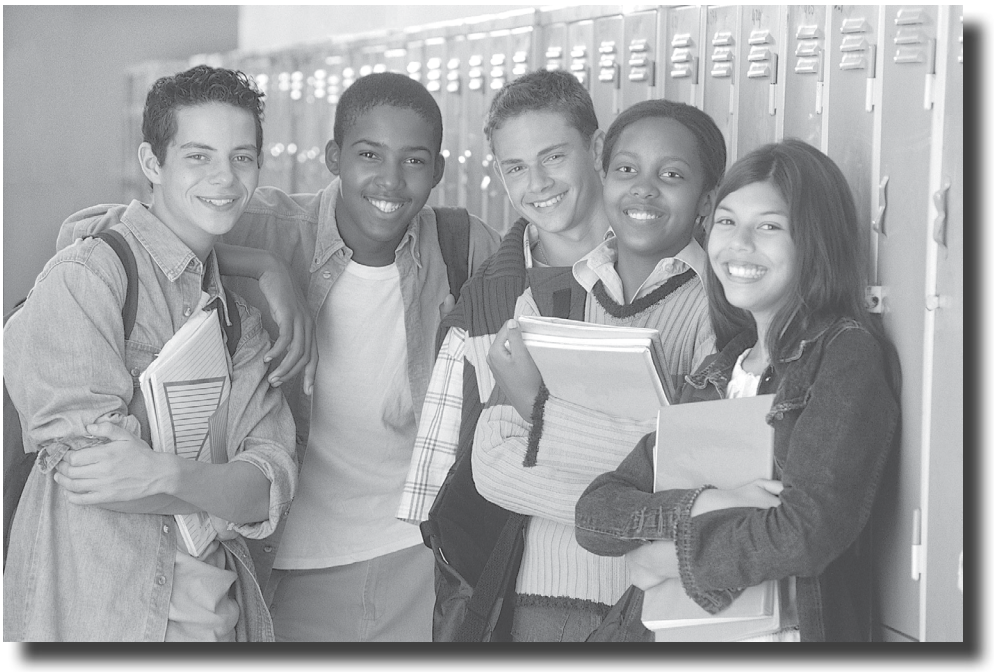
pennsylvania
DEPARTMENT OF EDUCATION

The Pennsylvania System of School Assessment

Mathematics
Item and Scoring Sampler



2024–2025
Grade 8

Pennsylvania Department of Education Bureau of Curriculum, Assessment and Instruction—August 2024

TABLE OF CONTENTS

INFORMATION ABOUT MATHEMATICS

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 and Scoring 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 Item and Scoring 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* [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 Item and Scoring 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 Item and Scoring Sampler may be used[1] 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 Item and Scoring Sampler. Educators may then use the Item and Scoring Sampler as a guide to score the responses either independently or together with colleagues within a school or district. This Item and Scoring 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 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 in mathematics is scored using an item-specific scoring guideline based on a 0–4-point scale. In this Item and Scoring 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.

[1] The permission to copy and/or use these materials does not extend to commercial purposes.

Testing Time and Mode of Test 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 estimated response time for each item type is listed below.

- **Multiple-Choice:** 2 minutes
- **Open-Ended:** 10 to 15 minutes

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
- 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 8.

- A–N = The Number System
- B–E = Expressions and Equations
- B–F = Functions
- C–G = Geometry
- D–S = Statistics and Probability

Examples of MC and OE items assessing these categories are included in this Item and Scoring Sampler.

Item and Scoring Sampler Format

This Item and Scoring 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[2] 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 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. 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

Category	Item-Specific 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

Category	Item-Specific Information
Alignment	Assigned AAEC
Depth of Knowledge	Assigned DOK
Mean Score	Average Score

[2] All *p*-value percentages listed in the item information tables have been rounded.

General Description of Scoring Guidelines for Mathematics Open-Ended Questions

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. 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

Grade 8 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.
You may use calculator π or the number 3.14 as an approximation of π.

2024
Grade 8

Exponential Properties

$a^m \cdot a^n = a^{m+n}$

$(a^m)^n = a^{m \cdot n}$

$\frac{a^m}{a^n} = a^{m-n}$

$a^{-n} = \frac{1}{a^n}$

Algebraic Equations

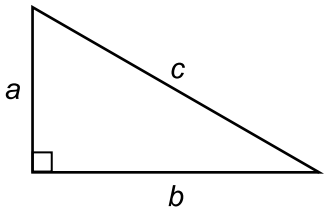
Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Standard Form: $Ax + By = C$

Pythagorean Theorem

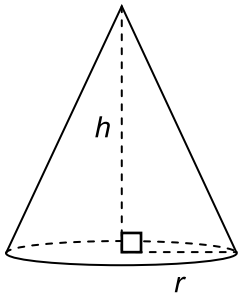


$a^2 + b^2 = c^2$

Distance Formula

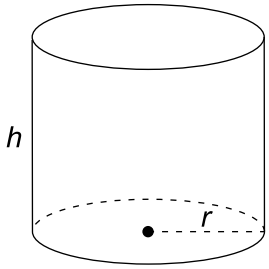
$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Cone



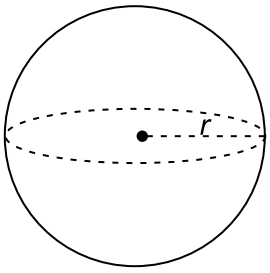
$V = \frac{1}{3}\pi r^2 h$

Cylinder



$V = \pi r^2 h$

Sphere



$V = \frac{4}{3}\pi r^3$

PSSA MATHEMATICS GRADE 8

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 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 asks you to explain, be sure to use words to 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 Item and Scoring Sampler is to be solved without the use of a calculator.

Multiple-Choice Items

1. The speed of sound is approximately 3×10^2 meters per second. The speed of light is approximately 3×10^8 meters per second. The speed of light is approximately how many times as fast as the speed of sound?

Ⓐ 1,000,000

Ⓑ 3,000,000

Ⓒ 10,000,000,000

Ⓓ 30,000,000,000

Category	Item-Specific Information
Alignment	B-E.1.1.3
Answer Key	A
Depth of Knowledge	1
p-value A	42% (correct answer)
p-value B	28%
p-value C	15%
p-value D	15%
Option Annotations	A. Correct: divides 3×10^8 by 3×10^2 by dividing the coefficients as $\frac{3}{3}$ = 1 and the powers of 10 as $\frac{10^8}{10^2}=10^{8-2}=10^6$, which results in a quotient of 1×10^6, and then converts the quotient to standard form by moving the decimal point in 1.0 to the right 6 places B. divides the powers of 10 as $\frac{10^8}{10^2}=10^{8-2}=10^6$ but then uses the common coefficient (3), resulting in a quotient of 3×10^6, and then converts to standard form C. divides the coefficients as $\frac{3}{3}$ = 1 but then divides the powers of 10 by adding the exponents $\left(\frac{10^8}{10^2}=10^{8+2}=10^{10}\right)$, resulting in a quotient of 1×10^{10}, and then converts to standard form D. uses the common coefficient (3) and divides the powers of 10 by adding the exponents $\left(\frac{10^8}{10^2}=10^{8+2}=10^{10}\right)$, resulting in a quotient of 3×10^{10}, and then converts to standard form

A calculator is permitted for use in solving questions 2–17 in this Item and Scoring Sampler.

2. Which pair has one rational number and one irrational number?

Ⓐ $\sqrt{0}$ $\sqrt{9}$

Ⓑ $\sqrt{4}$ $\sqrt{5}$

Ⓒ $\sqrt{3}$ $\sqrt{6}$

Ⓓ $\sqrt{4}$ $\sqrt{9}$

Category	Item-Specific Information
Alignment	A-N.1.1.1
Answer Key	B
Depth of Knowledge	1
p-value A	20%
p-value B	57% (correct answer)
p-value C	12%
p-value D	11%
Option Annotations	A. considers $\sqrt{0}$ to be irrational (may have confused $\sqrt{0}$ with "dividing by 0") B. Correct: recognizes that $\sqrt{4}$ is a rational number since $\sqrt{4}$ simplifies to 2 because $4 = 2^2$ and recognizes that $\sqrt{5}$ is an irrational number since $\sqrt{5}$ cannot be simplified to a rational number because there is no whole number that when squared equals 5 C. considers $\sqrt{6}$ to be rational by identifying 6 as a composite number but does not recognize that the prime factors of 6 are 2 and 3 (i.e., $6 = 2 \cdot 3$), which means $\sqrt{6}$ cannot be simplified to a rational number since the prime factors do not have even exponents (2 and 3 have exponents of 1) D. does not recognize that $\sqrt{4}$ simplifies to 2 and that $\sqrt{9}$ simplifies to 3, which makes both numbers rational

3. To determine the width, in units, of a rectangle, Jamal uses a calculator to divide the area of the rectangle by its length. The result on the calculator is shown below.

3.188888889

Which value is **most likely** the exact width, in units, of the rectangle?

