of Hours	Amount Earned (\$)
2	27
4	36
6	45
8	54

D. Jasmine’s Baby-Sitting Earnings

Number of Hours	Amount Earned (\$)
2	32
4	36
6	42
8	50

Item Information	
Alignment	A-R.1.1.4 A-R.1.1.3
Answer Key	A
Depth of Knowledge	2
p-value A	78% (correct answer)
p-value B	8%
p-value C	9%
p-value D	5%
Option Annotations	A. correct B. adds/subtracts change in hours from earnings C. finds rate is \$9 per hour, but assumes hours in table are in increments of 1 D. adds/subtracts amount in hours from earnings

8. Alon started in 60% of his team’s basketball games this season. He started a total of 12 games. How many games did Alon’s team play this season?
- A. 6
  - B. 7
  - C. 18
  - D. 20

Item Information	
Alignment	A-R.1.1.5
Answer Key	D
Depth of Knowledge	2
p-value A	13%
p-value B	23%
p-value C	18%
p-value D	46% (correct answer)
Option Annotations	A. subtracts $12 - 6$ B. finds 60% of 12, rounding down to 7 C. adds $12 + 6$ D. correct

9. An inequality is shown below.

$$x + 2.5 < 20$$

What is the **greatest** value of  $x$  from the set {10.5, 12.5, 17.5, 19.5} that makes the inequality true?

- A. 10.5
- B. 12.5
- C. 17.5
- D. 19.5

Item Information	
Alignment	B-E.2.1.1
Answer Key	B
Depth of Knowledge	1
p-value A	11%
p-value B	55% (correct answer)
p-value C	19%
p-value D	15%
Option Annotations	<p>A. <math>10.5 + 2.5 = 13</math>; makes the inequality true but is not the greatest value from the set to do so</p> <p>B. correct</p> <p>C. <math>17.5 + 2.5 = 20</math>; makes the inequality not true</p> <p>D. <math>19.5 + 2.5 = 22</math>; though 19.5 is the greatest value in the set that is less than 20, adding the value to 2.5 makes the inequality not true</p>

10. There are 150 children playing in a park.

The number of boys ( $x$ ) playing in the park is **greater** than 50.

The number of girls ( $y$ ) playing in the park is **less** than 100.

Which values of  $x$  and  $y$  could be the numbers of boys and girls playing in the park?

A.  $x = 35$

$y = 115$

B.  $x = 50$

$y = 100$

C.  $x = 55$

$y = 85$

D.  $x = 60$

$y = 90$

Item Information	
Alignment	B-E.2.1.3 B-E.2.1.4
Answer Key	D
Depth of Knowledge	2
p-value A	3%
p-value B	9%
p-value C	11%
p-value D	77% (correct answer)
Option Annotations	A. reverses inequality statements B. uses numbers given, does not consider inequality statements C. does not consider total number of boys and girls D. correct

11. Gary saves \$2.50 each day. Which equation describes the relationship between the number of days ( $d$ ) Gary saves money and the total amount of money ( $m$ ), in dollars, that he saves?
- A.  $m = 2.50d$
  - B.  $m = d - 2.50$
  - C.  $d = 2.50m$
  - D.  $d = 2.50/m$

Item Information	
Alignment	B-E.3.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	55% (correct answer)
p-value B	10%
p-value C	24%
p-value D	11%
Option Annotations	<ul style="list-style-type: none"> <li>A. correct</li> <li>B. equation creates incorrect relationship</li> <li>C. equation switches <math>d</math> and <math>m</math></li> <li>D. equation creates incorrect relationship</li> </ul>

12. A trapezoid is shown below.

A graphic of a trapezoid with the height labeled 3 meters, the top labeled 5 meters, and the bottom labeled 9 meters.

What is the area of the trapezoid?

