



ISTEP+: Grade 8

Mathematics

Released Part 1 Applied Skills (open-ended) Items
and Scoring Notes

Introduction

The *ISTEP+* Spring 2016 test was administered to Indiana students in Grades 3-8 and 10. The test included two parts: Part 1 was given in March, and Part 2 took place in late April and early May. Part 1 contained Applied Skills test questions (also referred to as open-ended items) that were hand scored by trained evaluators, and Part 2 was machine scored. Scores for Part 1 and Part 2 are combined to generate a student's total score.

Test results, as well as images of the Applied Skills student responses, are available online, and schools are expected to discuss results with parents and students. As a springboard for these conversations and to serve as a resource for teachers, the Indiana Department of Education has created this document, which consists of the following:

- a brief description of the types of questions on the test
- a short summary of scoring rules utilized by the trained evaluators
- a copy of the rubrics—or scoring guides—used by evaluators to score student responses
- a copy of the released Applied Skills questions (*“released” means the items are posted on the web and are no longer secure; therefore, the released test items can be discussed and used with students as future practice items*)
- anchor papers—or sample student responses—used by evaluators to distinguish between score points

Notes:

- The Part 1 open-ended questions are released when test results are made available.
- It is important to keep in mind that the majority of a student's score is calculated from items in Part 2. Since Part 2 items are secure and are not released, they are not included in this document.

Question Types

This document addresses questions from *ISTEP+ Part 1*. *Students* demonstrate their knowledge and understanding by responding to items that are open-ended, providing written responses in a short-answer or essay-type format.

Part 1 consists of the following test question types: Constructed-Response (CR), Extended-Response (ER), and a Writing Prompt (WP). Item types vary by subject area. Math, Science, and Social Studies include CR and ER items. English/Language Arts includes CR and WP test questions.

Scoring

The questions on *ISTEP+ Part 1* are scored by evaluators who must have a four-year college degree and pass a series of qualifying tests. Prior to scoring student responses, evaluators receive extensive training to ensure that student responses are scored accurately and consistently.

For Part 1 of *ISTEP+*, each question is scored according to a rubric, or scoring guide. Rubrics clearly define the requirements for each score point. A set of student responses representing all of the score points on a rubric are selected as samples—called anchor papers—and are used as clear examples of specific score points. Anchor papers are presented within this document.

ISTEP+ Part 1: Mathematics		
Question Type	Score Reporting Categories	Scoring Method
Constructed-Response (CR)	Computation Algebra and Functions Geometry and Measurement Data Analysis, Statistics, and Probability Mathematical Process	2-pt. CR Content Rubric (Grades 3-8, 10) 2-pt. CR Process Rubric (Grades 3-8, 10)
Extended-Response (ER)	Computation Algebra and Functions Geometry and Measurement Data Analysis, Statistics, and Probability Mathematical Process	3-pt. ER Content Rubric (Grades 3-8, 10) 3-pt. ER Process Rubric (Grades 3-8, 10)

If a student's response is unable to be scored, it is assigned one of the following condition codes:

- A** Blank/No Response/Refusal
- B** Illegible
- C** Written predominantly in a language other than English
- D** Insufficient response/Copied from text
- E** Response not related to test questions or scoring rule (not applied to Mathematics questions)

More information is available regarding assessment topics on the Office of Student Assessment homepage at <http://www.doe.in.gov/assessment>.

Constructed-Response Rubric

Content Rubric	
2	A score of two indicates a thorough understanding of the mathematical concepts embodied in the task. The response <ul style="list-style-type: none"> • shows algorithms, computations, and other content related work executed correctly and completely.
1	A score of one indicates a partial understanding of the mathematical concepts embodied in the task. The response <ul style="list-style-type: none"> • contains errors in the execution of algorithms, computations, and/or other content related work.
0	A score of zero indicates limited or no understanding of the mathematical concepts embodied in the task.
Process Rubric	
2	A score of two indicates a thorough understanding of the problem-solving concepts embodied in the task. The response <ul style="list-style-type: none"> • shows an appropriate strategy to solve the problem, and the strategy is executed correctly and completely. • identifies all important elements of the problem and shows a complete understanding of the relationships among them. • provides clear and complete explanations and/or interpretations when required.
1	A score of one indicates a partial understanding of the problem-solving concepts embodied in the task. The response contains one or more of the following errors. The response <ul style="list-style-type: none"> • shows an appropriate strategy to solve the problem. However, the execution of the strategy contains errors and/or is incomplete. • identifies some of the important elements of the problem and shows a general understanding of the relationships among them. • provides incomplete, partial, or unclear explanations and/or interpretations when required.
0	A score of zero indicates limited or no understanding of the problem-solving concepts embodied in the task.