Ⓐ $3\frac{17}{99}$

Ⓑ $3\frac{17}{90}$

Ⓒ $3\frac{19}{99}$

Ⓓ $3\frac{18}{90}$

Category	Item-Specific Information
Alignment	A-N.1.1.2
Answer Key	B
Depth of Knowledge	1
p-value A	11%
p-value B	54% (correct answer)
p-value C	17%
p-value D	18%
Option Annotations	A. begins with the fraction $\frac{18}{100}$ and then subtracts 1 from the numerator and from the denominator B. Correct: recognizes that 3.188888889 on a calculator represents the repeating decimal number $3.1\overline{8}$ and then either represents $3.1\overline{8}$ as $3 + 0.1 + 0.0\overline{8}$, converts 0.1 to $\frac{1}{10}$, and converts $0.0\overline{8}$ as $0.0\overline{8} = 0.1 \cdot 0.\overline{8} = \frac{1}{10} \cdot \frac{8}{9} = \frac{8}{90}$, resulting in $3.1\overline{8} = 3 + 0.1 + 0.0\overline{8} = 3 + \frac{1}{10} + \frac{8}{90} = 3 + \frac{9}{90} + \frac{8}{90} = 3 + \frac{17}{90} = 3\frac{17}{90}$ OR writes the equation $x = 3.1\overline{8}$, $10x = 31.8\overline{8}$, and $100x = 318.8\overline{8}$, and subtracts $10x = 31.8\overline{8}$ from $100x = 318.8\overline{8}$, resulting in a difference of $90x = 287$, and then solves for x by dividing both sides by 90, resulting in $x = \frac{287}{90} = 3\frac{17}{90}$ C. uses the non-repeating decimal digits (1 and 9) to create a fraction using 99 as the denominator D. uses the 18 as if it were the repeating decimal digits and uses 90 rather than 99 as the denominator

4. Which set of statements correctly describes how to compare the values of $5\sqrt{7}$ and $7\sqrt{5}$?

Ⓐ $5\sqrt{7} \approx 17.5$
$7\sqrt{5} \approx 5.9$
$5\sqrt{7} > 7\sqrt{5}$

Ⓑ $5\sqrt{7} \approx 7.6$
$7\sqrt{5} \approx 5.9$
$5\sqrt{7} > 7\sqrt{5}$

Ⓒ $5\sqrt{7} \approx 13.2$
$7\sqrt{5} \approx 17.5$
$5\sqrt{7} < 7\sqrt{5}$

Ⓓ $5\sqrt{7} \approx 13.2$
$7\sqrt{5} \approx 15.7$
$5\sqrt{7} < 7\sqrt{5}$

Category	Item-Specific Information
Alignment	A-N.1.1.4
Answer Key	D
Depth of Knowledge	2
p-value A	12%
p-value B	12%
p-value C	14%
p-value D	62% (correct answer)
Option Annotations	A. calculates $5\sqrt{7}$ as $5 \cdot \frac{7}{2}$ and $7\sqrt{5}$ as $\sqrt{7 \cdot 5}$ B. calculates $5\sqrt{7}$ as $5 + \sqrt{7}$ and $7\sqrt{5}$ as $\sqrt{7 \cdot 5}$ C. calculates $5\sqrt{7}$ as $5 \cdot \sqrt{7}$ but then calculates $7\sqrt{5}$ as $7 \cdot \frac{5}{2}$ D. Correct: calculates $5\sqrt{7}$ as $5 \cdot \sqrt{7}$, resulting in the product 13.22875 . . ., calculates $7\sqrt{5}$ as $7 \cdot \sqrt{5}$, resulting in the product 15.65247 . . ., and then uses these values to compare the two expressions

5. A computer monitor uses square pixels to display an image. The expression shown below represents the approximate area, in square inches, of one pixel on the computer monitor.

$$(1.04 \times 10^{-2})^2$$

What is the approximate area, in square inches, of one pixel on the computer monitor?

Ⓐ 1.0816×10^{-4}

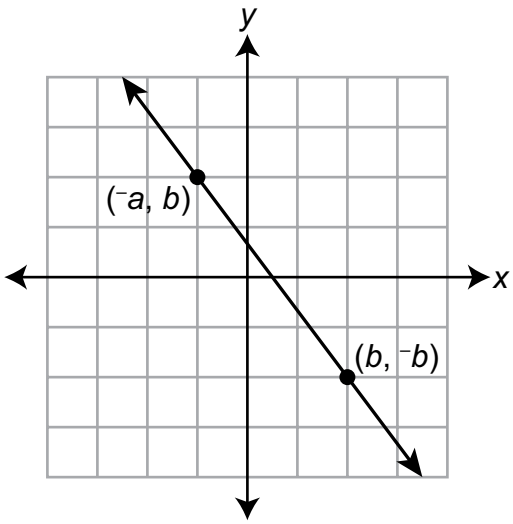
Ⓑ 1.0816×10^{-2}

Ⓒ 1.0816×10^{0}

Ⓓ 1.0816×10^{4}

Category	Item-Specific Information
Alignment	B-E.1.1.4
Answer Key	A
Depth of Knowledge	1
p-value A	60% (correct answer)
p-value B	12%
p-value C	17%
p-value D	11%
Option Annotations	A. Correct: recognizes that the expression $\left(1.04 \times 10^{-2}\right)^2$ can be represented as $\left(1.04 \times 10^{-2}\right)\left(1.04 \times 10^{-2}\right) = 1.04^2 \times \left(10^{-2}\right)^2$, squares the 1.04, resulting in 1.0816, and then applies the exponential property $\left(a^m\right)^n = a^{m \cdot n}$ to simplify $\left(10^{-2}\right)^2$ as $10^{-2 \cdot 2}$, resulting in 10^{-4} B. squares only the 1.04 C. squares the 1.04 but adds the exponents when simplifying $\left(10^{-2}\right)^2$ D. squares the 1.04 but squares the exponent ⁻2 when simplifying $\left(10^{-2}\right)^2$

6. A line on a coordinate grid is shown below.



Which equation can be used to determine the slope (m) of the line?

Ⓐ $m = \dfrac{{}^{-}a - b}{{}^{-}b - b}$

Ⓑ $m = \dfrac{{}^{-}b - b}{{}^{-}a - b}$

Ⓒ $m = \dfrac{b - {}^{-}a}{{}^{-}b - b}$

Ⓓ $m = \dfrac{{}^{-}b - b}{b - {}^{-}a}$

Category	Item-Specific Information
Alignment	B-E.2.1
Answer Key	D
Depth of Knowledge	1
p-value A	27%
p-value B	17%
p-value C	16%
p-value D	40% (correct answer)
Option Annotations	A. uses the reciprocal of the slope and reverses the order of the difference in the numerator B. reverses the order of the difference in the denominator C. uses the reciprocal of the slope D. Correct: applies the slope formula $m = \frac{y_2 \quad y_1}{x_2 \quad x_1}$, using $\left(^{-}a, b\right)$ for (x_1, y_1) and $\left(b, ^{-}b\right)$ for (x_2, y_2) by substituting ^{-}b for y_2, b for y_1, b for x_2, and ^{-}a for x_1

7. Information about the costs of apples at an orchard is listed below.

- The cost of apples is $1.00 per pound when picked by an employee.
- The equation $t = 0.85n$ describes the relationship between the total cost (t), in dollars, and the number of pounds of apples (n) when picked by a customer.

An employee and a customer both pick some apples. The employee and the customer each picked $34.00 worth of apples. How many more pounds of apples did the customer pick than the employee picked?

Ⓐ 5.1

Ⓑ 6.0

Ⓒ 40.0

Ⓓ 62.9

Category	Item-Specific Information
Alignment	B-E.2.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	16%
p-value B	45% (correct answer)
p-value C	32%
p-value D	7%
Option Annotations	A. determines that the employee picked 34 pounds of apples since the cost is $1.00 per pound of apples but then determines that the customer picked 28.9 pounds of apples by substituting 34.00 for n (rather than for t) into the equation $t = 0.85n$, resulting in $t = 0.85(34.00) = 28.90$, and then finds the difference between the two amounts picked ($34 - 28.9 = 5.1$) B. Correct: determines that the employee picked 34 pounds of apples since the cost is $1.00 per pound of apples, determines that the customer picked 40 pounds of apples by substituting 34.00 for t into the equation $t = 0.85n$, resulting in $34.00 = 0.85n$, and dividing both sides of the equation by 0.85, resulting in $40 = n$, and then finds the difference between the two amounts picked ($40 - 34 = 6$) C. substitutes 34.00 for t into the equation $t = 0.85n$, resulting in $34.00 = 0.85n$, and then solves the equation for n by dividing both sides of the equation by 0.85, resulting in 40 pounds of apples picked by the customer, but does not consider the pounds of apples picked by the employee D. adds the two costs, resulting in $1 + 0.85 = 1.85$, and then multiplies the sum by 34.00

8. Mr. Klavier rents out two different studio spaces to bands. The equations shown below represent the total cost (y), in dollars, to rent each studio for x hours.

large studio: $y = 80x + 40$

small studio: $y = 60x + 60$

Based on the system of equations, which statement about the rental costs is correct?

Ⓐ There is no length of time at which the rental cost for the large studio is equal to the rental cost for the small studio since the graph consists of two curves that never intersect.

Ⓑ There is no length of time at which the rental cost for the large studio is equal to the rental cost for the small studio since the graph consists of two straight lines that never intersect.

Ⓒ There is a length of time at which the rental cost for the large studio is equal to the rental cost for the small studio since the graph consists of two curves that intersect at two points.

Ⓓ There is a length of time at which the rental cost for the large studio is equal to the rental cost for the small studio since the graph consists of two straight lines that intersect at a single point.