- A.  $21 \text{ m}^2$
- B.  $27 \text{ m}^2$
- C.  $34 \text{ m}^2$
- D.  $42 \text{ m}^2$

Item Information	
Alignment	C-G.1.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	60% (correct answer)
p-value B	19%
p-value C	9%
p-value D	12%
Option Annotations	A. correct B. $3 \times 9$ C. $(5 + 9 + 3) \times 2$ ; incorrect formula D. $(5 + 9) \times 3$ ; forgot to multiply by $1/2$

13. The vertices of a parallelogram are plotted on the coordinate plane shown below.

A coordinate grid is shown. The numbers to the left of the y-axis are negative 10, negative 8, negative 6, negative 4, negative 2, 2, 4, 6, 8, 10. The numbers below the x-axis are negative 10, negative 8, negative 6, negative 4, negative 2, 2, 4, 6, 8, 10. There are four points on the coordinate grid.

What is the area, in square units, of the parallelogram?

- A. 8
- B. 9
- C. 12
- D. 24

Item Information	
Alignment	C-G.1.1.4
Answer Key	D
Depth of Knowledge	2
p-value A	11%
p-value B	7%
p-value C	14%
p-value D	68% (correct answer)
Option Annotations	A. uses $(-9, 2)$ and $(-1, 2)$ instead of $(-9, -2)$ and $(-1, -2)$ B. uses the vertical and horizontal distances between $(-6, 1)$ and $(-9, -2)$ C. thinks the formula is $(1/2) \times bh$ D. correct

14. Rosa built a jewelry box. She first cut out all the pieces she would need by using the pattern shown below.

A graphic of 6 shapes is shown. Four of the shapes are rectangles with side lengths of 3 units by 4 units. The other two shapes are squares with side lengths of 3 units.

Based on the pattern, which phrase **best** describes the shape of the completed jewelry box?

- A. a cube with a box top
- B. a cube with no box top
- C. a rectangular prism with a box top
- D. a rectangular prism with no box top

Item Information	
Alignment	C-G.1.1.5
Answer Key	C
Depth of Knowledge	2
p-value A	21%
p-value B	4%
p-value C	64% (correct answer)
p-value D	11%
Option Annotations	A. thinks any six-sided solid is a cube B. thinks any six-sided solid is a cube and does not realize that the top is included C. correct D. does not see that the row of four sides eventually folds around to make the top

15. A rectangular prism is pictured below.

A graphic of a rectangular prism with the length labeled 13 centimeters, the width labeled 5 centimeters, and the height labeled 6 centimeters.

What is the surface area of the rectangular prism?

- A.  $173 \text{ cm}^2$
- B.  $320 \text{ cm}^2$
- C.  $346 \text{ cm}^2$
- D.  $390 \text{ cm}^2$

Item Information	
Alignment	C-G.1.1.6
Answer Key	C
Depth of Knowledge	1
p-value A	10%
p-value B	7%
p-value C	46% (correct answer)
p-value D	37%
Option Annotations	A. does not multiply by 2 B. uses $5 \times 13$ face 4 times instead of twice, forgetting that 2 faces are $6 \times 13$ C. correct D. calculates volume instead of surface area

16. Franco asked his soccer team how many glasses of milk and how many glasses of water each player drinks per day. The line plots below show his data.

Two line plots are shown. The title of the first line plot is Amount of Milk Each Player Drinks. The title of the second line plot is Amount of Water Each Player Drinks. The label below each line plot is Glasses per Day. The numbers below each line plot are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. On the first line plot, there are 2 Xs above the 0, 4 Xs above the 1, 6 Xs above the 2, 5 Xs above the 3, 3 Xs above the 4, 1 X above the 6, and 1 X above the 7. On the second line plot, there is 1 X above the 1, 3 Xs above the 2, 2 Xs above the 3, 5 Xs above the 4, 3 Xs above the 5, 2 Xs above the 6, 2 Xs above the 7, 3 Xs above the 8, and 1 X above the 9.

