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	A. right-aligns the numbers, ignoring the decimal points (39093 + 5272), adds left to right and regroups to the next right place value (3 + 0 = 3, 9 + 5 = 14, regroups the 1 to the right for 1 + 0 + 2 = 3, 9 + 7 = 16, regroups the 1 to the right for 1 + 3 + 2 = 5), and then places the decimal point between the 2nd and 3rd digits to match the initial addends B. right-aligns the numbers, ignoring the decimal points (39093 + 5272), adds those number correctly, and then places the decimal point between the 2nd and 3rd digits to match the initial addends C. adds left to right and regroups to the next right place value (3 + 5 = 8, 9 + 2 = 11, regroups the 1 to the right for 1 + 0 + 7 = 8, 9 + 2 = 11, regroups the 1 to the right for 1 + 3 + 0 = 4) D. Correct: aligns the place values before adding OR includes a 0 in the thousandths place of 52.72 and then adds 39.093 + 52.720, starting with the thousandths place

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	A. reverses the ratio B. uses the ratio of lima beans to total weight C. Correct: recognizes the ratio of ounces of lima beans to ounces of corn is 63:18 and divides each number by 9 (63 ÷ 9 = 7, 18 ÷ 9 = 2) D. uses the ratio of total weight to lima beans

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	A. inverts the fraction B. subtracts 3 from 64 to determine that the difference is 61 and then uses 3 as the numerator and 61 as the denominator C. subtracts 3 from 64 to determine that the difference is 61 and then uses 3 as the denominator and 61 as the numerator 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 ($64 \div 3 = \frac{64}{3}$, $3 \div 3 = 1$)

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	A. uses the 2 from the ratio without converting to a percentage B. multiplies the number of silver coins by 10 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 D. thinks the 3 from the ratio represents silver coins and determines the percentage using 3 ÷ (3 + 2) • 100

5. Which equation shows the value of x raised to the 4th power when $x = 3$?

A. $x^3 = 4 \bullet 4 \bullet 4 = 64$

B. $x^4 = 4 \bullet 4 \bullet 4 = 64$

C. $x^3 = 3 \bullet 3 \bullet 3 \bullet 3 = 81$

D. $x^4 = 3 \bullet 3 \bullet 3 \bullet 3 = 81$

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	A. switches the meanings of the 3 and the 4, using 3 as the exponent and 4 as the value of x B. uses 4 as both the exponent and the value of x but multiplies 4 three times based on “when $x = 3$” C. uses 3 as both the exponent and the value of x 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) D. Correct: represents x to the fourth power as x^4 using x as the base and 4 as the exponent, substitutes 3 in for x, and then multiplies 3 four times since the exponent is 4

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	A. calculates 3 • 2 rather than 3^2; views 0.5x as 0.53, rather than 0.5 • 3 B. calculates 3 • 2 rather than 3^2 C. views 0.5x as 0.53, rather than 0.5 • 3 D. Correct: substitutes 3 in for x, calculates 3^2 = 3 • 3 = 9 and 0.5(3) = 1.5, and then adds 9 + 1.5 to determine that the sum is 10.5

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	A. substitutes 8.6 in for *y* but then multiplies 8.6 by 2.5 B. substitutes 19 in for *y* but then adds 2.5 to 19 C. substitutes 23.5 in for *y* but then subtracts only the whole parts (23 – 2 = 21) while “carrying over” the .5 D. Correct: substitutes 24 in for *y* and recognizes that 24 – 2.5 = 21.5 is a true number sentence

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	A. recognizes that *t* should be less than 71.3 but uses the same symbol with 67.5 B. Correct: recognizes the temperature (*t*) must be greater than 67.5 (the temperature at 3 P.M.) and less than 71.3 (the temperature at 5 P.M.) C. reverses the direction of both inequalities D. recognizes that *t* should be greater than 67.5 but uses the same symbol with 71.3

