



**pennsylvania**  
DEPARTMENT OF EDUCATION

# **The Pennsylvania System of School Assessment**

## **Mathematics Item and Scoring Sampler**



**2023–2024  
Grade 6**

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## INTRODUCTION

### General Introduction

The Pennsylvania Department of Education (PDE) 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 Anchors and Eligible Content (AAEC) 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 by providing samples of test item types and scored student responses. The item sampler is not designed to be used as a pretest, a curriculum, or any other benchmark for operational testing.

This Item and Scoring Sampler is available in Braille format. For more information regarding Braille, call (717) 901-2238.

### Pennsylvania Core Standards (PCS)

This sampler contains examples of test questions designed to assess the Pennsylvania Assessment Anchors and Eligible Content aligned to the PCS. 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 PCS-aligned Assessment Anchors and Eligible Content documents are posted on this portal:

- [www.education.pa.gov](http://www.education.pa.gov) [Hover over “Data and Reporting,” select “Assessment and Accountability,” and select “PSSA-PA System of School Assessment.” Then select “Assessment Anchors/Eligible Content” on the right side of the screen.]

### What Is Included

This sampler contains test questions, or test “items,” that have been written to align to the Assessment Anchors that are based on the PCS. The sample test questions model the types of items that may appear on an operational PSSA. Each sample test question has been through a rigorous review process to ensure alignment with the Assessment Anchors prior to being piloted in an embedded field test within a PSSA assessment and then used operationally on a PSSA assessment. Answer keys, scoring guidelines, and any related stimulus material are also included. Additionally, sample student responses are provided with each open-ended (OE) item to demonstrate the range of responses that students provided in response to these items.

## Purpose and Uses

The items in this sampler may be used<sup>1</sup> as examples for creating assessment items at the classroom level. Classroom teachers may find it beneficial to have students respond to the open-ended item in this sampler. Educators may then use the sampler as a guide to score the responses either independently or together with colleagues within a school or district. This sampler also includes the *General Description of Scoring Guidelines for Mathematics Open-Ended Items* that students will have access to during a PSSA mathematics administration. The general description of scoring guidelines may be distributed to students for use during local assessments and may also be used by educators when scoring local assessments.

## 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 OE item is designed to take approximately ten to fifteen minutes to complete. 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.

## 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.

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

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

The PSSA is delivered in a 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. The following table shows the estimated response time for each item type.

<b>Mathematics Item Type</b>	<b>MC</b>	<b>OE</b>
Estimated Response Time (minutes)	2	10 to 15

During an official test administration, students are given as much additional time as is necessary to complete the test questions.

## Mathematics Reporting Categories

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

• A = Numbers and Operations	• C = Geometry
• B = Algebraic Concepts	• 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.

- 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 MC and OE items assessing these categories are included in this sampler.

## Item and Scoring Sampler Format

This sampler includes the test directions and scoring guidelines that appear in the PSSA Mathematics assessments. Each MC item is followed by a table that includes the item alignment, the answer key, the depth of knowledge (DOK) level, the percentage<sup>2</sup> of students who chose each answer option, and a brief answer-option analysis or rationale. The OE item is followed by a table that includes the item alignment, the DOK level, and the 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 Items* 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. The student responses in this item and scoring sampler are actual student responses; however, the handwriting has been changed to protect the students' identities and to make the item and scoring sampler accessible to as many people as possible.

### 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 option A
p-value B	Percentage of students who selected option B
p-value C	Percentage of students who selected option C
p-value D	Percentage of students who selected option D
Option Annotations	Brief answer-option analysis or rationale

### Example Open-Ended Item Information Table

Alignment	Assigned AAEC	Depth of Knowledge	Assigned DOK	Mean Score	Average Score

<sup>2</sup> All p-value percentages listed in the item information tables have been rounded.

**General Description of Scoring Guidelines for Mathematics Open-Ended Items**

**4— The response demonstrates a *thorough* understanding of the 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. The 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.**

The response may show only information copied from the question.

Special Categories within zero reported separately:

BLK (blank).....Is blank, is entirely erased, or gives a written refusal to respond