Which statement correctly describes the number of glasses of milk and the number of glasses of water each player drinks per day?

- A. The mean would be a better measure of center than the median for the number of glasses of milk the players drink.
- B. There is less variability in the number of glasses of milk the players drink than the number of glasses of water they drink.
- C. The median number of glasses of milk the players drink is greater than the mean number of glasses of milk the players drink.
- D. The range for the number of glasses of milk and the range for the number of glasses of water the players drink are the same.

Item Information	
Alignment	D-S.1
Answer Key	B
Depth of Knowledge	3
p-value A	21%
p-value B	50% (correct answer)
p-value C	19%
p-value D	10%
Option Annotations	A. confuses mean and median B. correct C. thinks extreme values affect the median more than the mean D. forgets the x on the 9 for glasses of water

## OPEN-ENDED QUESTION

17. Sam and Annika ride their bikes to school. Sam rides his bike  $k$  kilometers. Annika rides her bike 2 less than 4 times as many kilometers as Sam rides.
- A. Write an expression to represent how many kilometers Annika rides her bike to school.  
Sam rides his bike at most 2 kilometers to school.
- B. What is the **greatest** distance, in kilometers, Annika could ride her bike to school? Show or explain all your work.
- C. Explain why Sam must ride his bike more than  $1/2$  kilometer to school.

## Item-Specific Scoring Guideline

### #17 Item Information

Alignment B-E.1

Depth of Knowledge 3

Mean Score 1.40

### Assessment Anchor this item will be reported under:

M06.B-E.1—Apply and extend previous understandings of arithmetic to numerical and algebraic expressions.

### Specific Anchor Descriptor addressed by this item:

M06.B-E.1.1—Identify, write, and evaluate numerical and algebraic expressions.

### Scoring Guide

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of identifying, writing, and evaluating numerical and algebraic expressions by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of identifying, writing, and evaluating numerical and algebraic expressions by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of identifying, writing, and evaluating numerical and algebraic expressions by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of identifying, writing, and evaluating numerical and algebraic expressions.
0	The response has no correct answer and insufficient evidence to demonstrate any understanding of the mathematical concepts and procedures as required by the task. Response may show only information copied from the question.

### Top-Scoring Student Response and Training Notes

Score	Description
4	Student earns 4 points.
3	Student earns 3.0–3.5 points.
2	Student earns 2.0–2.5 points.

<b>Score</b>	<b>Description</b>
<b>1</b>	Student earns 0.5–1.5 points.  OR  Student demonstrates minimal understanding of identifying, writing, and evaluating numerical and algebraic expressions.
<b>0</b>	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Top-Scoring Response

Part A (1 point):

1 point for correct answer

What?	Why?
$4k - 2$  <b>OR equivalent</b>	

Part B (2 points):

1 point for correct answer

1 point for complete explanation

OR  $\frac{1}{2}$  point for correct but incomplete explanation

What?	Why?
6 (kilometers)  [Note: Carry over any error from Part A unless it is blank.]	<p><b>Sample Work:</b></p> $4(2) - 2 = 8 - 2 = 6$ <p><b>OR</b></p> <p><b>Sample Explanation:</b></p> <p>Since Annika rides her bicycle 2 less than 4 times as many kilometers as Sam, she rides her bike 2 less than <math>4(2) = 8</math> kilometers, which is <math>8 - 2 = 6</math> kilometers.</p>

**Part C (1 point):**

1 point for complete explanation

OR  $\frac{1}{2}$  point for correct but incomplete explanation

What?	Why?
	<p><b>Sample Explanation:</b></p> <p>If Sam were to ride his bike <math>\frac{1}{2}</math> kilometer, that means that Annika would ride her bike <math>4\left(\frac{1}{2}\right) - 2 = 2 - 2 = 0</math> kilometers. Then she would not be riding her bike to school at all. So Sam must ride a distance greater than <math>\frac{1}{2}</math> kilometer from his home to school.</p> <p>[Note: Carry over any error from Part A unless it is blank.]</p>

## STUDENT RESPONSE

## Handwritten Response Score: 4 points

17. Sam and Annika ride their bikes to school. Sam rides his bike  $k$  kilometers. Annika rides her bike 2 less than 4 times as many kilometers as Sam rides.