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	A. Correct: recognizes that the number of cups of oil (y) can be found by multiplying the amount of oil, in cups, in each batch $\left(\frac{2}{3}\right)$ by the number of batches (x) B. uses the reciprocal of the number of cups per batch C. uses subtraction rather than multiplication D. uses addition rather than multiplication

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	A. interprets the amount of gas as increasing rather than decreasing 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 C. reverses dependent and independent values and misinterprets the relationship D. reverses dependent and independent values

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	A. uses 4 + 1.5 + 1.75 rather than 4 • 1.5 • 1.75 to find the volume and then adds 7.48 rather than multiplying by 7.48 B. calculates the volume (10.5 cubic feet) but then adds 7.48 rather than multiplying by 7.48 C. uses 4 + 1.5 + 1.75 rather than 4 • 1.5 • 1.75 to find the volume but then multiplies by 7.48 D. Correct: multiplies the side lengths to find the volume in cubic feet (4 • 1.5 • 1.75 = 10.5) and then multiplies the volume by the gallons of water per cubic foot (7.48)

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	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 $\left(A = \frac{1}{2}bh = \frac{1}{2} \bullet 7 \bullet 4\right)$ B. counts the gridlines and includes both endpoints ($b = 8$, $h = 5$) for lengths C. does not multiply the product 7 • 4 (i.e., *bh*) by $\frac{1}{2}$ D. counts the gridlines and includes both endpoints ($b = 8$, $h = 5$) for lengths and does not multiply the product 8 • 5 (i.e., *bh*) by $\frac{1}{2}$

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	A. confuses skewed to the left with skewed to the right B. identifies the midpoint of the data [(9 + 3) ÷ 2 = 6] 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" D. interprets the mode (5) as though it were the median value, which is where the data set is divided in half

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.

GO ON

Item-Specific Scoring Guideline

#17 Item Information

Alignment	B-E.2.1	**Depth of Knowledge**	3	**Mean Score**	1.15

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

Score	In this item, the student . . .
4	Demonstrates a thorough understanding of how to interpret and solve one-variable equations and inequalities by correctly solving problems and clearly explaining procedures.
3	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.
2	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.
1	Demonstrates minimal understanding of how to interpret and solve one-variable equations and inequalities.
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 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)	**Sample Work:** 0 adult tickets: [117 – 0(31.50)] ÷ 18 = 6.5 student tickets × 1 adult ticket: [117 – 1(31.50)] ÷ 18 = 4.75 student tickets × 2 adult tickets: [117 – 2(31.50)] ÷ 18 = 3 student tickets ✓ 3 adult tickets: [117 – 3(31.50)] ÷ 18 = 1.25 student tickets × 4 adult tickets: [117 – 4(31.50)] ÷ 18 = $^{-}0.5$ student tickets × **OR** **Sample Explanation:** 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 117 ÷ 18 = 6.5 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 (117 – 31.50 • 2) ÷ 18 = 3 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). **OR equivalent**