Clarification and Implementation Guidance

- Correct answers ONLY, on all parts of the problem with no work shown, will receive a maximum of 1 point in content and a maximum of 1 point in Process.
- A student can receive the top score point in Process if the strategy used would result in a correct answer even though the response contains computational errors.
- A student can receive the top score point in Process if an error made in the “content” portion is used with an appropriate strategy to solve the problem.

Extended-Response Rubric

Content Rubric	
3	A score of three indicates a thorough understanding of the mathematical concepts embodied in the task. The response <ul style="list-style-type: none"> • shows algorithms, computations, and other content related work executed correctly and completely.
2	A score of two indicates a partial understanding of the mathematical concepts embodied in the task. The response <ul style="list-style-type: none"> • shows an attempt to execute algorithms, computations, and other content related work correctly and completely; computation errors or other minor errors in the content related work may be present.
1	A score of one indicates a limited understanding of the mathematical concepts embodied in the task. The response <ul style="list-style-type: none"> • contains major errors, or only a partial process. • contains algorithms, computations, and other content related work which may only be partially correct.
0	A score of zero indicates no understanding of the mathematical concepts embodied in the task.
Process Rubric	
3	A score of three indicates a thorough understanding of the problem-solving concepts embodied in the task. The response <ul style="list-style-type: none"> • shows an appropriate strategy to solve the problem, and the strategy is executed correctly and completely. • identifies all important elements of the problem and shows a complete understanding of the relationships among them. • provides clear and complete explanations and/or interpretations when required.
2	A score of two indicates a partial understanding of the problem-solving concepts embodied in the task. The response contains one or more of the following errors. The response <ul style="list-style-type: none"> • shows an appropriate strategy to solve the problem. However, the execution of the strategy lacks an essential element. • identifies some of the important elements of the problem and shows a general understanding of the relationships among them. • provides incomplete or unclear explanations and/or interpretations when required.
1	A score of one indicates a limited understanding of the problem-solving concepts embodied in the task. The response contains one or more of the following errors. The response <ul style="list-style-type: none"> • shows an appropriate strategy to solve the problem. However, the execution of the strategy is applied incorrectly and/or is incomplete. • shows a limited understanding of the relationships among the elements of the problem. • provides incomplete, unclear, or omitted explanations and/or interpretations when required.
0	A score of zero indicates no understanding of the problem-solving concepts embodied in the task.

Clarification and Implementation Guidance

- Correct answers ONLY, on all parts of the problem with no work shown, will receive a maximum of 2 points in content and a maximum of 2 points in Process.
- A student can receive the top score point in Process if the strategy used would result in a correct answer even though the response contains computational errors.
- A student can receive the top score point in Process if an error made in the “content” portion is used with an appropriate strategy to solve the problem.

Item #1
Constructed-Response

Constructed-Response
Standard 2: Computation
Standard 6: Mathematical Process

Question 1

1. A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?

Show All Work

Answer _____ yards

Exemplary Response:

- Sample Process:

$$(0.4)(100 \text{ yards}) = 40 \text{ yards left}$$
$$100 \text{ yards} - 40 \text{ yards} = 60 \text{ yards used}$$

$$10 \text{ feet} = 10/3 \text{ yards or } 3 \frac{1}{3} \text{ yards}$$

$$60 \text{ yards} - 10/3 \text{ yards} = (180 - 10)/3 \text{ yards} =$$
$$170/3 \text{ yards} = 56 \frac{2}{3} \text{ yards}$$

$$170/3 \text{ yards divided by } 5 = 34/3 \text{ yards}$$
$$56 \frac{2}{3} \text{ yards divided by } 5 = 11 \frac{1}{3} \text{ yards,}$$

so $11 \frac{1}{3}$ yards or $34/3$ yards of fencing
per garden for each of the five gardens

OR

- Other valid process

Question 1, Sample A – Computation Score Point 2; Process Score Point 2

1 A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?

Show All Work

$$\begin{array}{r}
 100 \text{ yds} \\
 \times 0.4 \\
 \hline
 40 \text{ yds}
 \end{array}$$

$$\begin{array}{r}
 100 \text{ yds} \\
 - 40 \text{ yds} \\
 \hline
 60 \text{ yds}
 \end{array}$$

$$\begin{array}{r}
 60 \text{ yds} \\
 - 13.3 \text{ yds} \\
 \hline
 46.7 \text{ yds}
 \end{array}$$

$$\frac{46.7}{5} = 9.34$$

Answer 11.3 yards

$$\frac{180 \text{ ft}}{170 \text{ ft}} = 1.0588$$

5 fences = 13.3 yds
60 for project

Scoring Notes: The response demonstrates a thorough understanding of computation with at least one step utilizing a fraction or a decimal, appropriate work for determining how much fencing was not used, and a good conversion from feet to yards. The response demonstrates a thorough understanding of the mathematical process with the correct determination of the amount of fencing used, the amount of fencing used for repair factored in, and correct division used in the determination of the fencing used for each garden. This response receives two points for content and two points for process.