- A. Write an expression to represent how many kilometers Annika rides her bike to school.

**Student Response:**  $K4-2$

**Annotation:** The student has given a correct expression.

Sam rides his bike at most 2 kilometers to school.

- B. What is the **greatest** distance, in kilometers, Annika could ride her bike to school? Show or explain all your work.

**Student Response:** the greatest distance is 6 kilometers because if you insert 2 into the expression it would be  $2 \times 4 - 2 = A$  so 2 times 4 is 8 and 2 subtracted from 8 is six

$$4 \times 2 = 8$$

$$8 - 2 = 6$$

6 kilometers

**Annotation:** The student has given a correct answer and complete support.

- C. Explain why Sam must ride his bike more than  $1/2$  kilometer to school.

**Student Response:** If Sam doesn't ride his bike more than  $1/2$  kilometer then Annika won't be able to ride her bike at all. So if you insert half in the expression you will get this  $1/2 \times 4 - 2 = A$

$$\text{So } 1/2 \times 4 = 2 \text{ and } 2 - 2 = 0$$

So Annika couldn't go anywhere unless he rides more than  $1/2$  kilometer.

**Annotation:** The student has given a complete explanation.

## STUDENT RESPONSE

## Online Response Score: 3 points

17 Sam and Annika ride their bikes to school. Sam rides his bike  $k$  kilometers. Annika rides her bike 2 less than 4 times as many kilometers as Sam rides.

- A. Write an expression to represent how many kilometers Annika rides her bike to school.

**Student Response:**  $k^2 - 2 =$

**Annotation:** The student has given an incorrect expression.

Sam rides his bike at most 2 kilometers to school.

- B. What is the **greatest** distance, in kilometers, Annika could ride her bike to school? Show or explain all your work.

**Student Response:** The greatest distance she could ride is 2 kilometers. I used the expression  $k^2 - 2 = 2$ . First I plugged 2 in for  $k$ ,  $2 \times 2 = 4$  and  $4 - 2 = 2$ . That is how I got my answer.

**Annotation:** The student has given a correct answer and complete support, based on the expression given in Part A.

- C. Explain why Sam must ride his bike more than  $1/2$  kilometer to school.

**Student Response:** Sam must ride more than  $1/2$  to school because  $1/2 \times 2 - 2 = -1$  and Anika can not ride negative 1 kilometers to school. That is why Sam must ride more than  $1/2$  kilometer to school.

**Annotation:** The student has given a complete explanation, based on the expression given in Part A.

## STUDENT RESPONSE

## Online Response Score: 2 points

17 Sam and Annika ride their bikes to school. Sam rides his bike  $k$  kilometers. Annika rides her bike 2 less than 4 times as many kilometers as Sam rides.

- A. Write an expression to represent how many kilometers Annika rides her bike to school.

**Student Response:**  $2 \times 4 - k = 6$

**Annotation:** The student has given an incorrect expression.

Sam rides his bike at most 2 kilometers to school.

- B. What is the **greatest** distance, in kilometers, Annika could ride her bike to school? Show or explain all your work.

**Student Response:** Annika could ride her bike 6 kilometers to school.

$$2 \times 4 = 8$$

$$8 - 2 = 6$$

**Annotation:** The student has given a correct answer and complete support.

- C. Explain why Sam must ride his bike more than  $1/2$  kilometer to school.

**Student Response:** Sam must ride his bike  $1/2$  kilometer to school because Anika rides 2 less than 4 times as many kilometers as Sam. Also it is because Annika is riding 6 kilometers to school.