OT.....Is off-task

LOE.....Is in a language other than English

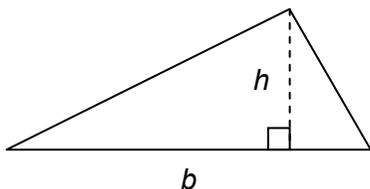
IL.....Is illegible

Grade 6 Formula Sheet

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

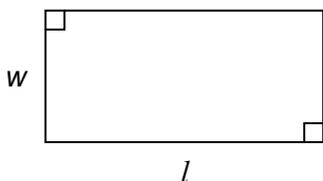
2023  
Grade 6

**Triangle**



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

**Rectangle**



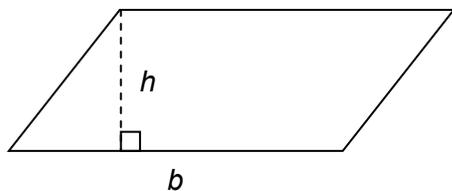
$$A = lw$$

**Square**



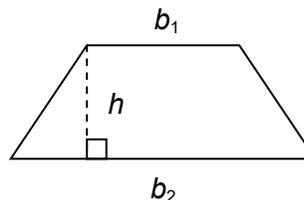
$$A = s^2$$

**Parallelogram**



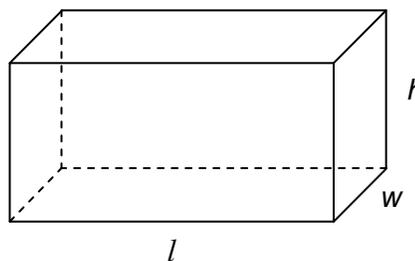
$$A = bh$$

**Trapezoid**



$$A = \frac{1}{2}h(b_1 + b_2)$$

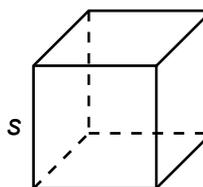
**Rectangular Prism**



$$V = lwh$$

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

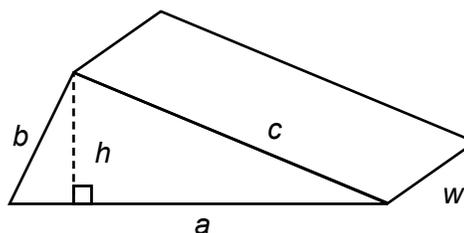
**Cube**



$$V = s \cdot s \cdot s$$

$$SA = 6s^2$$

**Triangular Prism**



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

**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. Add:  $39.093 + 52.72$

- A. 34.366
- B. 44.365
- C. 81.814
- D. 91.813

Item Information	
Alignment	A-N.2.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	3%
p-value B	11%
p-value C	6%
p-value D	80% (correct answer)
Option Annotations	<p>A. right-aligns the numbers, ignoring the decimal points (<math>39093 + 5272</math>), adds left to right and regroups to the next right place value (<math>3 + 0 = 3</math>, <math>9 + 5 = 14</math>, regroups the 1 to the right for <math>1 + 0 + 2 = 3</math>, <math>9 + 7 = 16</math>, regroups the 1 to the right for <math>1 + 3 + 2 = 5</math>), and then places the decimal point between the 2nd and 3rd digits to match the initial addends</p> <p>B. right-aligns the numbers, ignoring the decimal points (<math>39093 + 5272</math>), adds those number correctly, and then places the decimal point between the 2nd and 3rd digits to match the initial addends</p> <p>C. adds left to right and regroups to the next right place value (<math>3 + 5 = 8</math>, <math>9 + 2 = 11</math>, regroups the 1 to the right for <math>1 + 0 + 7 = 8</math>, <math>9 + 2 = 11</math>, regroups the 1 to the right for <math>1 + 3 + 0 = 4</math>)</p> <p>D. Correct: aligns the place values before adding OR includes a 0 in the thousandths place of <math>52.72</math> and then adds <math>39.093 + 52.720</math>, starting with the thousandths place</p>

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

2. A chef made a vegetable dish. She used 63 ounces of lima beans and 18 ounces of corn in the dish. What is the ratio of lima beans to corn in the vegetable dish?
- A. 2:7
  - B. 7:9
  - C. 7:2
  - D. 9:7

Item Information	
Alignment	A-R.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	12%
p-value B	18%
p-value C	57% (correct answer)
p-value D	13%
Option Annotations	<ul style="list-style-type: none"> <li>A. reverses the ratio</li> <li>B. uses the ratio of lima beans to total weight</li> <li>C. Correct: recognizes the ratio of ounces of lima beans to ounces of corn is 63:18 and divides each number by 9 (<math>63 \div 9 = 7</math>, <math>18 \div 9 = 2</math>)</li> <li>D. uses the ratio of total weight to lima beans</li> </ul>

3. Mike makes lemonade to sell at the fair. He can sell 64 glasses of lemonade from the 3 full jugs he makes. Each jug is the same size, and each glass contains the same amount of lemonade. Which fraction represents the number of glasses of lemonade Mike sells from each jug?
- A.  $\frac{3}{64}$
  - B.  $\frac{3}{61}$
  - C.  $\frac{61}{3}$
  - D.  $\frac{64}{3}$

Item Information	
Alignment	A-R.1.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	34%
p-value B	5%
p-value C	4%
p-value D	57% (correct answer)
Option Annotations	<p>A. inverts the fraction</p> <p>B. subtracts 3 from 64 to determine that the difference is 61 and then uses 3 as the numerator and 61 as the denominator</p> <p>C. subtracts 3 from 64 to determine that the difference is 61 and then uses 3 as the denominator and 61 as the numerator</p> <p>D. Correct: recognizes the ratio as 64 glasses to 3 jugs and then divides each number by 3 to find the unit rate, in glasses per jug  <math>(64 \div 3 = \frac{64}{3}, 3 \div 3 = 1)</math></p>

4. All of the coins in Mr. Mateo’s coin collection are either gold or silver. The ratio of the number of gold coins to the number of silver coins in his coin collection is 3:2. What percent of Mr. Mateo’s collection is silver coins?
- A. 2%
  - B. 20%
  - C. 40%
  - D. 60%

Item Information	
Alignment	A-R.1.1.5 A-R.1.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	11%
p-value B	23%
p-value C	45% (correct answer)
p-value D	21%
Option Annotations	<p>A. uses the 2 from the ratio without converting to a percentage</p> <p>B. multiplies the number of silver coins by 10</p> <p>C. Correct: divides the number of silver coins represented in the ratio (2) by the total number of coins represented in the ratio (5) and then multiplies the quotient (0.4) by 100 to determine the percentage</p> <p>D. thinks the 3 from the ratio represents silver coins and determines the percentage using <math>3 \div (3 + 2) \cdot 100</math></p>

5. Which equation shows the value of  $x$  raised to the 4th power when  $x = 3$ ?
- A.  $x^3 = 4 \cdot 4 \cdot 4 = 64$
  - B.  $x^4 = 4 \cdot 4 \cdot 4 = 64$
  - C.  $x^3 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$
  - D.  $x^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