Question 1, Sample B – Computation Score Point 2; Process Score Point 1

1 A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?...

Show All Work

$$\begin{array}{r} 100 \text{ yds} = 300\text{ft} \\ 300 - 5x - 10 = 120 \\ -300 \quad +10 \quad -10 \\ \hline -5x = -170 \\ \hline x = 34 \end{array}$$

$$\begin{array}{r} 300 \\ \times .4 \\ \hline 120 \end{array}$$

Answer 34 yards

Scoring Notes: The response demonstrates a thorough understanding of computation with at least one step utilizing a fraction or a decimal, appropriate work for determining how much fencing was not used, and a good conversion from feet to yards. The response demonstrates a partial understanding of the mathematical process with the correct determination of the amount of fencing used, the amount of fencing used for repair factored in, and correct division used in the determination of the fencing used for each garden. However, the answer was given in feet instead of yards. This response receives two points for content and one point for process.

Question 1, Sample C – Computation Score Point 1; Process Score Point 2

1 A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?

Show All Work

Handwritten work:

$100 \text{ yds} = 300 \text{ ft}$
 $100 \text{ yds} = 10 \text{ ft}$
 $40\% \text{ of } 100 \text{ is } 40 \text{ yds}$
 $5 \overline{) 57}$
 96.6
 97
 -40
 $\hline 57$

Answer 11.4 yards

Scoring Notes: The response demonstrates a partial understanding of computation with at least one step utilizing a fraction or a decimal and appropriate work for determining how much fencing was not used. However, a rounding error is made when converting footage to yardage of fencing needed for the repair. This rounding error impacts the overall answer so that it is slightly incorrect. The response demonstrates a thorough understanding of the mathematical process with the correct determination of the amount of fencing used, the amount of fencing used for repair factored in, and correct division used in the determination of the fencing used for each garden. This response receives one point for content and two points for process.

Question 1, Sample D – Computation Score Point 1; Process Score Point 1

1 A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?

Show All Work

Answer 60 yards

100 yards

$$5x + 10$$
$$.40 \cdot 100 = 40$$
$$100 - 40 = 60$$
$$.40 \cdot 100 = 40$$
$$100 - 40 = 60$$
$$10 \cdot 3 = 30$$
$$60 - 30 = 30$$
$$30 / 5 = 6$$

Scoring Notes: The response demonstrates a partial understanding of computation with at least one step utilizing a fraction or a decimal and appropriate work for determining how much fencing was used. However, there is not a good conversion from feet to yards. The response demonstrates a partial understanding of the mathematical process with the correct determination of the amount of fencing used, the amount of fencing used for repair factored in, and correct division used in the determination of the fencing used for each garden. However, A transcription error occurs from the last step to the answer line. This response receives one point for content and one point for process.

Question 1, Sample E – Computation Score Point 0; Process Score Point 2

1 A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?

Show All Work

$$\frac{100}{5} = 20$$

$$100(.4) = 40$$
$$\begin{array}{r} 40 \\ -10 \\ \hline 30 \\ \div 5 = 6 \end{array}$$

Answer 6 yards

Scoring Notes: The response demonstrates a limited understanding of computation with at least one step utilizing a fraction or a decimal. However, the response shows how much fencing remains as being the amount of fencing used, and there is not a good conversion from feet to yards. The response demonstrates a thorough understanding of the mathematical process with the correct determination of the amount of fencing used, the amount of fencing used for repair factored in, and correct division used in the determination of the fencing used for each garden. However, this work is based upon the amount of fencing which remains as opposed to the amount that is used. This response receives zero points for content and two points for process.

Question 1, Sample F – Computation Score Point 0; Process Score Point 0

1 A farmer needs to repair and build some fences. She has a roll of fencing that is 100 yards long.

- First, she builds 5 identical fences for her vegetable gardens.
- Next, she uses 10 FEET of the roll to repair a fence.
- After she completes this work, she has 40% of the ORIGINAL roll of fencing left.

What is the length, in YARDS, of fencing used for each vegetable garden?

Show All Work

$$\begin{array}{r} 5x + 10 = 100 \\ -10 \quad -10 \\ \hline \end{array}$$

$$\frac{5x}{5} = \frac{90}{5} \quad x = 18$$

Answer 18 yards

Scoring Notes: The response demonstrates limited or no understanding of computation with an unacceptable fraction provided. The response demonstrates limited or no understanding of the mathematical process with only one of the three process steps shown, the attempt to divide the fencing evenly among the gardens. This response receives zero points for content and zero points for process.