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

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

1 point for correct and complete explanation

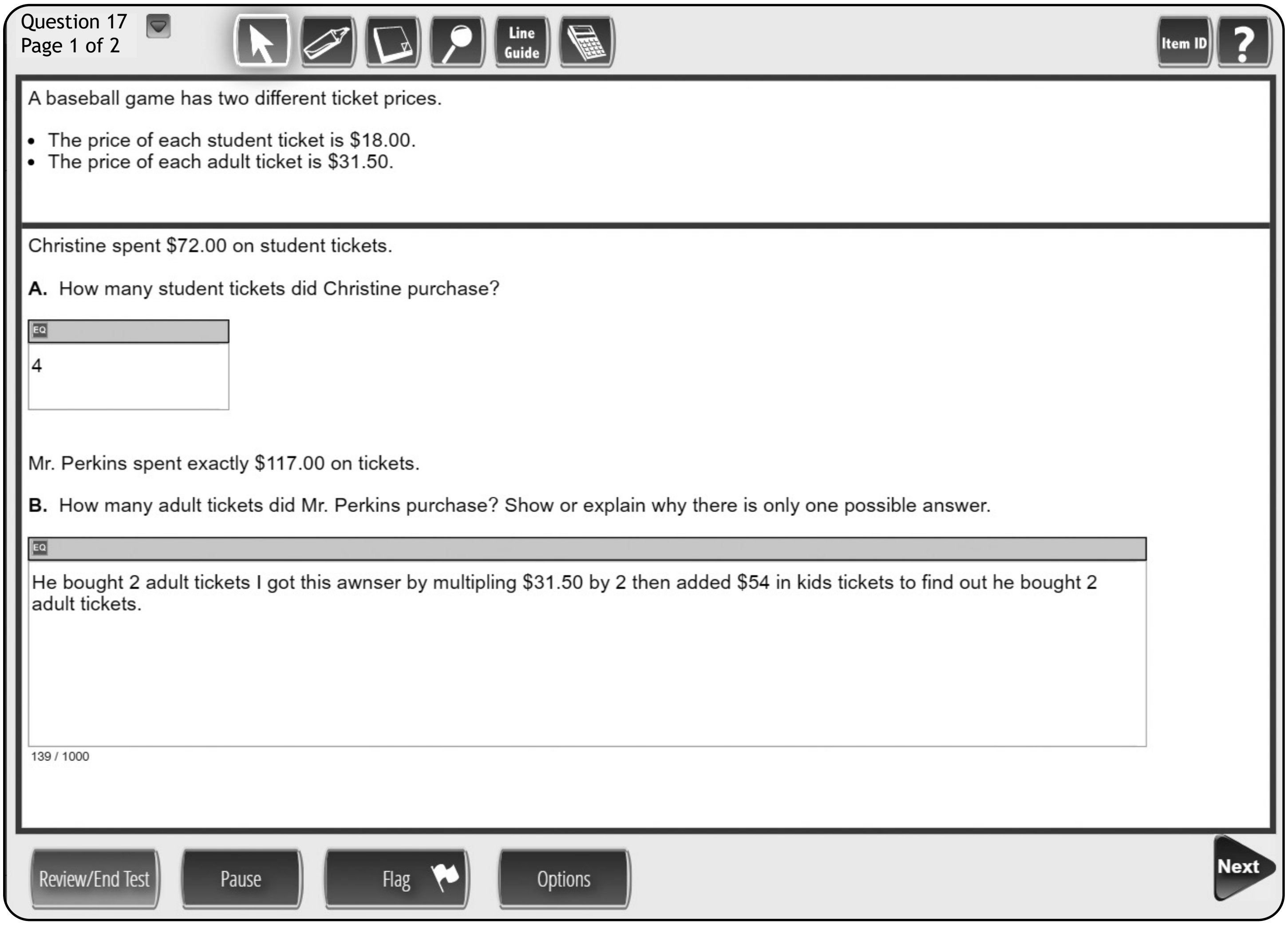
OR $\frac{1}{2}$ point for correct but incomplete explanation

What?	Why?
5 (prices)	**Sample Explanation:** 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. **OR equivalent**

STUDENT RESPONSE

Response Score: 3 points

PARTS A and B



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?

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.