Item Information	
Alignment	B-E.1.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	13%
p-value B	12%
p-value C	11%
p-value D	64% (correct answer)
Option Annotations	<p>A. switches the meanings of the 3 and the 4, using 3 as the exponent and 4 as the value of <math>x</math></p> <p>B. uses 4 as both the exponent and the value of <math>x</math> but multiplies 4 three times based on “when <math>x = 3</math>”</p> <p>C. uses 3 as both the exponent and the value of <math>x</math> but still multiplies 3 four times based on “raised to the 4th power” (i.e., recognizes what “raised to the 4th power” means but does not know how to represent “raised to the 4th power” as an exponent)</p> <p>D. Correct: represents <math>x</math> to the fourth power as <math>x^4</math> using <math>x</math> as the base and 4 as the exponent, substitutes 3 in for <math>x</math>, and then multiplies 3 four times since the exponent is 4</p>

6. An expression is shown below.

$$x^2 + 0.5x$$

What is the value of the expression when  $x$  is 3?

- A. 6.53
- B. 7.5
- C. 9.53
- D. 10.5

Item Information	
Alignment	B-E.1.1.4
Answer Key	D
Depth of Knowledge	1
p-value A	11%
p-value B	10%
p-value C	27%
p-value D	52% (correct answer)
Option Annotations	<p>A. calculates <math>3 \cdot 2</math> rather than <math>3^2</math>; views <math>0.5x</math> as <math>0.53</math>, rather than <math>0.5 \cdot 3</math></p> <p>B. calculates <math>3 \cdot 2</math> rather than <math>3^2</math></p> <p>C. views <math>0.5x</math> as <math>0.53</math>, rather than <math>0.5 \cdot 3</math></p> <p>D. Correct: substitutes 3 in for <math>x</math>, calculates <math>3^2 = 3 \cdot 3 = 9</math> and <math>0.5(3) = 1.5</math>, and then adds <math>9 + 1.5</math> to determine that the sum is 10.5</p>

7. An equation is shown below.

$$y - 2.5 = 21.5$$

What value of  $y$  from the set  $\{8.6, 19, 23.5, 24\}$  makes the equation true?

- A. 8.6
- B. 19
- C. 23.5
- D. 24

Item Information	
Alignment	B-E.2.1.1
Answer Key	D
Depth of Knowledge	1
p-value A	7%
p-value B	14%
p-value C	12%
p-value D	67% (correct answer)
Option Annotations	<ul style="list-style-type: none"> <li>A. substitutes 8.6 in for <math>y</math> but then multiplies 8.6 by 2.5</li> <li>B. substitutes 19 in for <math>y</math> but then adds 2.5 to 19</li> <li>C. substitutes 23.5 in for <math>y</math> but then subtracts only the whole parts (<math>23 - 2 = 21</math>) while “carrying over” the .5</li> <li>D. Correct: substitutes 24 in for <math>y</math> and recognizes that <math>24 - 2.5 = 21.5</math> is a true number sentence</li> </ul>

8. Peter measured the outdoor temperature five times on Thursday. The temperature increased throughout the day until 6 P.M. Peter’s measurements, in degrees Fahrenheit (°F), are shown in the table below.

Thursday Temperatures

Time of Day	1 P.M.	2 P.M.	3 P.M.	4 P.M.	5 P.M.	6 P.M.
Temperature (°F)	59.7	62.8	67.5	$t$	71.3	72.0

Which pair of inequalities represents all the possible temperatures ( $t$ ), in degrees Fahrenheit (°F), at 4 P.M.?

- A.  $t < 67.5$  and  $t < 71.3$
- B.  $t > 67.5$  and  $t < 71.3$
- C.  $t < 67.5$  and  $t > 71.3$
- D.  $t > 67.5$  and  $t > 71.3$

Item Information	
Alignment	B-E.2.1.4
Answer Key	B
Depth of Knowledge	2
p-value A	13%
p-value B	60% (correct answer)
p-value C	17%
p-value D	10%
Option Annotations	<p>A. recognizes that <math>t</math> should be less than 71.3 but uses the same symbol with 67.5</p> <p>B. Correct: recognizes the temperature (<math>t</math>) must be greater than 67.5 (the temperature at 3 P.M.) and less than 71.3 (the temperature at 5 P.M.)</p> <p>C. reverses the direction of both inequalities</p> <p>D. recognizes that <math>t</math> should be greater than 67.5 but uses the same symbol with 71.3</p>

9. A cook uses  $\frac{2}{3}$  cup of oil to make each batch of pizza dough. Which equation describes the relationship between the number of batches of pizza dough ( $x$ ) the cook makes and the number of cups of oil ( $y$ ) the cook uses?

A.  $y = \frac{2}{3}x$

B.  $y = \frac{3}{2}x$

C.  $y = x - \frac{2}{3}$

D.  $y = x + \frac{2}{3}$

Item Information	
Alignment	B-E.3.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	57% (correct answer)
p-value B	11%
p-value C	13%
p-value D	19%
Option Annotations	<p>A. Correct: recognizes that the number of cups of oil (<math>y</math>) can be found by multiplying the amount of oil, in cups, in each batch (<math>\frac{2}{3}</math>) by the number of batches (<math>x</math>)</p> <p>B. uses the reciprocal of the number of cups per batch</p> <p>C. uses subtraction rather than multiplication</p> <p>D. uses addition rather than multiplication</p>

10. The table below shows the relationship between the amount of gas, in gallons, remaining in the gas tank of Zoey’s car and the distance, in miles, she has traveled in the car.

Zoey’s Car

Distance (miles)	Gas Remaining (gallons)
120	14
150	13
180	12
210	11

Based on the relationship shown in the table, which statement about Zoey’s car is true?