Item #2
Constructed-Response

Constructed-Response
Standard 3: Algebra and Functions
Standard 6: Mathematical Process

Question 2

2. Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation _____

Part C

Solve your equation from Part B.

Show All Work

Answer _____

Exemplary Response:

- Sample Process

Part A

$$3(x - 2) = 3x - 2$$

$$3x - 6 = 3x - 2$$

$$-6 = -2$$

or

$$0 = 4 \text{ (by adding 6 to both sides)}$$

Neither of the last 2 equalities are true.

Therefore there is NO SOLUTION.

OR

- Other valid process

Part B

Write an equation with different slopes then the lines will not be parallel (no solution, like in Part A). Also, one expression is not a multiple of the other (which means the same line and an infinite number of solutions). Avoiding no solutions and infinite solutions while having linear expressions means an intersection of one point.

So, let's try:

$$4x + 7 = 5x - 3$$

- Other valid process

Part C

$$4x + 7 = 5x - 3$$

$$4x + 10 = 5x$$

$$10 = 5x - 4x$$

$$x = 10$$

(value of each side of original equation equals 47 when $x = 10$)

- Other valid process

**Question 2, Sample A – Algebra and Functions Score Point 2;
Process Score Point 2**

Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work

$$\begin{aligned} 3(x-2) &= 3x-2 \\ \underline{3x} - 6 &= \underline{3x} - 2 \\ -6 &\neq -2 \end{aligned}$$

This equation has no solutions because
 $-6 \neq -2$.

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation $4x + 2 = 2x + 2$

Part C

Solve your equation from Part B.

Show All Work

$$\underline{4x} + 2 = \underline{2x} + 2$$

$$\begin{aligned} 2x + 2 &= 2 \\ -2 &\quad -2 \\ \underline{2x} &= \underline{0} \end{aligned}$$

Answer $x = 0$

Scoring Notes: The response indicates a thorough understanding of algebra and functions with the correct conclusion that there are no solutions possible in Part A and with a valid linear equation with one solution showing a variable on each side in Part B. This response demonstrates a thorough understanding of the mathematical process with a correct explanation given in Part A and the equation in Part B correctly solved in Part C. This response receives two points for content and two points for process.

**Question 2, Sample B – Algebra and Functions Score Point 2;
Process Score Point 0**

Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work

$$\begin{array}{r} 3x - 6 = 3x - 2 \\ 6x - 6 = -2 \\ \underline{+6 \quad +6} \\ 6x = 4 \end{array}$$

No, it does not have a solution because 4 can't go into 6.

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation $10x + 10 = 40 + 5x$

Part C

Solve your equation from Part B.

Show All Work

$$\begin{array}{r} 10x + 10 = 40 + 5x \\ 15x + 10 = 40 \quad x = 2 \\ \underline{-10 \quad -10} \\ 15x = 30 \\ \underline{\quad \quad 15} \\ 15x = 30 \\ \underline{\quad \quad 15} \end{array}$$

Answer $x = 2$

Scoring Notes: The response indicates a thorough understanding of algebra and functions with the correct conclusion that there are no solutions possible in Part A and with a valid linear equation with one solution showing a variable on each side in Part B. This response demonstrates little to no understanding of the mathematical process related to the task with an invalid explanation given in Part A and an incorrect solution in Part C of the equation given in Part B. This response receives two points for content and zero points for process.

**Question 2, Sample C – Algebra and Functions Score Point 1;
Process Score Point 1**

Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work

$$\begin{array}{l} 3(x-2) = 3x - 2 \\ 3x - 6 = 3x - 2 \end{array}$$

The answer would be no solutions because
its not the same on both sides.

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation $3x + 5 = 18$

Part C

Solve your equation from Part B.

Show All Work

$$\begin{array}{r} 3x + 5 = 18 \\ -3x \quad -3x \\ \hline 5 = 15 \\ \frac{5}{3} = \frac{15}{3} = 3 \end{array}$$

Answer 3

Scoring Notes: The response indicates a partial understanding of algebra and functions with the correct conclusion that there are no solutions possible in Part A. However, Part B does not show a valid linear equation with one solution and a variable on each side. This response demonstrates a partial understanding of the mathematical process with a correct explanation given in Part A and the equation in Part B correctly solved in Part C, but there is not a variable on both sides. This response receives one point for content and one point for process.

**Question 2, Sample D – Algebra and Functions Score Point 1;
Process Score Point 1**

Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

$$3x - 6 = 3x - 2$$

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work

$$\begin{array}{r} 3x - 6 = 3x - 2 \\ -3x \quad -3x \\ \hline -6 = -2 \end{array}$$

The equation is no solution because
-6 does not equal -2 in any way

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation $7(x+4) = 7(x+4)$

Part C

Solve your equation from Part B.