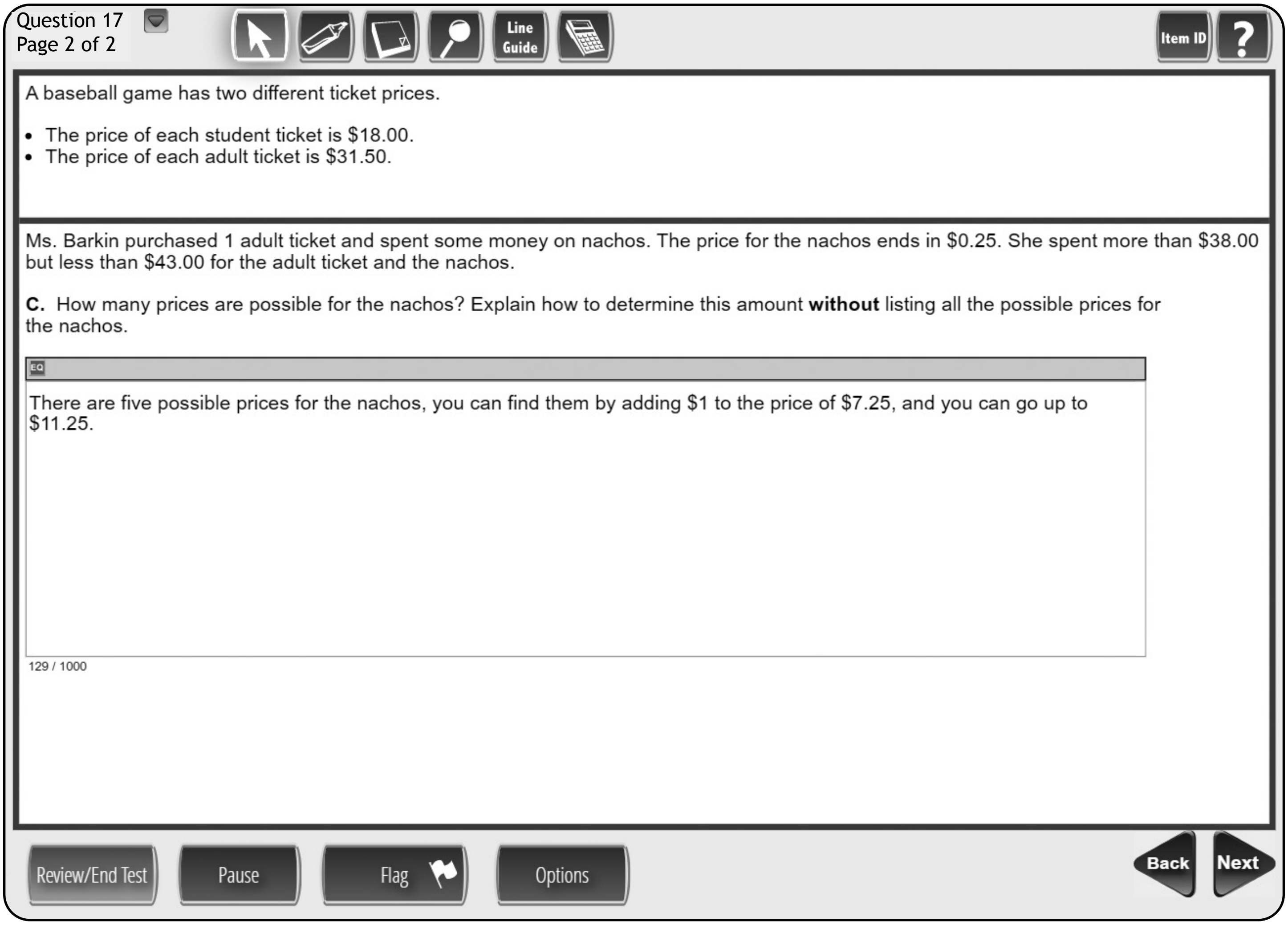
He bought 2 adult tickets I got this awnser by multipling $31.50 by 2 then added $54 in kids tickets to find out he bought 2 adult tickets.

139 / 1000

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



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.

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.