**Annotation:** The student has given an incorrect explanation.

## STUDENT RESPONSE

## Handwritten Response Score: 1 point

17 Sam and Annika ride their bikes to school. Sam rides his bike  $k$  kilometers. Annika rides her bike 2 less than 4 times as many kilometers as Sam rides.

- A. Write an expression to represent how many kilometers Annika rides her bike to school.

**Student Response:**  $k \times 4 - 2$

$\times$  = multiplication

**Annotation:** The student has given a correct expression.

Sam rides his bike at most 2 kilometers to school.

- B. What is the **greatest** distance, in kilometers, Annika could ride her bike to school? Show or explain all your work.

**Student Response:** The greatest distance Annika could ride her bike to school is 0 kilometers. because Sam rides 2 k. and Annika rides 2K less than Sam, making it 0 kilometers.

**Annotation:** The student has given an incorrect answer and incorrect support.

- C. Explain why Sam must ride his bike more than  $\frac{1}{2}$  kilometer to school.

**Student Response:** because his house is further than  $\frac{1}{2}$  kilo. to school? ?  
I'm confused.

**Annotation:** The student has given an incorrect explanation.

## STUDENT RESPONSE

## Online Response Score: 0 points

18. Sam and Annika ride their bikes to school. Sam rides his bike  $k$  kilometers. Annika rides her bike 2 less than 4 times as many kilometers as Sam rides.

- A. Write an expression to represent how many kilometers Annika rides her bike to school.

**Student Response:**  $k - 2 \times 4$

**Annotation:** The student has given an incorrect answer.

Sam rides his bike at most 2 kilometers to school.

- B. What is the **greatest** distance, in kilometers, Annika could ride her bike to school? Show or explain all your work.

**Student Response:** If Sam ride his bike for almost 2 kilometers than Annika rides for almost 4 kilometers because  $2 - 2 = 0 + 4 = 4$  kilometers

**Annotation:** The student has given an incorrect answer and incorrect support.

- C. Explain why Sam must ride his bike more than  $1/2$  kilometer to school.

**Student Response:** Because he has to Annika rides 6 kilometers than 2 less than Sam she  $\times$  by 2 so she gets 4.

**Annotation:** The student has given an incorrect explanation.

**MATHEMATICS—SUMMARY DATA**

**MULTIPLE-CHOICE**

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
1	A-N.1.1.1	C	1	28%	12%	52% (correct answer)	8%
2	A-N.2.1.1	C	2	8%	13%	69% (correct answer)	10%
3	A-N.3.1	A	2	76% (correct answer)	8%	8%	8%
4	A-N.3.2.1	D	1	15%	11%	6%	68% (correct answer)
5	A-R.1.1.1	B	1	15%	64% (correct answer)	8%	13%
6	A-R.1.1.2	A	2	71% (correct answer)	10%	10%	9%
7	A-R.1.1.4 A-R.1.1.3	A	2	78% (correct answer)	8%	9%	5%
8	A-R.1.1.5	D	2	13%	23%	18%	46% (correct answer)
9	B-E.2.1.1	B	1	11%	55% (correct answer)	19%	15%
10	B-E.2.1.3 B-E.2.1.4	D	2	3%	9%	11%	77% (correct answer)
11	B-E.3.1.1	A	2	55% (correct answer)	10%	24%	11%
12	C-G.1.1.1	A	1	60% (correct answer)	19%	9%	12%
13	C-G.1.1.4	D	2	11%	7%	14%	68% (correct answer)

**PSSA MATHEMATICS GRADE 6**

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
14	C-G.1.1.5	C	2	21%	4%	64% (correct answer)	11%
15	C-G.1.1.6	C	1	10%	7%	46% (correct answer)	37%
16	D-S.1	B	3	21%	50% (correct answer)	19%	10%

**OPEN-ENDED**

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	B-E.1	4	3	1.40



# **PSSA Grade 6 Mathematics Item and Scoring Sampler**