Category	Item-Specific Information
Alignment	B-E.3.1.3
Answer Key	D
Depth of Knowledge	2
p-value A	13%
p-value B	23%
p-value C	19%
p-value D	45% (correct answer)
Option Annotations	A. recognizes that the equations are not equivalent because the *y*-intercepts are not equal (40 ≠ 60) but thinks that each equation can be represented by a curve rather than a line and that the curves are "parallel" since 80 + 40 = 60 + 60 B. recognizes that each equation can be represented by a line and that the lines are not collinear since the *y*-intercepts are not equal (40 ≠ 60) but thinks that the lines are parallel since 80 + 40 = 60 + 60 C. thinks that each equation can be represented by a curve rather than a line, which would make two points of intersection possible D. Correct: recognizes that each equation can be represented by a line since 80*x* and 60*x* both represent constant rates of change (80 and 60 are the rates of change, and the *x* indicates the rate of change is constant because the exponent for the *x* variable is 1) and recognizes that the lines will have a single point of intersection since the rates of change are not equal (80 ≠ 60)

9. The Rodriguez family buys 4 student tickets and 2 adult tickets to the school play for a total of $22. The Delgado family buys 2 student tickets and 3 adult tickets for a total of $21. What is the price of an adult ticket to the school play?

Ⓐ $3

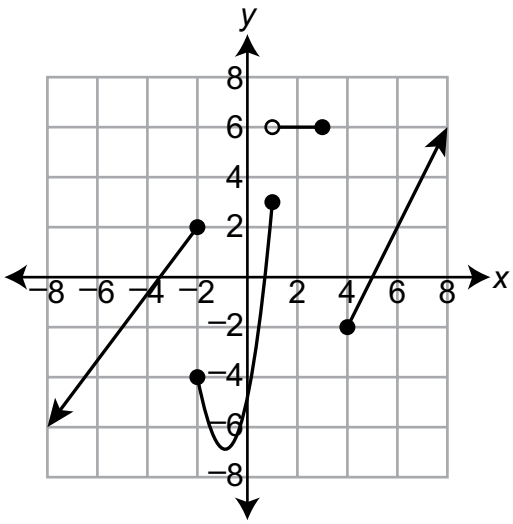
Ⓑ $5

Ⓒ $7

Ⓓ $8

Category	Item-Specific Information
Alignment	B-E.3.1.5
Answer Key	B
Depth of Knowledge	2
p-value A	15%
p-value B	58% (correct answer)
p-value C	18%
p-value D	9%
Option Annotations	A. solves the system of equations $4x + 2y = 22$ and $2x + 3y = 21$ for x, resulting in $x = 3$, but misinterprets this solution as the price of an adult ticket rather than the price of a student ticket (i.e., did not define the variables x and y prior to writing the system of equations) B. Correct: writes the equation for the Rodriguez family as $4s + 2a = 22$, writes the equation for the Delgado family as $2s + 3a = 21$, and then solves the system of two equations either by multiplying both sides of the second equation by 2, resulting in $4s + 6a = 42$, subtracting the first equation from the second equation, resulting in $4a = 20$, and then dividing each side of the equation by 4, resulting in $a = 5$ OR by multiplying both sides of the first equation by $\frac{1}{2}$, resulting in $2s + 1a = 11$, subtracting the first equation from the second equation, resulting in $2a = 10$, and then dividing each side of the equation by 2, resulting in $a = 5$ C. writes the system of equations as $4s + 2a = 22$ and $2s + 3a = 21$, multiplies both sides of the second equation by 2, resulting in $4s + 6a = 42$, but then eliminates the $4s$ terms and uses only the remaining part of the second equation, resulting in $6a = 42$, and then divides each side of the equation by 6, resulting in $a = 7$ D. writes the system of equations as $4s + 2a = 22$ and $2s + 3a = 21$, multiplies both sides of the second equation by 2, resulting in $4s + 6a = 42$, but then combines the two equations by eliminating the $4s$ terms and adding the remaining terms of the equations, resulting in $8a = 64$, and then divides each side of the equation by 8, resulting in $a = 8$

10. A relation is shown on the graph below.



Which statement explains why this relation is **not** a function?

Ⓐ At $x = -2$, the relation has two closed points.

Ⓑ Between $x = -2$ and $x = 1$, the relation is not a straight line.

Ⓒ At $x = 1$, the relation has a closed point and an open point.

Ⓓ Between $x = 3$ and $x = 4$, the relation has no values.

Category	Item-Specific Information
Alignment	B-F.1.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	31% (correct answer)
p-value B	30%
p-value C	21%
p-value D	18%
Option Annotations	A. Correct: either recognizes that a relation cannot be a function if there are two or more distinct *y*-values for any given *x*-value and that the two closed points at $x = -2$ represent two distinct *y*-values (2 and -4) OR uses the vertical line test and identifies two distinct points for the vertical line at $x = -2$, resulting in a failure of the vertical line test B. considers that functions can be represented only by straight lines and notices that the relation is represented by a curved segment between $x = -2$ and $x = 1$ C. recognizes that a relation cannot be a function if there are two or more distinct *y*-values for any given *x*-value but does not realize that the open point at (1, 6) does not represent an actual value for $x = 1$ and that the open point only indicates that the line segment extends to the right of (1, 6) D. considers that functions must be continuous for all *x*-values and notices a gap in the relation between $x = 3$ and $x = 4$

11. Which equation is a linear function?

Ⓐ $y = \frac{65}{1.2x}$

Ⓑ $y = \frac{1.2}{x} + 65$

Ⓒ $y = 65 + 1.2x$

Ⓓ $y = 1.2x^2 + 65$

Category	Item-Specific Information
Alignment	B-F.1.1.3
Answer Key	C
Depth of Knowledge	2
p-value A	15%
p-value B	15%
p-value C	50% (correct answer)
p-value D	20%
Option Annotations	A. considers any equation with no *y*-intercept to represent a proportional relationship and is therefore a linear function B. selects an equation that appears to be in the form $y = mx + b$ but does not consider that the *x*-variable is in the denominator C. Correct: recognizes that the equation can be written in the form $y = mx + b$, with $m = 1.2$ and $b = 65$ D. selects an equation that appears to be in the form $y = mx + b$ but does not consider the exponent of the *x*-variable

12. A library charges a flat fee of $0.50 for keeping a book past its due date. The library also charges $0.15 for each day the book is overdue. The table shown below represents some of the library's fees.

Library Overdue Fees

Days Overdue	Total Fee
1	$0.65
2	?
3	$0.95

What is the total fee when a library book is 2 days overdue?

Ⓐ $0.70

Ⓑ $0.75

Ⓒ $0.80

Ⓓ $0.90

Category	Item-Specific Information
Alignment	B-F.2.1
Answer Key	C
Depth of Knowledge	2
p-value A	4%
p-value B	14%
p-value C	79% (correct answer)
p-value D	3%
Option Annotations	A. uses \$0.05 rather than \$0.15 and adds \$0.05 to the 1-day overdue fee (\$0.65) B. adds \$0.10 to the 1-day overdue fee (\$0.65) since the change in the number of days was 1 C. Correct: uses the description "charges a flat fee of \$0.50 . . . [and] \$0.15 for each day" to write the equation $y = 0.50 + 0.15x$ and then substitutes 2 for x into the equation, resulting in $y = 0.50 + 0.15(2) = 0.50 + 0.30 = 0.80$ OR uses the table and finds the midpoint between \$0.65 and \$0.95 (\$0.65 + \$0.95 = \$1.60, \$1.60 ÷ 2 = \$0.80) since 2 days overdue is the midpoint between 1 day overdue and 3 days overdue OR uses the description "charges \$0.15 for each day" along with the table and adds \$0.15 to the 1-day overdue fee (\$0.65) D. uses \$0.05 rather than \$0.15 and subtracts \$0.05 from the 3-day overdue fee (\$0.95)

13. A science experiment requires students to find the mass of a bucket with different numbers of pennies in it. The table below shows the total masses, in grams, of the bucket with different numbers of pennies in the bucket.

Penny Experiment

Number of Pennies	Total Mass (grams)
1	252.5
3	257.5
4	260
6	265
9	272.5

Which equation represents the relationship between the total mass (y), in grams, of the bucket and the number of pennies (x) in the bucket?

Ⓐ $y = 2.5x$

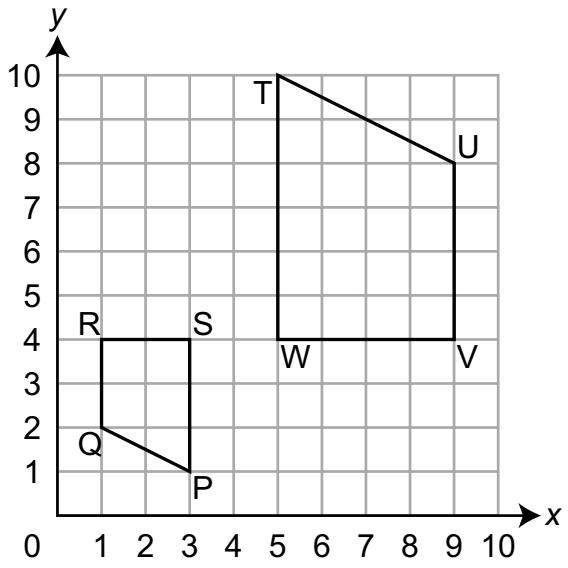
Ⓑ $y = 2.5x + 250$

Ⓒ $y = 250x$

Ⓓ $y = 250x + 2.5$

Category	Item-Specific Information
Alignment	B-F.2.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	18%
p-value B	54% (correct answer)
p-value C	11%
p-value D	17%
Option Annotations	A. calculates the rate of change by using the change in total mass for any two rows divided by the change in the number of pennies for the same two rows $\left(\text{e.g., } \frac{257.5-252.5}{3-1}=\frac{5}{2}=2.5\right)$ but does not include the *y*-intercept B. Correct: calculates the rate of change by using the change in total mass for any two rows divided by the change in the number of pennies for the same two rows $\left(\text{e.g., } \frac{260-257.5}{4-3}=\frac{2.5}{1}=2.5\right)$ and then determines the *y*-intercept by subtracting the rate of change from the total mass for 1 penny (252.5 − 2.5 = 250) C. uses the *y*-intercept as the rate of change and does not include a *y*-intercept D. switches the *y*-intercept and rate of change

14. Trapezoid PQRS and trapezoid TUVW are graphed on the coordinate grid shown below.



Which series of two transformations can be used to map trapezoid PQRS onto trapezoid TUVW?