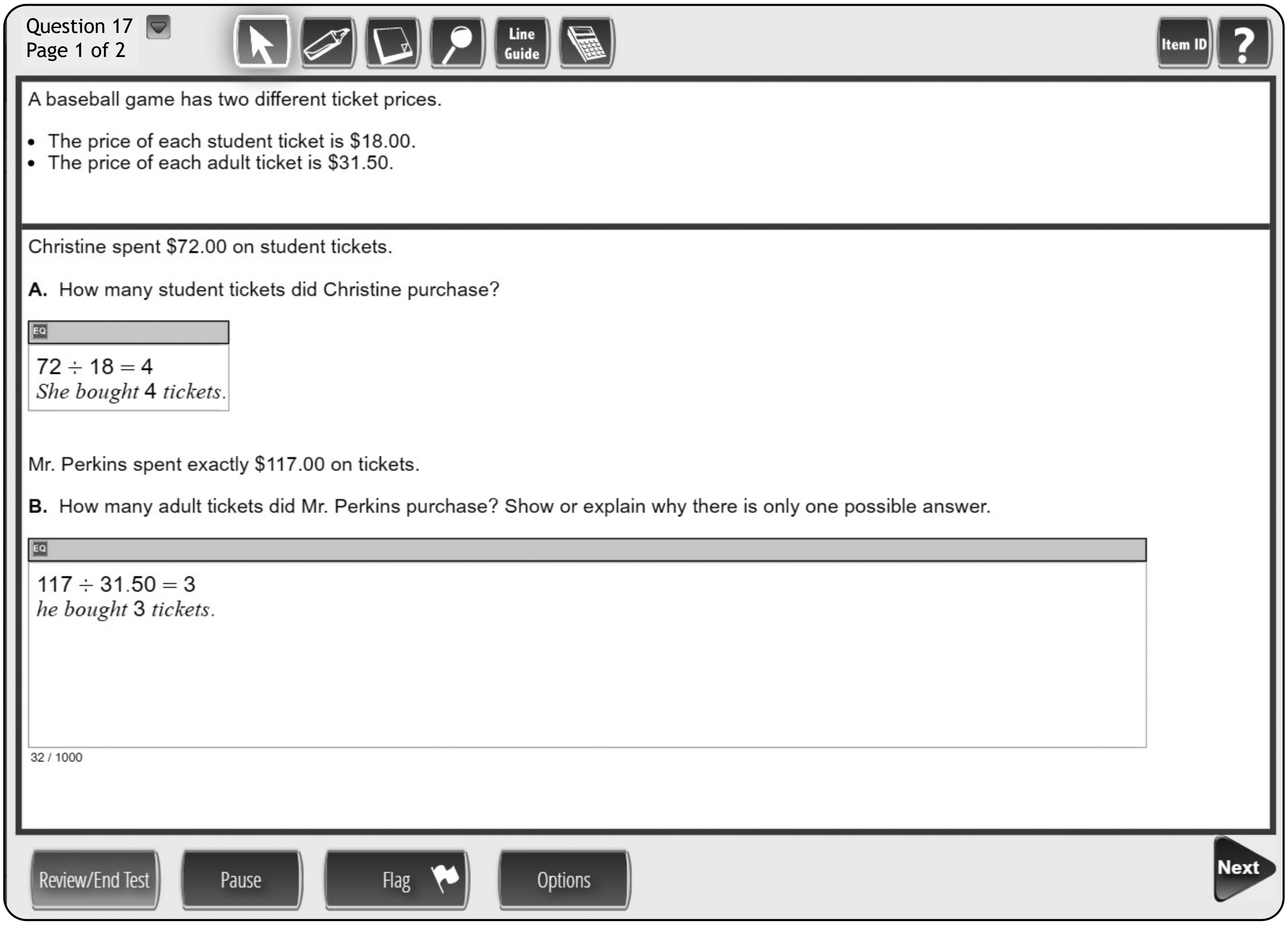
129 / 1000

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: 1 point

PARTS A and B



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.