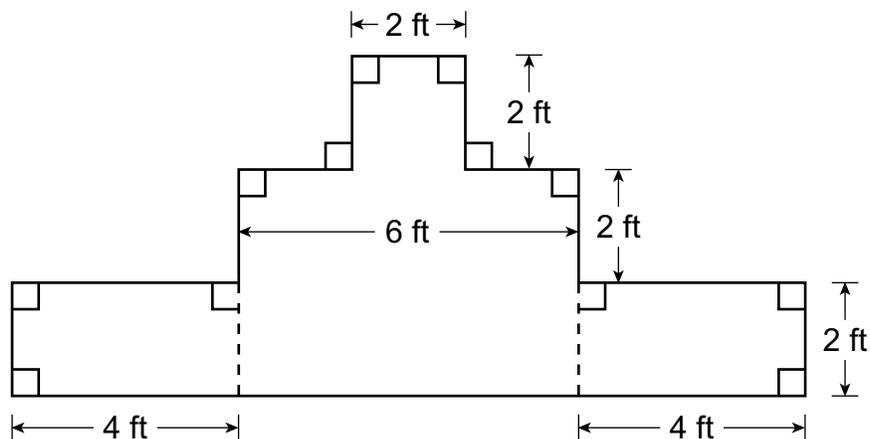
- A. As the distance Zoey travels in the car increases by 30 miles, the amount of gas remaining increases by 1 gallon.
- B. As the distance Zoey travels in the car increases by 30 miles, the amount of gas remaining decreases by 1 gallon.
- C. As the amount of gas remaining increases by 30 gallons, the distance Zoey travels in the car increases by 1 mile.
- D. As the amount of gas remaining increases by 30 gallons, the distance Zoey travels in the car decreases by 1 mile.

Item Information	
Alignment	B-E.3.1.2
Answer Key	B
Depth of Knowledge	2
p-value A	13%
p-value B	70% (correct answer)
p-value C	9%
p-value D	8%
Option Annotations	<p>A. interprets the amount of gas as increasing rather than decreasing</p> <p>B. Correct: interprets the table to mean the amount of gas remaining is dependent on the distance and recognizes that the distance is increasing by 30 miles while the amount of gas remaining is decreasing by 1 gallon</p> <p>C. reverses dependent and independent values and misinterprets the relationship</p> <p>D. reverses dependent and independent values</p>

11. Dave has an aquarium in the shape of a rectangular prism. Rounded to the nearest hundredth, the aquarium can hold 7.48 gallons of water for each cubic foot. The aquarium measures 4 feet by 1.5 feet by 1.75 feet. Which amount is **closest** to the number of gallons of water Dave’s aquarium can hold?
- A. 14.73
  - B. 17.98
  - C. 54.23
  - D. 78.54

Item Information	
Alignment	C-G.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	31%
p-value B	18%
p-value C	15%
p-value D	36% (correct answer)
Option Annotations	<p>A. uses <math>4 + 1.5 + 1.75</math> rather than <math>4 \cdot 1.5 \cdot 1.75</math> to find the volume and then adds 7.48 rather than multiplying by 7.48</p> <p>B. calculates the volume (10.5 cubic feet) but then adds 7.48 rather than multiplying by 7.48</p> <p>C. uses <math>4 + 1.5 + 1.75</math> rather than <math>4 \cdot 1.5 \cdot 1.75</math> to find the volume but then multiplies by 7.48</p> <p>D. Correct: multiplies the side lengths to find the volume in cubic feet (<math>4 \cdot 1.5 \cdot 1.75 = 10.5</math>) and then multiplies the volume by the gallons of water per cubic foot (7.48)</p>

12. A figure is shown below.

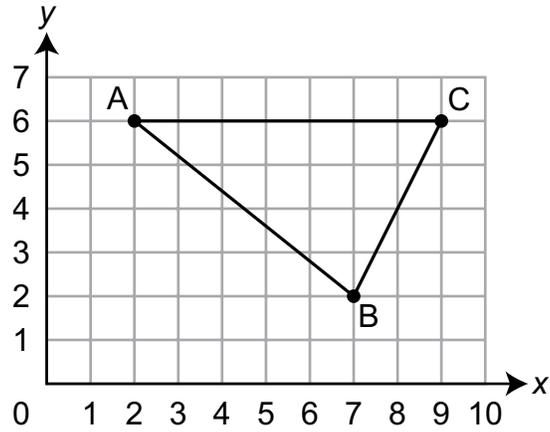


What is the area, in square feet, of the figure?

- A. 32
- B. 36
- C. 42
- D. 44

Item Information	
Alignment	C-G.1.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	18%
p-value B	18%
p-value C	15%
p-value D	49% (correct answer)
Option Annotations	<p>A. calculates the area of the large rectangle using <math>6 \cdot 2</math> rather than <math>6 \cdot 4</math></p> <p>B. uses <math>4 \cdot 2</math> only once in the calculation of the area of the figure</p> <p>C. notices that the bottom left or right rectangle can fit above the other to make a large rectangle, finds the area of the large rectangle (<math>4 \cdot 10</math>), but then adds 2 to the result (40) rather than adding <math>2 \cdot 2</math></p> <p>D. Correct: adds the areas of all 4 rectangles <math>[(4 \cdot 2) + (4 \cdot 2) + (2 \cdot 2) + (6 \cdot 4) = 8 + 8 + 4 + 24 = 44]</math></p>

13. Triangle ABC is plotted on the coordinate grid shown below.

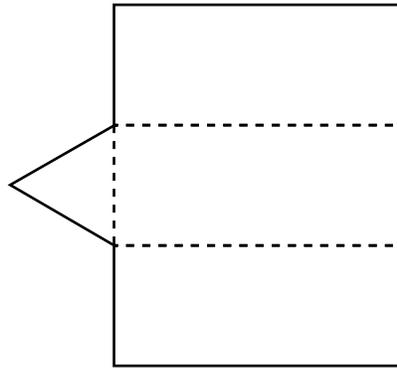


What is the area, in square units, of triangle ABC?