Ⓐ a rotation of 180° centered at (4, 4)
a dilation with a scale factor of 2 centered at (5, 4)

Ⓑ a rotation of 180° centered at (4, 4)
a dilation with a scale factor of 2 centered at the origin

Ⓒ a rotation of 180° centered at the origin
a dilation with a scale factor of 2 centered at (5, 4)

Ⓓ a rotation of 180° centered at the origin
a dilation with a scale factor of 2 centered at the origin

Category	Item-Specific Information
Alignment	C-G.1.1.4
Answer Key	A
Depth of Knowledge	2
p-value A	41% (correct answer)
p-value B	20%
p-value C	25%
p-value D	14%
Option Annotations	A. Correct: recognizes that to orient trapezoid PQRS in the same direction as trapezoid TUVW, a rotation of 180° must occur and that the rotation should be centered at $(4, 4)$ to move point S from $(3, 4)$ to $(5, 4)$, which is the location of point W, and this would result in point P rotating from $(3, 1)$ to $(5, 7)$, point Q rotating from $(1, 2)$ to $(7, 6)$, and point R rotating from $(1, 4)$ to $(7, 4)$, and then recognizes that, to increase the size of trapezoid PQRS to match the size of trapezoid TUVW, a dilation with a scale factor of 2 must occur and that the dilation should be centered at $(5, 4)$ to keep the rotated point S on point W, and this would result in moving the rotated point P from $(5, 7)$ to $(5, 10)$, which is the location of point T, moving the rotated point Q from $(7, 6)$ to $(9, 8)$, which is the location of point U, and moving the rotated point R from $(7, 4)$ to $(9, 4)$, which is the location of point V B. considers that all dilations must be centered at the origin C. considers that all rotations must be centered at the origin D. considers that all rotations and all dilations must be centered at the origin *Note: On future assessments, centers of dilation will be limited to the origin and centers of rotation will be limited to the origin or a vertex on the original figure.*

15. The lengths of the two legs of a right triangle are 4 centimeters and 8 centimeters. The length (h), in centimeters, of the hypotenuse of the right triangle can be determined using the equation shown below.

$$4^2 + 8^2 = h^2$$

What is the length, in centimeters, of the hypotenuse of the right triangle?

Ⓐ $\sqrt{12}$

Ⓑ $\sqrt{32}$

Ⓒ $\sqrt{40}$

Ⓓ $\sqrt{80}$

Category	Item-Specific Information
Alignment	C-G.2.1.2
Answer Key	D
Depth of Knowledge	1
p-value A	11%
p-value B	11%
p-value C	9%
p-value D	69% (correct answer)
Option Annotations	A. adds 4 and 8 without applying the exponents, resulting in the equation 12 = h^2, and then takes the square root of both sides of the equation to remove the exponent of 2 from h^2 B. multiplies 4 and 8 without applying the exponents, resulting in the equation 32 = h^2, and then takes the square root of both sides of the equation to remove the exponent of 2 from h C. determines that 4^2 = 16 and 8^2 = 64, adds 16 and 64, resulting in the equation 80 = h^2, but then divides 80 by 2 before taking the square root of both sides of the equation to remove the exponent of 2 from h^2 D. Correct: determines that 4^2 = 16 and 8^2 = 64, adds 16 and 64, resulting in the equation 80 = h^2, and then takes the square root of both sides of the equation to remove the exponent of 2 from h^2

16. An artist has a piece of wood in the shape of a cylinder. It has a height of 36 inches and a diameter of 8 inches. The artist cuts the piece of wood into 6 equal-sized pieces. Which measurement is **closest** to the volume of each piece?

Ⓐ 201 cubic inches

Ⓑ 301 cubic inches

Ⓒ 1,206 cubic inches

Ⓓ 1,356 cubic inches

Category	Item-Specific Information
Alignment	C-G.3.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	15%
p-value B	58% (correct answer)
p-value C	16%
p-value D	11%
Option Annotations	A. divides the diameter by 6 rather than 2, resulting in a quotient of $\frac{4}{3}$, and applies the volume formula for a cylinder as $V = \pi \cdot \left(\frac{4}{3}\right)^2 \cdot 36 = 64\pi$, which can be approximated using $64 \cdot 3.14 = 200.96$ B. Correct: divides the diameter (8) by 2 to determine the radius, resulting in a radius of 4, applies the volume formula for a cylinder ($V = \pi r^2 h$), using $r = 4$ and $h = 36$ to write the equation $V = \pi \cdot 4^2 \cdot 36$, which can be simplified as $V = \pi \cdot 16 \cdot 36 = 576\pi$, and then divides the volume by 6, resulting in a quotient of 96π, which can be approximated using $96 \cdot 3.14 = 301.44$ C. uses d^2 rather than r^2 to apply the volume formula for a cylinder as $V = \pi \cdot (8)^2 \cdot 36 = 2{,}304\pi$, and then divides the volume by 6, resulting in a quotient of 384π, which can be approximated using $384 \cdot 3.14 = 1{,}205.76$ D. uses $\left(\frac{h}{2}\right)^2 \cdot d$ rather than $\left(\frac{d}{2}\right)^2 \cdot h$ to apply the volume formula for a cylinder as $V = \pi \cdot \left(\frac{36}{2}\right)^2 \cdot 8 = 2{,}592\pi$, and then divides the volume by 6, resulting in a quotient of 432π, which can be approximated using $432 \cdot 3.14 = 1{,}356.48$

Open-Ended Item

17. A quiz competition was held for grade 7 and grade 8 students. In the first round, each of the 150 contestants was given a quiz. Contestants advanced to the second round if they answered enough questions correctly. The tables below show some information about the 150 contestants in the competition as well as some information about the grade 8 students who competed.

Quiz Competition Contestants

	Grade 7	Grade 8
Advanced to Second Round	44	44
Did Not Advance to Second Round	33	29

Grade 8 Quiz Competition Contestants

	Male	Female
Advanced to Second Round	20	24
Did Not Advance to Second Round	?	12

A. How many grade 8 male students did **not** advance to the second round?

A grade 8 female student who competed is randomly selected.

B. What is the probability that the randomly selected student advanced to the second round?

Go to the next page to finish question 17.

GO ON

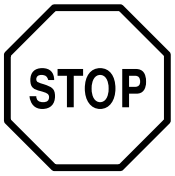
17. ***Continued.*** Please refer to the previous page for task explanation.

One of the 150 students who competed is randomly selected.

C. Explain why the randomly selected student **most likely** advanced to the second round.

D. Explain why a grade 7 student is less likely to have advanced to the second round than a grade 8 student even though the same number of grade 7 students advanced to the second round as grade 8 students.

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



Item-Specific Scoring Guideline

#17 Item Information

Category	Item-Specific Information
Alignment	D-S.1.2.1
Depth of Knowledge	2
Mean Score	1.45

Assessment Anchor this item will be reported under:

M08.D-S.1 Investigate patterns of association in bivariate data.

Specific Anchor Descriptor addressed by this item:

M08.D-S.1.2 Understand that patterns of association can be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.

Item-Specific Scoring Guideline

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of how to investigate patterns of association in bivariate data by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of how to investigate patterns of association in bivariate data by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of how to investigate patterns of association in bivariate data by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of how to investigate patterns of association in bivariate data.
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.
1	Student earns 0.5–1.5 points. OR Student demonstrates minimal understanding of how to investigate patterns of association in bivariate data.
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?

17 (male students)

Part B (1 point):

1 point for correct answer

What?

24/36 **OR** 2/3

OR equivalent

Part C (1 point):

1 point for correct and complete explanation

OR 1/2 point for correct but incomplete explanation

Why?

Sample Explanation:

The student most likely advanced to the second round because more than half the students who competed advanced to the second round (88 out of 150).

OR equivalent

Part D (1 point):

1 point for correct and complete explanation

OR 1/2 point for correct but incomplete explanation

Why?

Sample Explanations:

Even though the same number of grade 7 students advanced to the second round as grade 8 students, a grade 7 student is less likely to advance to the second round than a grade 8 student because more grade 7 students participated in the competition than grade 8 students.

OR

The probability a grade 7 student advanced to the second round is 44/77. The probability a grade 8 student advanced to the second round is 44/73. Since 44/77 is less than 44/73, a grade 7 student is less likely to advance to the second round than a grade 8 student.

OR

When comparing the probabilities, you have to use both the numerator and the denominator. Since the numerators are the same, the probability with the larger denominator represents a student who is less likely to advance to the second round. So a grade 7 student is less likely to advance to the second round than a grade 8 student.

OR equivalent

STUDENT RESPONSE

Response Score: 4 points

17. A quiz competition was held for grade 7 and grade 8 students. In the first round, each of the 150 contestants was given a quiz. Contestants advanced to the second round if they answered enough questions correctly. The tables below show some information about the 150 contestants in the competition as well as some information about the grade 8 students who competed.

Quiz Competition Contestants

	Grade 7	Grade 8
Advanced to Second Round	44	44
Did Not Advance to Second Round	33	29

Grade 8 Quiz Competition Contestants

	Male	Female
Advanced to Second Round	20	24
Did Not Advance to Second Round	?	12

A. How many grade 8 male students did **not** advance to the second round?

17 males

A grade 8 female student who competed is randomly selected.