Show All Work

$$\begin{array}{r} 7(x+4) = 7(x+4) \\ 7x + 28 = 7x + 28 \\ -7x \quad -7x \\ \hline 28 = 28 \end{array}$$

Answer all real numbers

Scoring Notes: The response indicates a partial understanding of algebra and functions with the correct conclusion that there are no solutions possible in Part A. However, Part B does not show a valid linear equation with one solution and a variable on each side. The equation given in Part B has an infinite number of solutions for the variable. This response demonstrates a partial understanding of the mathematical process with a correct explanation given in Part A and the equation in Part B correctly solved in Part C. However, there is not a single solution for the variable in the equation given in Part B and solved in Part C. This response receives one point for content and one point for process.

**Question 2, Sample E – Algebra and Functions Score Point 0;
Process Score Point 0**

Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work $3x-2=3x-2$

If both sides of the equation are the
same there will infinite solutions.

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation $5y = 4x + 20$

Part C

Solve your equation from Part B.

Show All Work

$$(5y = 4x + 20) \div 5$$

Answer $y = \frac{4}{5}x + 4$

Scoring Notes: The response indicates a limited understanding of algebra and functions with an incorrect solution for the equation in Part A and with the equation given in Part B having more than one variable and no variable on both sides of the equation. There is also not just one solution to the equation given in Part B. This response demonstrates no understanding of the mathematical process with an incorrect explanation given in Part A, no single solution found in Part C, and the slope-intercept form of the line written in Part B given in Part C. A line has an infinite number of solutions, not just one solution. This response receives zero points for content and zero points for process.

**Question 2, Sample F – Algebra and Functions Score Point 0;
Process Score Point 0**

Consider the equation.

$$3(x - 2) = 3x - 2$$

Part A

Determine whether the equation has one solution, no solutions, or an infinite number of solutions. Use words, numbers, and/or symbols to justify your answer.

Show All Work

$$3x - 2 = 3x - 2$$

This has infinite solutions.

Part B

Create a linear equation that has one solution. Include the variable on BOTH sides of the equal sign.

Equation $8y = 2x - 4$

Part C

Solve your equation from Part B.

Show All Work

$$\frac{8y}{8} = \frac{2x - 4}{8}$$
$$y = \frac{2}{4}x - \frac{1}{2}$$

Answer $y = \frac{1}{4}x - \frac{1}{2}$

Scoring Notes: The response indicates limited understanding of algebra and functions with an incorrect solution of the equation in Part A and an equation given in Part B that has more than one variable and no variable on both sides of the equation. There is also not just one solution to the equation given in Part B. This response demonstrates no understanding of the mathematical process with an incorrect explanation given in Part A, no single solution found in Part C, and the slope-intercept form of the line written in Part B given in Part C. A line has an infinite number of solutions, not just one solution. This response receives zero points for content and zero points for process.

Item #3
Constructed-Response

Constructed-Response
Standard 5: Data Analysis, Statistics, and Probability
Standard 6: Mathematical Process

Question 3

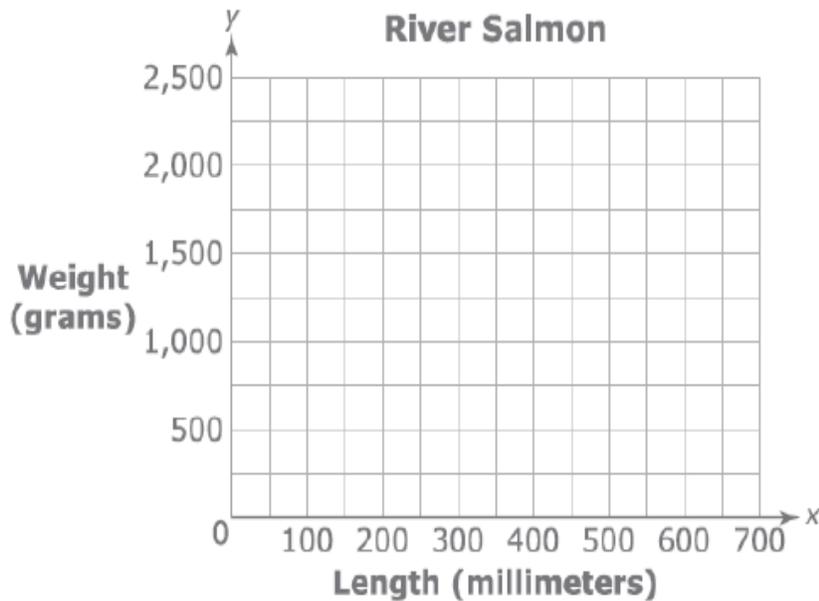
3. A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

Part C

Circle the equation that BEST models the data.