- A. 14
- B. 20
- C. 28
- D. 40

Item Information	
Alignment	C-G.1.1.4
Answer Key	A
Depth of Knowledge	2
p-value A	52% (correct answer)
p-value B	23%
p-value C	19%
p-value D	6%
Option Annotations	<p>A. Correct: uses side AC as the base, counts the distance between point A and point C as 7 units, uses the vertical distance between point B and side AC as the height, counts the height as 4 units, and then applies the formula for the area of a triangle</p> $\left( A = \frac{1}{2}bh = \frac{1}{2} \cdot 7 \cdot 4 \right)$ <p>B. counts the gridlines and includes both endpoints (<math>b = 8, h = 5</math>) for lengths</p> <p>C. does not multiply the product <math>7 \cdot 4</math> (i.e., <math>bh</math>) by <math>\frac{1}{2}</math></p> <p>D. counts the gridlines and includes both endpoints (<math>b = 8, h = 5</math>) for lengths and does not multiply the product <math>8 \cdot 5</math> (i.e., <math>bh</math>) by <math>\frac{1}{2}</math></p>

14. Carter is making a paper lampshade. To make the shade, he first draws the net shown below on a piece of paper.

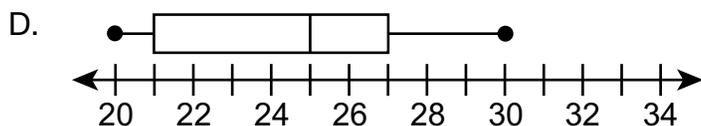
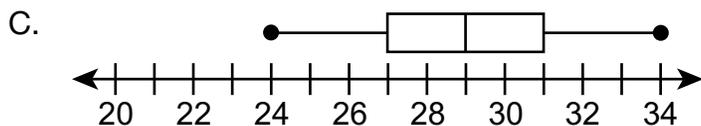
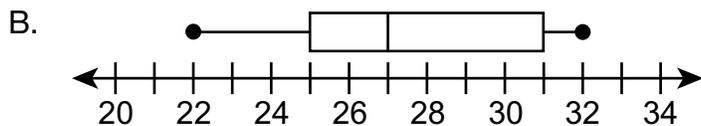
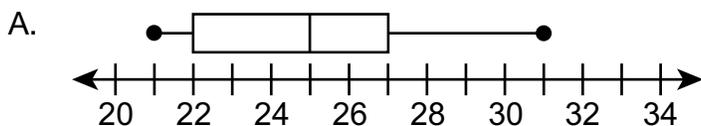


He cuts out the net and folds it into a three-dimensional figure. What is the shape of Carter's finished lampshade?

- A. a triangular prism with exactly 1 base covered with paper
- B. a triangular prism with exactly 2 bases covered with paper
- C. a triangular pyramid with exactly 1 base covered with paper
- D. a triangular pyramid with exactly 2 bases covered with paper

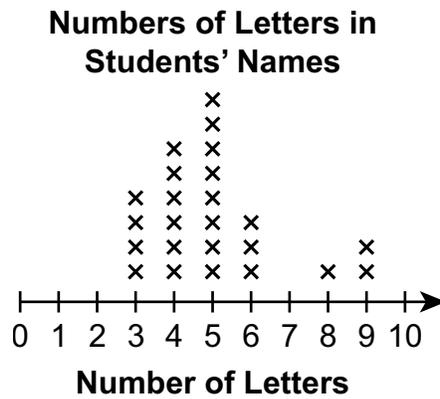
Item Information	
Alignment	C-G.1.1.5
Answer Key	A
Depth of Knowledge	2
p-value A	48% (correct answer)
p-value B	21%
p-value C	19%
p-value D	12%
Option Annotations	<ul style="list-style-type: none"> <li>A. Correct: identifies the net as a triangular prism that has only 1 base since there is only 1 triangle shown in the net</li> <li>B. assumes there are 2 bases</li> <li>C. confuses pyramid with prism</li> <li>D. confuses pyramid with prism and assumes there are 2 bases</li> </ul>

15. A data set has a **median** of 25 and an **interquartile range** of 6. A box-and-whisker plot is created to represent the data set. Which box-and-whisker plot could represent the data set?



Item Information	
Alignment	D-S.1.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	30%
p-value B	13%
p-value C	9%
p-value D	48% (correct answer)
Option Annotations	<p>A. counts 22, 23, 24, 25, 26, and 27 as 6 values rather than subtracting <math>27 - 22 = 5</math> for the interquartile range</p> <p>B. considers the left edge of the box as representing the median value rather than the 1st quartile value</p> <p>C. uses a symmetrical box-and-whisker plot without consideration of the given statistical measures</p> <p>D. Correct: recognizes that the line inside the box represents the median value (25) and that the distance between the left edge (1st quartile value, which is 21) and the right edge (3rd quartile value, which is 27) of the box is the interquartile range (<math>27 - 21 = 6</math>)</p>

16. The line plot below shows the number of letters in each student's name for the 24 students in a classroom.



Which statement **best** describes the data displayed in the line plot?