B. What is the probability that the randomly selected student advanced to the second round?

$\frac{2}{3}$

Go to the next page to finish question 17.

GO ON

Part A: The student provided the correct answer (*17 males*). While support is not required for Part A, the student likely calculated the total number of grade 8 students (44 + 29 = 73), found the total number of grade 8 students already accounted for in the second table (20 + 24 + 12 = 56), and then subtracted the sums (73 − 56 = 17). [1 point]

Part B: The student provided the correct answer $\left(\frac{2}{3}\right)$. While support is not required for Part B, the student likely calculated the total number of grade 8 female students from the second table (24 + 12 = 36), identified the number of grade 8 female students who advanced to the second round (24), and then wrote the probability as $\frac{24}{36}$, and then simplified the fraction to $\frac{2}{3}$. [1 point]

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

One of the 150 students who competed is randomly selected.

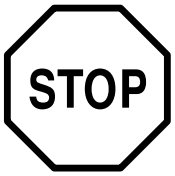
C. Explain why the randomly selected student **most likely** advanced to the second round.

A student, who is randomly selected, is most likely to advance to the second round because there are more students who it to the second round than students that didn't make it to the second round.

D. Explain why a grade 7 student is less likely to have advanced to the second round than a grade 8 student even though the same number of grade 7 students advanced to the second round as grade 8 students.

Even though both grades have the same amount of students Advancing grade 7 has more students not advancing meaning it is less likely for a grade 7 student to advance to the second round than a grade 8 student.

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



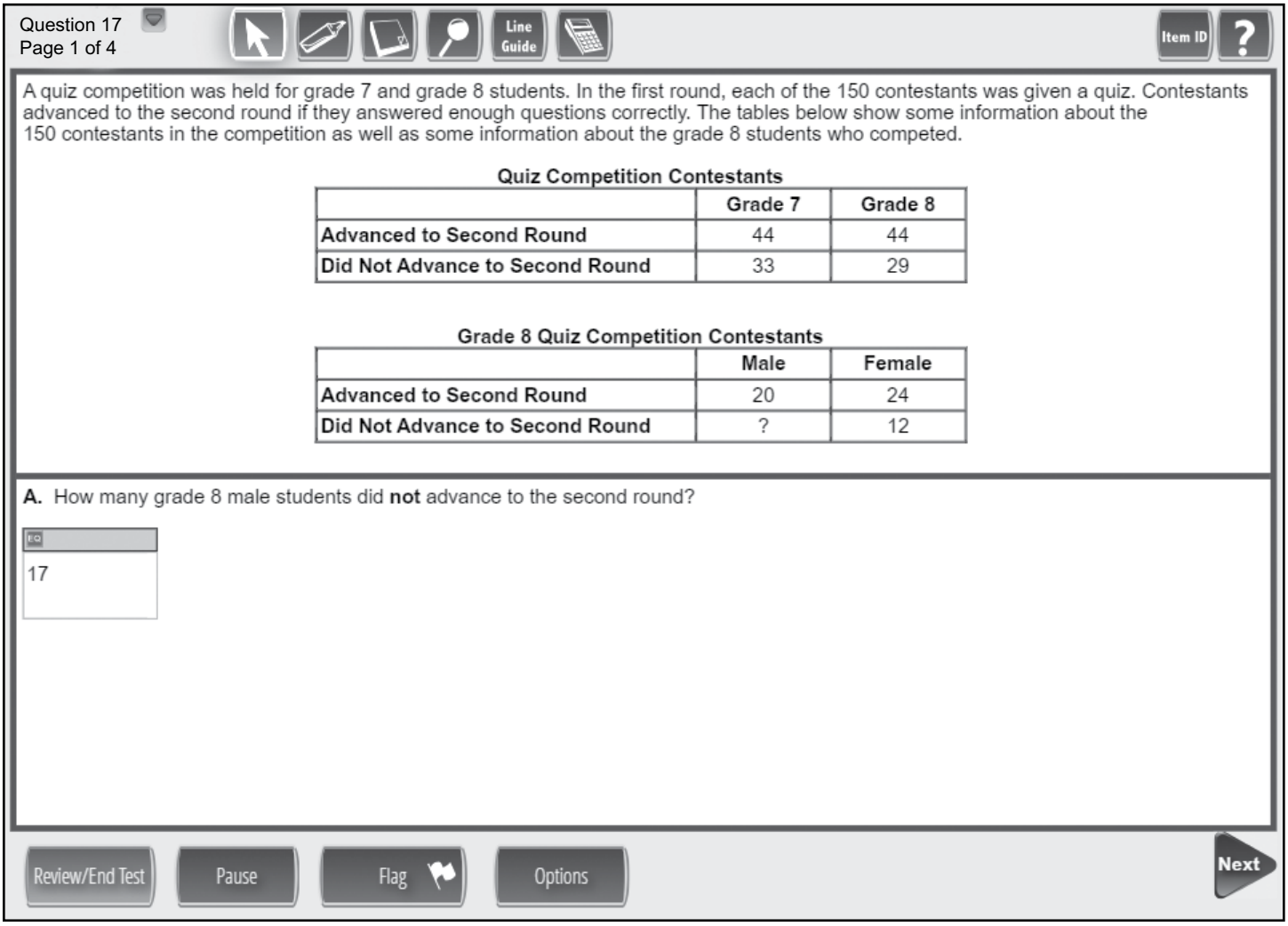
Part C: The student provided a correct and complete explanation as to why a randomly selected student most likely advanced to the second round (*there are more students who* [made] *it to the second round than students that didn't make it to the second round*). [1 point]

Part D: The student provided a correct and complete explanation as to why a grade 7 student is less likely to have advanced to the second round than a grade 8 student (*though both grades have the same amount of students Advancing grade 7 has more students not advoncing*). [1 point]