$$y = 5x - 1,000$$

$$y = x - 1,000$$

$$y = -5x + 3,500$$

$$y = -x + 2,000$$

Part D

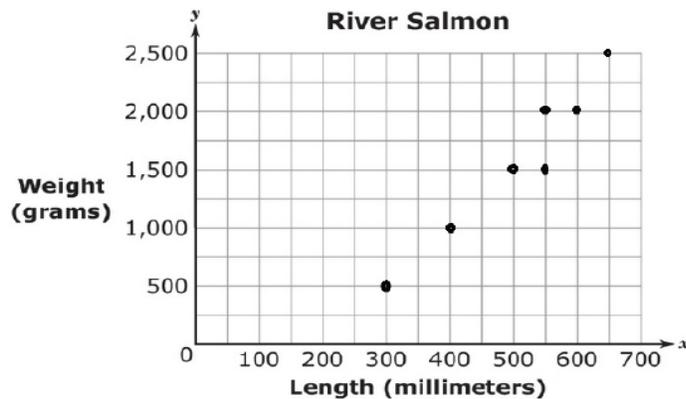
Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work

Answer _____ grams

Exemplary Response:

Part A



Part B

There is a positive linear correlation between the weight of river salmon and their length.

- Sample Process

Between 300 and 400 mm, the weight increases from 500 to 1000 g. So there appears to be a slope of about 5 as $(1000-500)/(400-300) = 500/100 = 5$. This appears to be the case from 400 mm to 500 mm too as the weight increases from 1000 to 1500 g. So $(1500-1000)/(500-400) = 500/100 = 5$. The data does not all lie on the same line. But the slope of a “best fit” line appears to be about 5. Extrapolating that line back to a length of 0 mm from 300 mm represents a decrease in weight of 1500 g from 500 g. (300, 500) is a data point. The slope is approximately equal to 5. So a 300 mm change means a $5 * 300$ or 1500 g change. So this line would have a y-intercept of $500 - 1500 = -1000$. So the “best fit” line’s equation is approximately:
 $y = 5x - 1000$.

OR

- Other valid explanation

AND

$$y = 5(850) - 1000$$

$$y = 4250 - 1000$$

$$y = 3250 \text{ g (weight of the river salmon which is 850 mm in length)}$$

OR

- Other valid process

**Question 3, Sample A – Data Analysis, Statistics, and Probability Score Point 2;
Process Score Point 2**

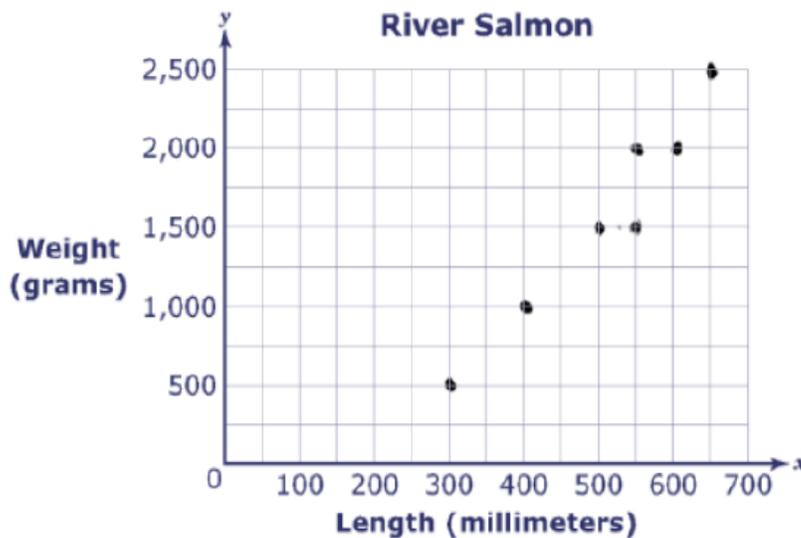
A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

The greater the length, the greater the weight will be.

Part C

Circle the equation that BEST models the data.

$y = 5x - 1,000$ $y = -5x + 3,500$

$y = x - 1,000$ $y = -x + 2,000$

Part D

Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work

$$5 \times 850 - 1000$$

Answer 3250 grams

Scoring Notes: The response indicates a thorough understanding of data analysis, statistics, and probability by accurately plotting all of the points in Part A and providing an appropriate explanation of the relationship between them in Part B. The response demonstrates a thorough understanding of the mathematical process with the correct equation in Part C and using that equation to predict a correct weight in Part D. This response receives two points for content and two points for process.