- A. The data are skewed to the left.
- B. The data are symmetrical about 6 letters.
- C. Most of the data are clustered around 3 to 6 letters.
- D. Half of the students have 5 or fewer letters in their name.

Item Information	
Alignment	D-S.1.1.3
Answer Key	C
Depth of Knowledge	2
p-value A	11%
p-value B	7%
p-value C	62% (correct answer)
p-value D	20%
Option Annotations	<p>A. confuses skewed to the left with skewed to the right</p> <p>B. identifies the midpoint of the data <math>[(9 + 3) \div 2 = 6]</math></p> <p>C. Correct: recognizes that 21 of the 24 data points are in the 3–6 interval and that a grouping of data points like this is a “cluster”</p> <p>D. interprets the mode (5) as though it were the median value, which is where the data set is divided in half</p>

## OPEN-ENDED QUESTION

17. A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Christine spent \$72.00 on student tickets.

**A.** How many student tickets did Christine purchase?

Mr. Perkins spent exactly \$117.00 on tickets.

**B.** How many adult tickets did Mr. Perkins purchase? Show or explain why there is only one possible answer.

Go to the next page to finish question 17.

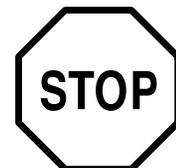


17. **Continued.** Please refer to the previous page for task explanation.

Ms. Barkin purchased 1 adult ticket and spent some money on nachos. The price for the nachos ends in \$0.25. She spent more than \$38.00 but less than \$43.00 for the adult ticket and the nachos.

- C. How many prices are possible for the nachos? Explain how to determine this amount **without** listing all the possible prices for the nachos.

**After you have finished your work, close this booklet so your teacher will know you are finished.**



## Item-Specific Scoring Guideline

### #17 Item Information

<b>Alignment</b>	B-E.2.1	<b>Depth of Knowledge</b>	3	<b>Mean Score</b>	1.15
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### Assessment Anchor this item will be reported under:

M06.B-E.2—Interpret and solve one-variable equations and inequalities.

### Specific Anchor Descriptor addressed by this item:

M06.B-E.2.1—Create, solve, and interpret one-variable equations or inequalities in real-world and mathematical problems.

### Scoring Guide

<b>Score</b>	<b>In this item, the student . . .</b>
<b>4</b>	Demonstrates a thorough understanding of how to interpret and solve one-variable equations and inequalities by correctly solving problems and clearly explaining procedures.
<b>3</b>	Demonstrates a general understanding of how to interpret and solve one-variable equations and inequalities by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
<b>2</b>	Demonstrates a partial understanding of how to interpret and solve one-variable equations and inequalities by correctly performing a significant portion of the required task.
<b>1</b>	Demonstrates minimal understanding of how to interpret and solve one-variable equations and inequalities.
<b>0</b>	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.
1	Student earns 0.5–1.5 points.  OR  Student demonstrates minimal understanding of how to interpret and solve one-variable equations and inequalities.
0	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?
4 (student tickets)	

Part B (1  $\frac{1}{2}$  points):

$\frac{1}{2}$  point for correct answer

1 point for correct and complete support

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

What?	Why?
2 (adult tickets)	<p><b>Sample Work:</b>                      0 adult tickets: <math>[117 - 0(31.50)] \div 18 = 6.5</math> student tickets <math>\times</math>                      1 adult ticket: <math>[117 - 1(31.50)] \div 18 = 4.75</math> student tickets <math>\times</math>                      2 adult tickets: <math>[117 - 2(31.50)] \div 18 = 3</math> student tickets <math>\checkmark</math>                      3 adult tickets: <math>[117 - 3(31.50)] \div 18 = 1.25</math> student tickets <math>\times</math>                      4 adult tickets: <math>[117 - 4(31.50)] \div 18 = -0.5</math> student tickets <math>\times</math></p> <p><b>OR</b></p> <p><b>Sample Explanation:</b>                      Since the price of a student ticket is a whole dollar amount (\$18.00), the only way Mr. Perkins could have spent \$117.00 (also a whole dollar amount) on tickets is if he purchased an even number of adult tickets (otherwise, the total amount would end in \$0.50). By purchasing 0 adult tickets, Mr. Perkins would have purchased <math>117 \div 18 = 6.5</math> student tickets; since the number of student tickets must be a whole number, this amount does not work. By purchasing 2 adult tickets, Mr. Perkins would have purchased <math>(117 - 31.50 \cdot 2) \div 18 = 3</math> student tickets; since the number of student tickets is a whole number, this amount works. By purchasing 4 (or more) adult tickets, Mr. Perkins would have spent \$126 (or more) on adult tickets; since \$126 is more than \$117, this amount does not work (so, any amount 4 or greater does not work). So the only way Mr. Perkins could have spent \$117.00 on tickets is if he purchased 2 adult tickets (and 3 student tickets).</p> <p><b>OR equivalent</b></p>

**Part C (1  $\frac{1}{2}$  points):**

$\frac{1}{2}$  point for correct answer

1 point for correct and complete explanation

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

What?	Why?
5 (prices)	<p><b>Sample Explanation:</b>                      Since Ms. Barkin spent \$31.50 for the ticket, she spent more than \$6.50 but less than \$11.50 on the nachos. For every increase in \$1, there is 1 possible price ending in \$0.25. So, from \$6.50 to \$11.50 (which is an increase of \$5) there is a total of 5 possible prices for nachos.</p> <p><b>OR equivalent</b></p>

## STUDENT RESPONSE

## Response Score: 4 points

17. A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Christine spent \$72.00 on student tickets.

A. How many student tickets did Christine purchase?

$$72/18 = 4 \text{ student tickets } \underline{\text{Ans.}}$$

Part A. The student provided the correct answer (4 student tickets). The work shown is correct, though not necessary for credit. The student divided the total amount spent on tickets by the price of each student ticket ( $72/18$ ). [1 point]

Mr. Perkins spent exactly \$117.00 on tickets.