STUDENT RESPONSE

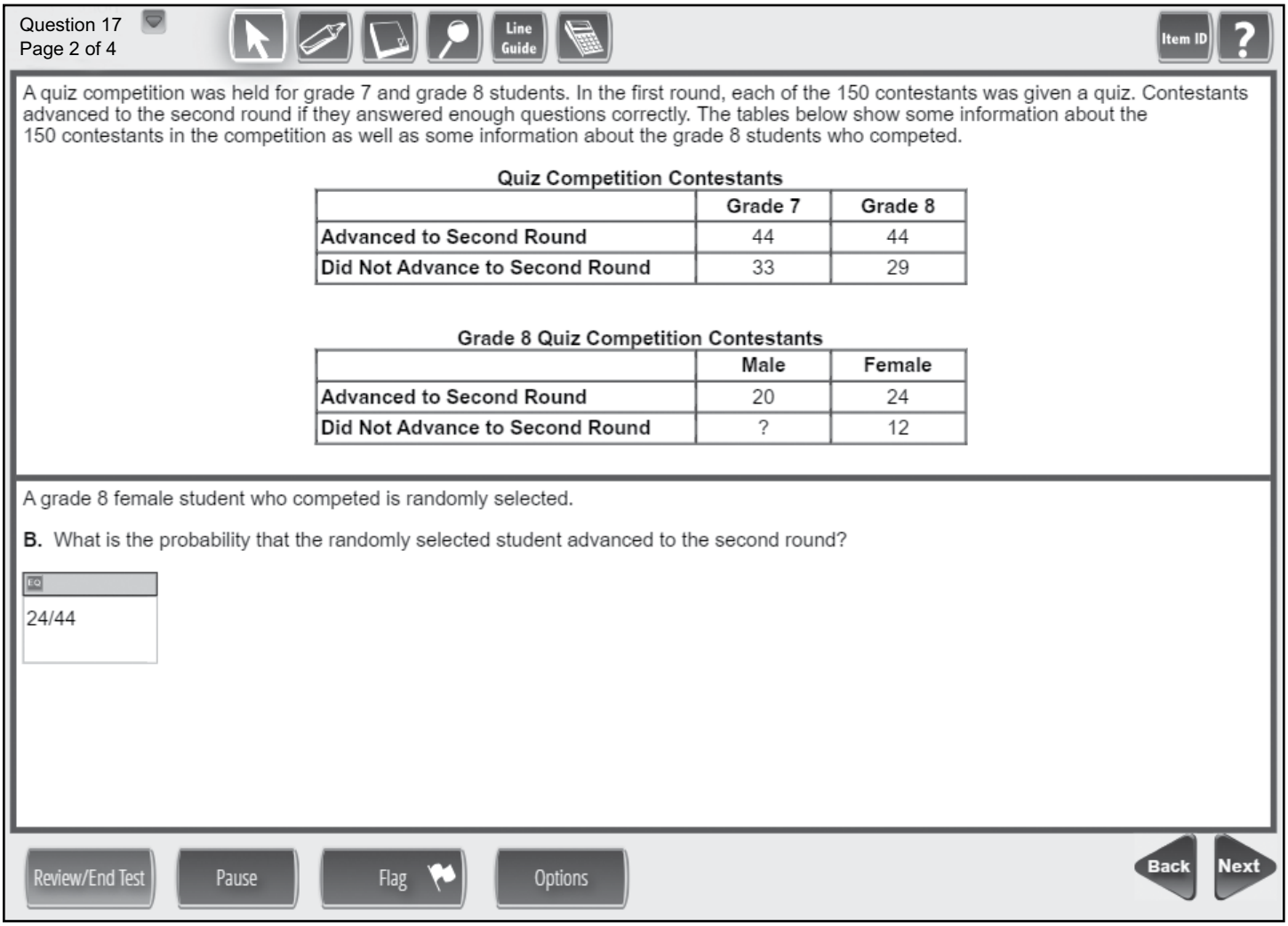
Computer Response Score: 3 points

PART A



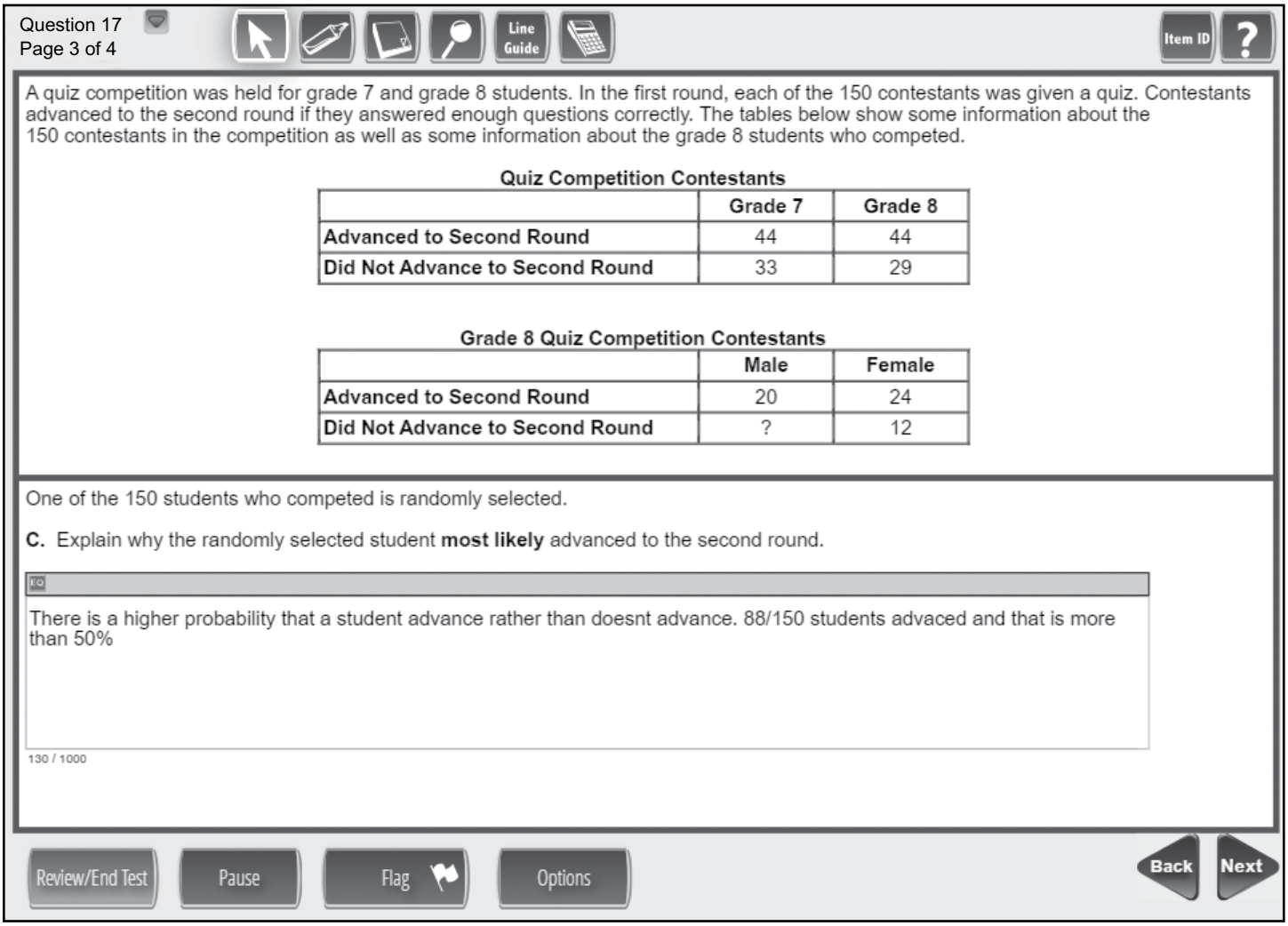
Part A: The student provided the correct answer (*17*). While support is not required for Part A, the student may have looked at the first table and noted that 29 grade 8 students did not advance to the second round, looked at the second table and noted that 12 female students did advance, and then subtracted these values (29 − 12 = 17). [1 point]

PART B



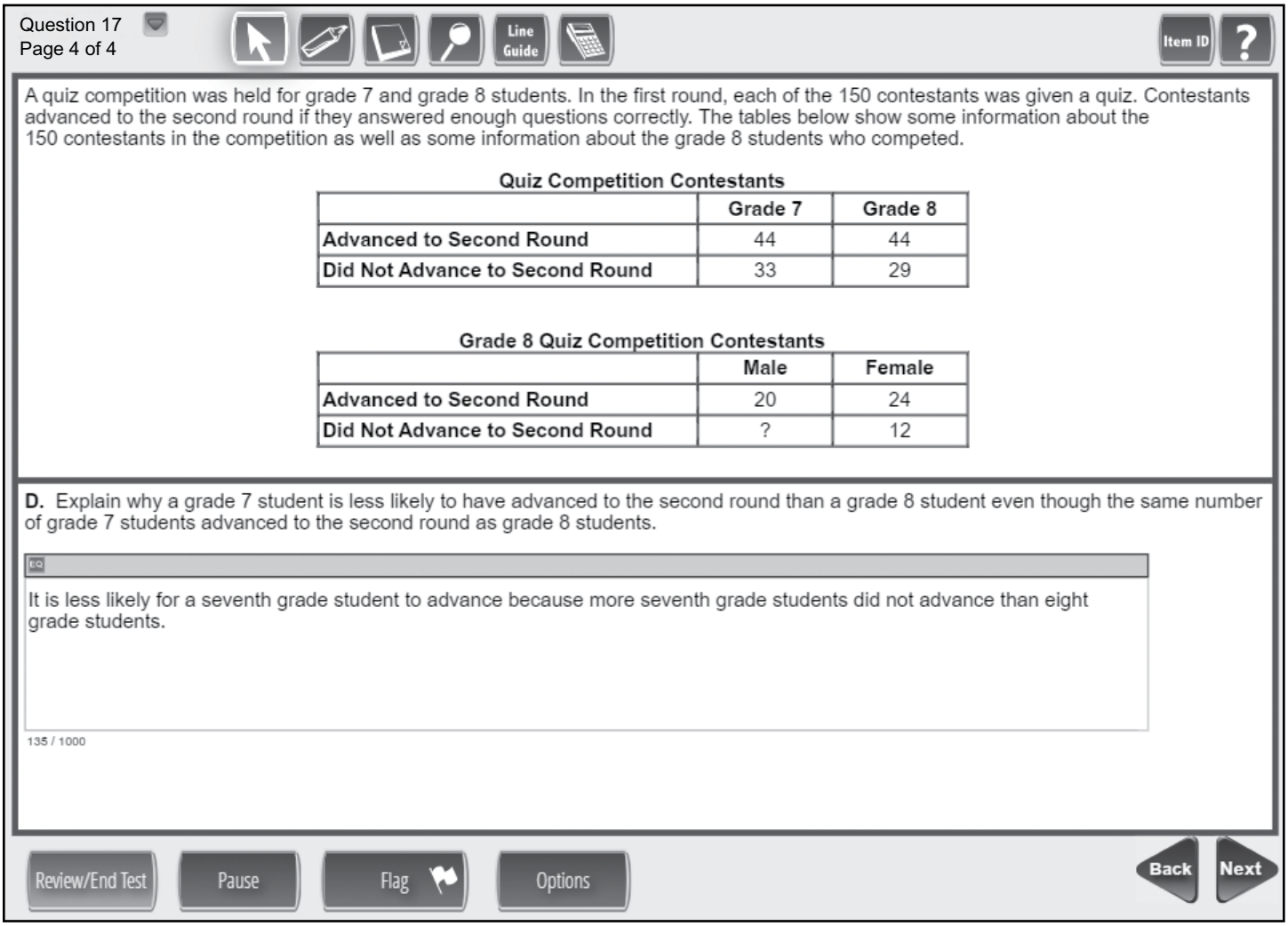
Part B: The student provided an incorrect answer (*24*/*44*). While the numerator (*24*) is correct, the denominator (*44*) is incorrect. No support (work or explanation) is required, so it is unclear where an error was made. The student may have looked at the first table and used the number of grade 8 students who advanced to the second round rather than calculating the total number of female grade 8 students from the second table. [0 points]

PART C



Part C: The student provided a correct and complete explanation as to why a randomly selected student likely advanced to the second round (*88/150 students advaced and that is more than 50%*). [1 point]

PART D



Part D: The student provided a correct and complete explanation as to why a grade 7 student is less likely to have advanced to the second round than a grade 8 student (*more seventh grade students did not advance than eight grade students*). [1 point]

STUDENT RESPONSE

Response Score: 2 points

17. A quiz competition was held for grade 7 and grade 8 students. In the first round, each of the 150 contestants was given a quiz. Contestants advanced to the second round if they answered enough questions correctly. The tables below show some information about the 150 contestants in the competition as well as some information about the grade 8 students who competed.

Quiz Competition Contestants

	Grade 7	Grade 8
Advanced to Second Round	44	44
Did Not Advance to Second Round	33	29

Grade 8 Quiz Competition Contestants

	Male	Female
Advanced to Second Round	20	24
Did Not Advance to Second Round	?	12

A. How many grade 8 male students did **not** advance to the second round?

10 male students

A grade 8 female student who competed is randomly selected.