**Question 3, Sample B – Data Analysis, Statistics, and Probability Score Point 2;
Process Score Point 1**

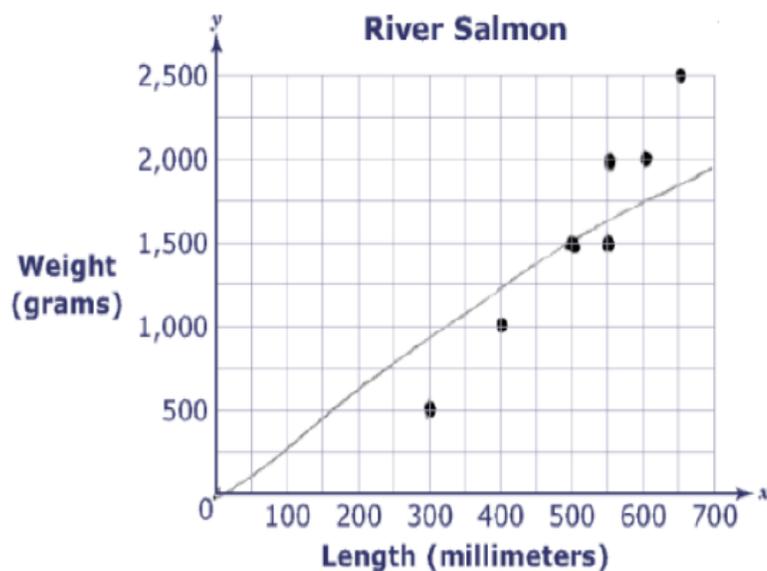
A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

The longer the Salmon is, the more it weighs.

Part C

Circle the equation that BEST models the data.

$y = 5x - 1,000$

$y = -5x + 3,500$

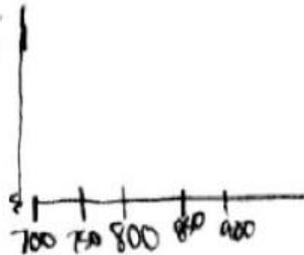
$y = x - 1,000$

$y = -x + 2,000$

Part D

Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work



$5 \cdot 850 - 1000$

Answer 4000 grams

Scoring Notes: The response indicates a thorough understanding of data analysis, statistics, and probability by accurately plotting all of the points in Part A and providing an appropriate explanation of the relationship between them in Part B. The response demonstrates a partial understanding of the mathematical process by finding the correct equation in Part C but incorrectly using that equation to predict the weight in Part D. This response receives two points for content and one point for process.

**Question 3, Sample C – Data Analysis, Statistics, and Probability Score Point 1;
Process Score Point 1**

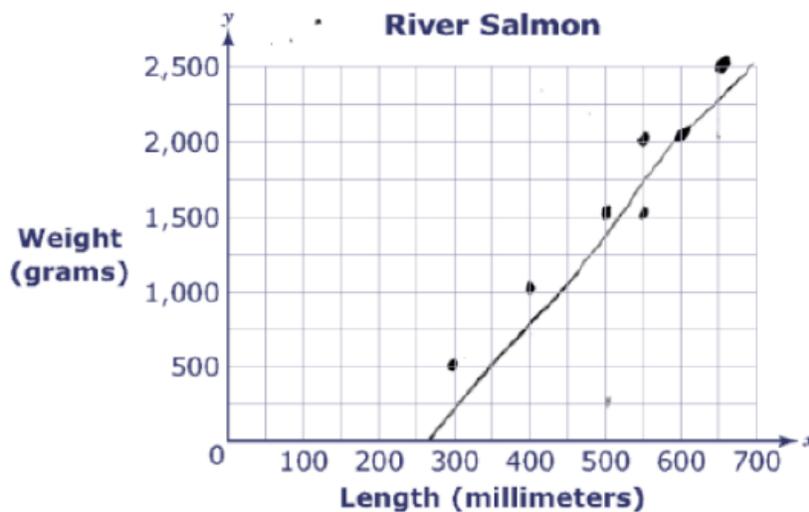
A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

The salmon relates to its length by increasing or doubling the size of the weight.

Part C

Circle the equation that BEST models the data.

$y = 5x - 1,000$

$y = -5x + 3,500$

$y = x - 1,000$

$y = -x + 2,000$

Part D

Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work

$$y = 5x - 1,000$$
$$\frac{y + 1,000}{5} = \frac{5x - 1,000 + 1,000}{5}$$
$$y = 200$$

$$\frac{850}{200} = 650$$

Answer 650 grams

Scoring Notes: The response indicates a partial understanding of data analysis, statistics, and probability by accurately plotting all of the points in Part A but providing an incorrect explanation of the relationship between them in Part B. The response indicates a partial understanding of the mathematical process by finding the correct equation in Part C but incorrectly calculating the predicted weight in Part D. This response receives one point for content and one point for process.