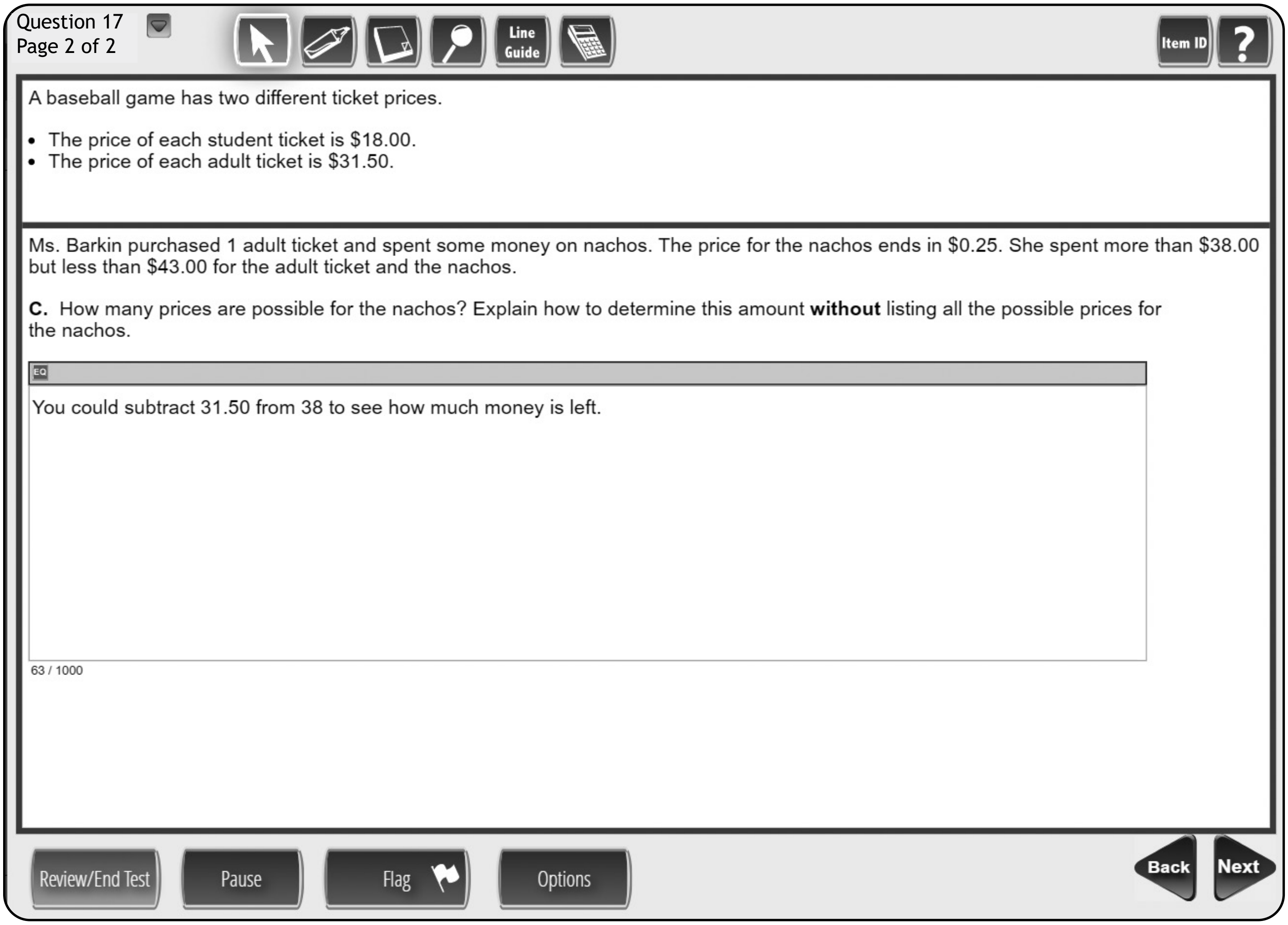
$117 \div 31.50 = 3$
he bought 3 *tickets.*

32 / 1000

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 ÷ 18 = 4*). [1 point]

Part B. The student provided an incorrect answer (*he bought 3 tickets*) with incorrect support (*117 ÷ 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



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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.

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

63 / 1000

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]

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