B. What is the probability that the randomly selected student advanced to the second round?

she has a 50% chance of advancing to the second round 12 is ½ of 24 (50 is ½ of 100)

Go to the next page to finish question 17.

GO ON

Part A: The student provided an incorrect answer (*10 male students*). No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have looked at the second table and noticed that, for the female column, those who did not advance happened to be half the number of those who did advance (12 did not advance compared to 24 who did advance), and then assumed the same would hold true for the male column (20 ÷ 2 = 10). [0 points]

Part B: The student provided an incorrect answer (*50%*). The explanation provided, though not required for Part B, shows that the student incorrectly compared the 24 and the 12 from the second table (*12 is* $\frac{1}{2}$ *of 24*). The student used the ratio of grade 8 female students who did not advance (12) to those who did advance (24) rather than the ratio of grade 8 female students who advanced (24) to the total number of grade 8 female students (12 + 24 = 36). [0 points]

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

One of the 150 students who competed is randomly selected.

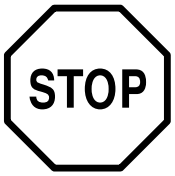
C. Explain why the randomly selected student **most likely** advanced to the second round.

they most likely advanced to the second round because more kids advanced than did not advance.

D. Explain why a grade 7 student is less likely to have advanced to the second round than a grade 8 student even though the same number of grade 7 students advanced to the second round as grade 8 students.

Because there was more 7th grade students who did not advance to the second round than there were 8th grade students who didn't advance.

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



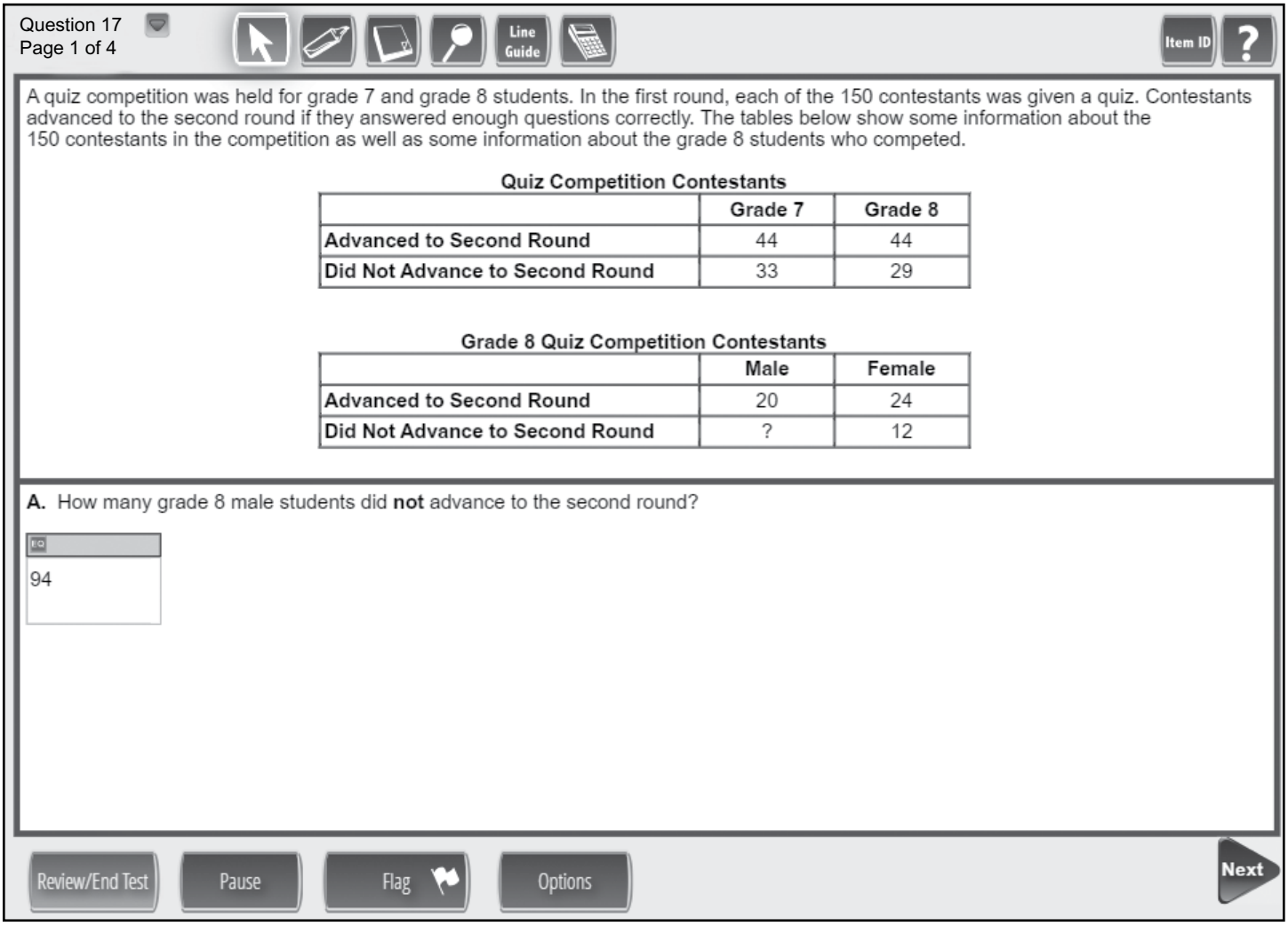
Part C: The student provided a correct and complete explanation as to why a randomly selected student likely advanced to the second round (*more kids advanced than did not advance*). [1 point]

Part D: The student provided a correct and complete explanation as to why a grade 7 student is less likely to have advanced to the second round than a grade 8 student (*there was more 7th grade students who did not advance . . . than there were 8th grade students who didn't advance*). [1 point]

STUDENT RESPONSE

Computer Response Score: 1 point

PART A



Part A: The student provided an incorrect answer (*94*). No support (work or explanation) is required, so it is unclear where an error was made. The student likely started with 150 (the total number of grade 7 and grade 8 students) and subtracted the values from the second table (150 − 20 − 24 − 12 = 94). [0 points]

PART B

Question 17
Page 2 of 4

Line Guide

Item ID

A quiz competition was held for grade 7 and grade 8 students. In the first round, each of the 150 contestants was given a quiz. Contestants advanced to the second round if they answered enough questions correctly. The tables below show some information about the 150 contestants in the competition as well as some information about the grade 8 students who competed.

Quiz Competition Contestants

	Grade 7	Grade 8
Advanced to Second Round	44	44
Did Not Advance to Second Round	33	29

Grade 8 Quiz Competition Contestants

	Male	Female
Advanced to Second Round	20	24
Did Not Advance to Second Round	?	12

A grade 8 female student who competed is randomly selected.

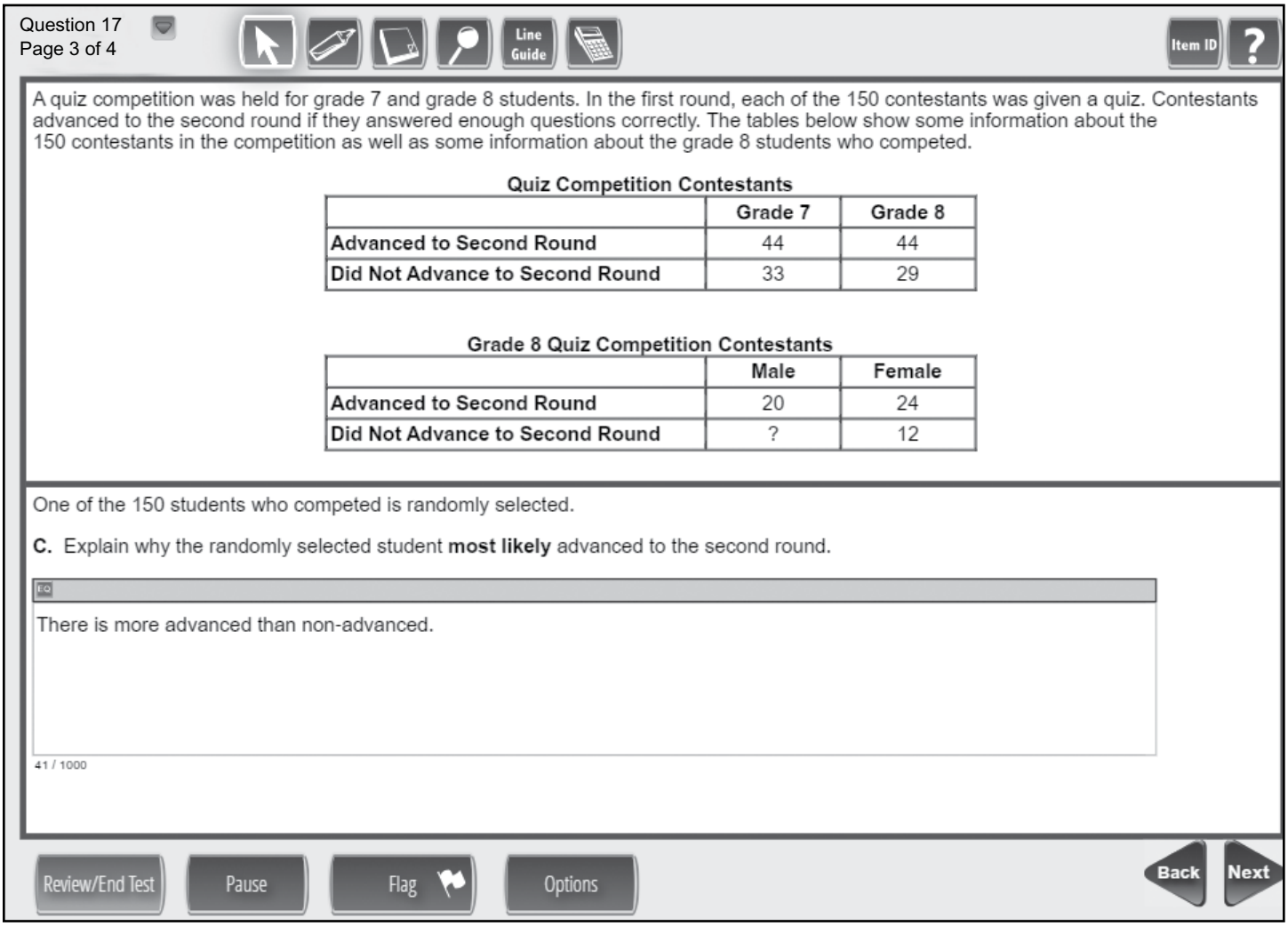
B. What is the probability that the randomly selected student advanced to the second round?