B. How many adult tickets did Mr. Perkins purchase? Show or explain why there is only one possible answer.

Mr. Perkins bought 2 adult tickets. This is the only possible answer of a few reasons. First of all, Mr. Perkins spent a whole number of dollars on tickets, meaning that the number of adult tickets had to be an even number. Also, the most adult tickets that can be purchased with \$117 is 3 tickets, leaving me with two choices - 0 or 2 adult tickets. Since the price of a student ticket is an even number and the price of the total amount spent is an odd number, the number of adult tickets cannot be 0, and therefore the answer is 2 tickets.

Part B. The student provided the correct answer (2 adult tickets) with a correct and complete explanation as to why this is the only possible answer (Mr. Perkins spent a whole number of dollars on tickets, meaning that the number of adult tickets had to be an even number. Also, the most adult tickets that can be purchased with \$117 is 3 tickets. . . . Since the price of a student ticket is an even number and the price of the total amount spent is an odd number, the number of adult tickets cannot be 0, and therefore the answer is 2 tickets). [1.5 points]

Go to the next page to finish question 17.

GO ON 

17. **Continued.** Please refer to the previous page for task explanation.

Ms. Barkin purchased 1 adult ticket and spent some money on nachos. The price for the nachos ends in \$0.25. She spent more than \$38.00 but less than \$43.00 for the adult ticket and the nachos.

- C. How many prices are possible for the nachos? Explain how to determine this amount **without** listing all the possible prices for the nachos.

First, I know that an adult ticket costs \$31.50, so I subtracted that amount from 38 and 43 to get a range of \$6.50 to \$11.50. Then, I knew the prices have to end in \$0.25, so the range narrows to \$7.25 to \$11.25, giving me 5 possible prices (11-7+1).

Part C. The student provided the correct answer (5 possible prices) with a correct and complete explanation as to how many prices are possible for the nachos (an adult ticket costs \$31.50, so I subtracted that amount from 38 and 43 to get a range of \$6.50 to \$11.50. Then, I knew the prices have to end in \$0.25, so the range narrows to \$7.25 to \$11.25, giving me 5 possible prices). [1.5 points]

**After you have finished your work, close this booklet so your teacher will know you are finished.**



## STUDENT RESPONSE

Response Score: 3 points



## PARTS A and B

Question 17  
Page 1 of 2

A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Christine spent \$72.00 on student tickets.

A. How many student tickets did Christine purchase?

EQ

4

Mr. Perkins spent exactly \$117.00 on tickets.

B. How many adult tickets did Mr. Perkins purchase? Show or explain why there is only one possible answer.

EQ

He bought 2 adult tickets I got this awnser by multipling \$31.50 by 2 then added \$54 in kids tickets to find out he bought 2 adult tickets.

139 / 1000

Review/End Test Pause Flag Options Next

Part A. The student provided the correct answer (4). While support is not required for Part A, the student likely divided the total amount spent (\$72) by the price of each student ticket (\$18). [1 point]

Part B. The student provided the correct answer (2 adult tickets) with a correct but incomplete explanation as to why this is the only possible answer. The student multiplied the adult ticket price (\$31.50) by 2 and added the cost of 3 student tickets (\$54). The student did not provide a reason why no other numbers would work. [1 point]

## PART C

Question 17

Page 2 of 2



Item ID



A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Ms. Barkin purchased 1 adult ticket and spent some money on nachos. The price for the nachos ends in \$0.25. She spent more than \$38.00 but less than \$43.00 for the adult ticket and the nachos.

C. How many prices are possible for the nachos? Explain how to determine this amount **without** listing all the possible prices for the nachos.

EQ  
There are five possible prices for the nachos, you can find them by adding \$1 to the price of \$7.25, and you can go up to \$11.25.

129 / 1000

Review/End Test

Pause

Flag

Options

Back

Next

Part C. The student provided a correct answer (*five possible prices*) with a correct but incomplete explanation as to how many prices are possible for the nachos (*you can find them by adding \$1 to the price of \$7.25, and you can go up to \$11.25*). The student did not explain or show how the range from \$7.25 to \$11.25 was found. [1 point]

STUDENT RESPONSE

Response Score: 2 points

17. A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Christine spent \$72.00 on student tickets.

A. How many student tickets did Christine purchase?

Part A. The student provided the correct answer (4 student tickets). While support is not required for Part A, the student likely divided the total amount spent (\$72) by the price of each student ticket (\$18). [1 point]

4 Student tickets

Mr. Perkins spent exactly \$117.00 on tickets.

B. How many adult tickets did Mr. Perkins purchase? Show or explain why there is only one possible answer.

$$\begin{array}{r}
 \$31.50 \\
 \times \quad 2 \\
 \hline
 \$63.00
 \end{array}
 +
 \begin{array}{r}
 \$63.00 \\
 18.00 \\
 18.00 \\
 \hline
 \$99.00
 \end{array}
 +
 \begin{array}{r}
 99.00 \\
 +18.00 \\
 \hline
 \$117.00
 \end{array}$$

Mr. Perkins bought 2 adult tickets and 3 student tickets because if you bought more than two adult tickets you would have spent more.

Part B. The student provided the correct answer (2 adult tickets) with correct but incomplete support as to why this is the only possible answer. The student showed work determining a combination of tickets that would equal the total amount spent (\$117.00). The student did not show or explain why no other numbers would work. [1 point]

Go to the next page to finish question 17.



17. **Continued.** Please refer to the previous page for task explanation.

Ms. Barkin purchased 1 adult ticket and spent some money on nachos. The price for the nachos ends in \$0.25. She spent more than \$38.00 but less than \$43.00 for the adult ticket and the nachos.

- C. How many prices are possible for the nachos? Explain how to determine this amount **without** listing all the possible prices for the nachos.

There are 6 possible prices if  
you are counting the prices  
that it is between.

Part C. The student provided an incorrect answer (6 possible prices) with an incorrect explanation as to how many prices are possible for the nachos (you are counting the prices that it is between). [0 points]

After you have finished your work, close this booklet so your teacher will know you are finished.



## STUDENT RESPONSE

Response Score: 1 point



## PARTS A and B

Question 17 Page 1 of 2

Item ID

A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Christine spent \$72.00 on student tickets.

A. How many student tickets did Christine purchase?

$72 \div 18 = 4$   
She bought 4 tickets.

Mr. Perkins spent exactly \$117.00 on tickets.

B. How many adult tickets did Mr. Perkins purchase? Show or explain why there is only one possible answer.

$117 \div 31.50 = 3$   
he bought 3 tickets.

32 / 1000

Review/End Test Pause Flag Options Next

Part A. The student provided the correct answer (*She bought 4 tickets*). The work shown is correct, though not necessary for credit. The student divided the total amount spent on tickets by the price of each student ticket ( $72 \div 18 = 4$ ). [1 point]

Part B. The student provided an incorrect answer (*he bought 3 tickets*) with incorrect support ( $117 \div 31.50 = 3$ ). Since \$31.50 does not divide evenly into \$117, this support and answer are incorrect and do not earn any credit. [0 points]

## PART C

Question 17

Page 2 of 2



Item ID



A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Ms. Barkin purchased 1 adult ticket and spent some money on nachos. The price for the nachos ends in \$0.25. She spent more than \$38.00 but less than \$43.00 for the adult ticket and the nachos.

C. How many prices are possible for the nachos? Explain how to determine this amount **without** listing all the possible prices for the nachos.

EQ

You could subtract 31.50 from 38 to see how much money is left.

63 / 1000

Review/End Test

Pause

Flag

Options

Back

Next

Part C. The student did not provide an answer but did provide a correct but incomplete explanation as to how many prices are possible for the nachos (*You could subtract 31.50 from 38 to see how much money is left*). This could be a correct first step to finding the answer by subtracting the price of an adult ticket from \$38.00 to find the lower end of the range for the price of nachos. [0.5 points]

## STUDENT RESPONSE

## Response Score: 0 points

17. A baseball game has two different ticket prices.

- The price of each student ticket is \$18.00.
- The price of each adult ticket is \$31.50.

Christine spent \$72.00 on student tickets.

A. How many student tickets did Christine purchase?

54

$$72.00 - 18.00 = 54$$

Part A. The student provided an incorrect answer (54). Though support (work or explanation) is not required, the work shows the student subtracted 18.00 from 72.00 rather than dividing 72 by 18. [0 points]

Mr. Perkins spent exactly \$117.00 on tickets.

B. How many adult tickets did Mr. Perkins purchase? Show or explain why there is only one possible answer.

$$117.00 - 31.50 = 85\frac{1}{2}$$

Part B. The student provided an incorrect answer ( $85\frac{1}{2}$ ) with incorrect support ( $117.00 - 31.50 = 85\frac{1}{2}$ ). The student showed how much money is remaining from \$117.00 after purchasing one adult ticket rather than showing or explaining why there is only one possible answer for how many adult tickets Mr. Perkins purchased. [0 points]

Go to the next page to finish question 17.



17. **Continued.** Please refer to the previous page for task explanation.

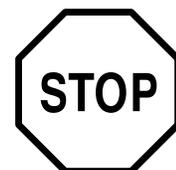
Ms. Barkin purchased 1 adult ticket and spent some money on nachos. The price for the nachos ends in \$0.25. She spent more than \$38.00 but less than \$43.00 for the adult ticket and the nachos.

- C. How many prices are possible for the nachos? Explain how to determine this amount **without** listing all the possible prices for the nachos.

39.00

Part C. The student provided an incorrect answer (39.00) with no work or explanation provided, so it is unclear where an error was made. [0 points]

**After you have finished your work, close this booklet so your teacher will know you are finished.**



**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.2.1.1	D	1	3%	11%	6%	80%
2	A-R.1.1	C	2	12%	18%	57%	13%
3	A-R.1.1.2	D	2	34%	5%	4%	57%
4	A-R.1.1.5 A-R.1.1.1	C	2	11%	23%	45%	21%
5	B-E.1.1.1	D	1	13%	12%	11%	64%
6	B-E.1.1.4	D	1	11%	10%	27%	52%
7	B-E.2.1.1	D	1	7%	14%	12%	67%
8	B-E.2.1.4	B	2	13%	60%	17%	10%
9	B-E.3.1.1	A	2	57%	11%	13%	19%
10	B-E.3.1.2	B	2	13%	70%	9%	8%
11	C-G.1.1	D	2	31%	18%	15%	36%
12	C-G.1.1.2	D	2	18%	18%	15%	49%
13	C-G.1.1.4	A	2	52%	23%	19%	6%
14	C-G.1.1.5	A	2	48%	21%	19%	12%
15	D-S.1.1.1	D	2	30%	13%	9%	48%
16	D-S.1.1.3	C	2	11%	7%	62%	20%

**Open-Ended**

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	B-E.2.1	4	3	1.15



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

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