1/150

Review/End Test | Pause | Flag | Options | Back | Next

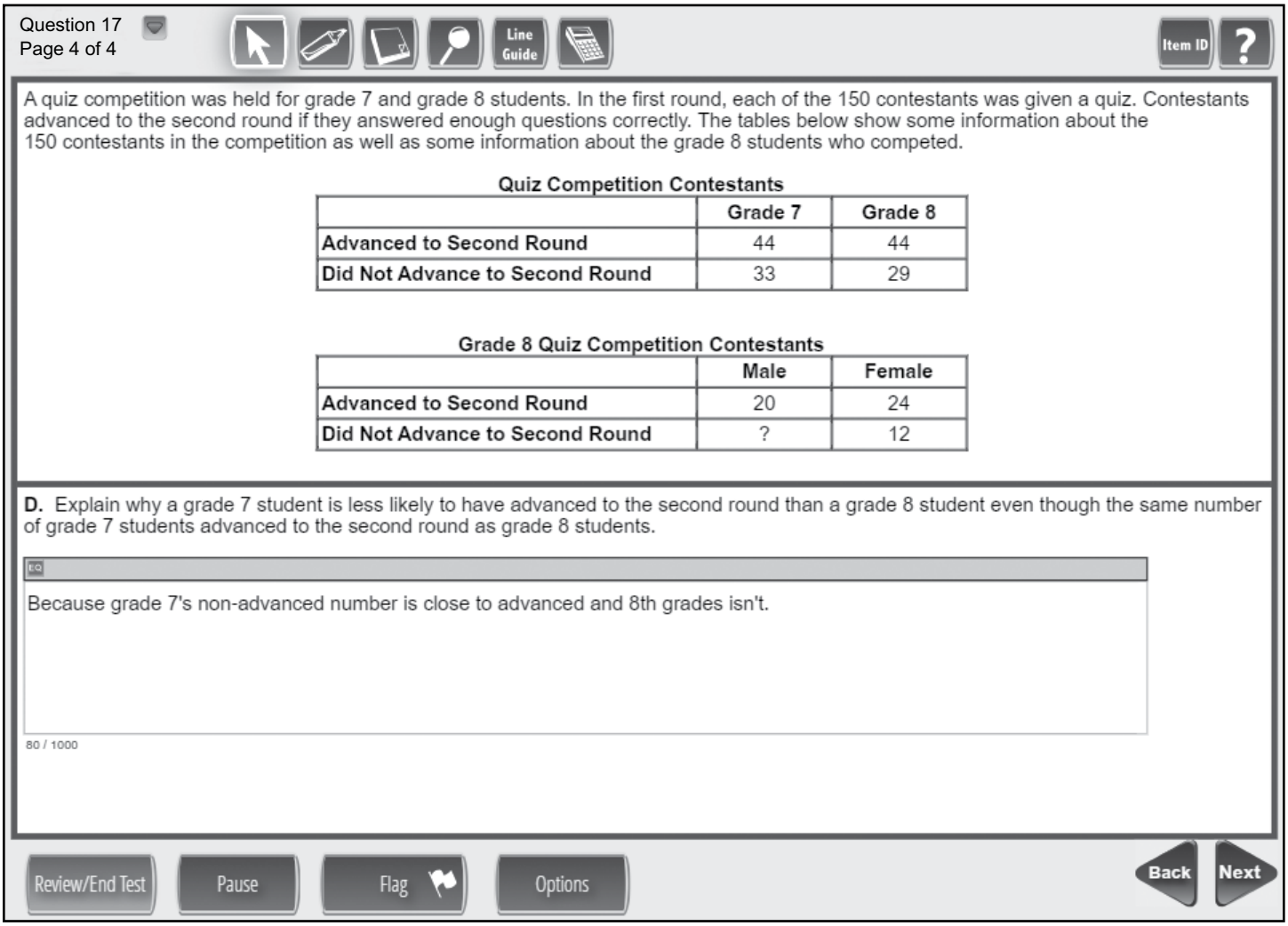
Part B: The student provided an incorrect answer (*1/150*). No support (work or explanation) is required, so it is unclear where an error was made. The student likely wrote the probability for 1 student out of all 150 students who participated in the quiz competition rather than the probability for one of the 24 grade 8 female students who advanced to the second round out of the 36 grade 8 female students who participated in the quiz competition. [0 points]

PART C



Part C: The student provided a correct and complete explanation as to why a randomly selected student likely advanced to the second round (*more advanced than non-advanced*). [1 point]

PART D



Part D: The student provided an incorrect explanation as to why a grade 7 student is less likely to have advanced to the second round than a grade 8 student (*grade 7's non-advanced number is close to advanced and 8th grades isn't*). The student incorrectly attempted to associate likelihood with the difference between those who advanced and those who did not advance. [0 points]

STUDENT RESPONSE

Response Score: 0 points

17. A quiz competition was held for grade 7 and grade 8 students. In the first round, each of the 150 contestants was given a quiz. Contestants advanced to the second round if they answered enough questions correctly. The tables below show some information about the 150 contestants in the competition as well as some information about the grade 8 students who competed.

Quiz Competition Contestants

	Grade 7	Grade 8
Advanced to Second Round	44	44
Did Not Advance to Second Round	33	29

Grade 8 Quiz Competition Contestants

	Male	Female
Advanced to Second Round	20	24
Did Not Advance to Second Round	?	12

A. How many grade 8 male students did **not** advance to the second round?

9 did not advance

A grade 8 female student who competed is randomly selected.

B. What is the probability that the randomly selected student advanced to the second round?

Their is a good Probability thatsh will advance to the second round.

Go to the next page to finish question 17.

GO ON

Part A: The student provided an incorrect answer (*9 did not advance*). No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have looked at the first table and noted that 29 grade 8 students did not advance to the second round, looked at the second table and noted that 20 male students advanced (rather than noting the 12 female students who did not advance), and then subtracted these values (29 − 20 = 9). [0 points]

Part B: The student provided an incorrect answer (*Their is a good probability thatsh* [that she] *will advance to the second round*). The student attempted to respond with a likelihood ("good probability" being similar to "more likely") rather than an actual probability. [0 points]

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

One of the 150 students who competed is randomly selected.

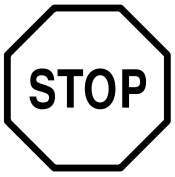
C. Explain why the randomly selected student **most likely** advanced to the second round.

Because their is a even chance of getting it right Just like their is getting it wrong.

D. Explain why a grade 7 student is less likely to have advanced to the second round than a grade 8 student even though the same number of grade 7 students advanced to the second round as grade 8 students.

Becavse their is less kids in the seventh grade to start with.

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



Part C: The student provided an incorrect explanation as to why a randomly selected student likely advanced to the second round (*their is a even chance of getting it right just like their is getting it wrong*). The student's explanation actually attempts to explain why the randomly selected student is equally likely, not most likely, to have advanced to the second round. [0 points]

Part D: The student provided an incorrect explanation as to why a grade 7 student is less likely to have advanced to the second round than a grade 8 student (*their is less kids in the seventh grade to start with*). The student incorrectly attempted to associate likelihood with the size of the population; however, there are more, not fewer, grade 7 students than grade 8 students who participated in the quiz competition. [0 points]

Mathematics—Summary Data

Multiple-Choice

An asterisk (*) indicates the key.

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-value A	*p*-value B	*p*-value C	*p*-value D
1	B-E.1.1.3	A	1	42%*	28%	15%	15%
2	A-N.1.1.1	B	1	20%	57%*	12%	11%
3	A-N.1.1.2	B	1	11%	54%*	17%	18%
4	A-N.1.1.4	D	2	12%	12%	14%	62%*
5	B-E.1.1.4	A	1	60%*	12%	17%	11%
6	B-E.2.1	D	1	27%	17%	16%	40%*
7	B-E.2.1.1	B	2	16%	45%*	32%	7%
8	B-E.3.1.3	D	2	13%	23%	19%	45%*
9	B-E.3.1.5	B	2	15%	58%*	18%	9%
10	B-F.1.1.1	A	1	31%*	30%	21%	18%
11	B-F.1.1.3	C	2	15%	15%	50%*	20%
12	B-F.2.1	C	2	4%	14%	79%*	3%
13	B-F.2.1.1	B	2	18%	54%*	11%	17%
14	C-G.1.1.4	A	2	41%*	20%	25%	14%
15	C-G.2.1.2	D	1	11%	11%	9%	69%*
16	C-G.3.1.1	B	2	15%	58%*	16%	11%

Open-Ended

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
17	D-S.1.2.1	4	2	1.45

PSSA Grade 8 Mathematics
Item and Scoring Sampler