**Question 3, Sample D – Data Analysis, Statistics, and Probability Score Point 1;
Process Score Point 0**

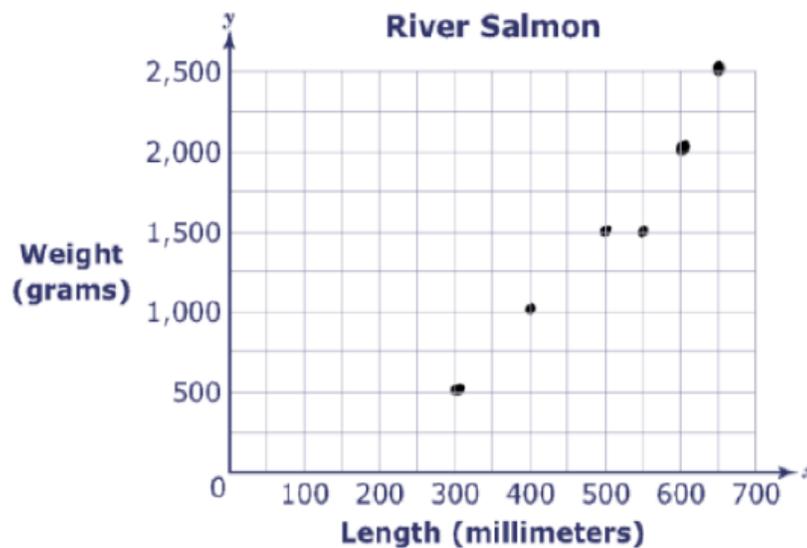
A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

The longer length a salmon is, the more weight it has.

Part C

Circle the equation that BEST models the data.

$$y = 5x - 1,000$$

$$y = -5x + 3,500$$

$$y = x - 1,000$$

$$y = -x + 2,000$$

Part D

Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work

$$\begin{array}{r} 850 = x - 1,000 \\ + 1,000 \quad + 1,000 \\ \hline 1,850 = x \end{array}$$

Answer 1,850 grams

Scoring Notes: The response indicates a partial understanding of data analysis, statistics, and probability by accurately plotting six of the seven points in Part A (one point is not plotted) and providing a correct explanation of the relationship between them in Part B. The response indicates limited or no understanding of the mathematical process by finding an incorrect equation in Part C and incorrectly calculating the predicted weight in Part D. This response receives one point for content and zero points for process.

**Question 3, Sample E – Data Analysis, Statistics, and Probability Score Point 0;
Process Score Point 1**

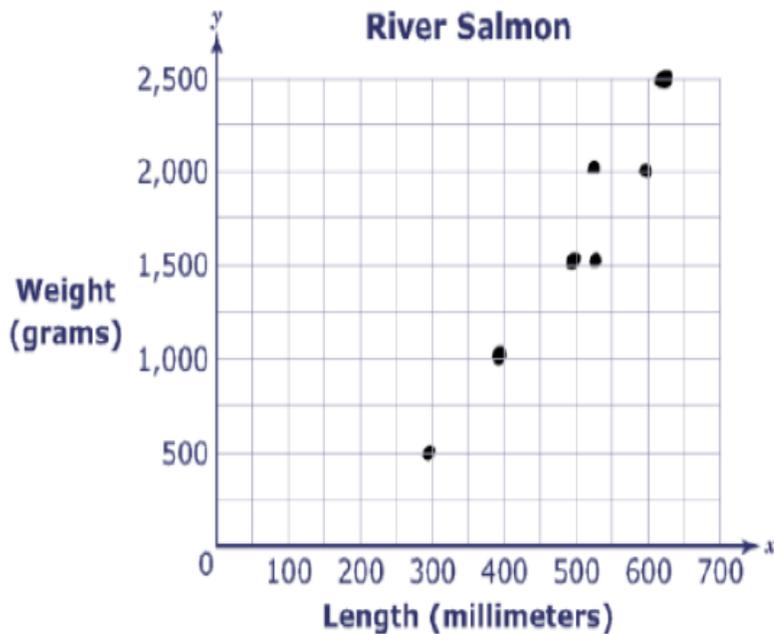
A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

The weight of a salmon relates to its length because the length depends on weight sometimes.

Part C

Circle the equation that BEST models the data.

$y = 5x - 1,000$

$y = -5x + 3,500$

$y = x - 1,000$

$y = -x + 2,000$

Part D

Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work

$$\begin{array}{r|l} y = 5x + 1000 & \\ - 5x & \\ \hline y = & 995 \end{array}$$

Answer 995 grams

Scoring Notes: The response indicates little or no understanding of data analysis, statistics, and probability by accurately plotting only four of the seven points in Part A and providing an incorrect explanation of the relationship between them in Part B. The response indicates partial understanding of the mathematical process by finding the correct equation in Part C but incorrectly calculating the predicted weight in Part D. This response receives zero points for content and one point for process.

**Question 3, Sample E – Data Analysis, Statistics, and Probability Score Point 0;
Process Score Point 0**

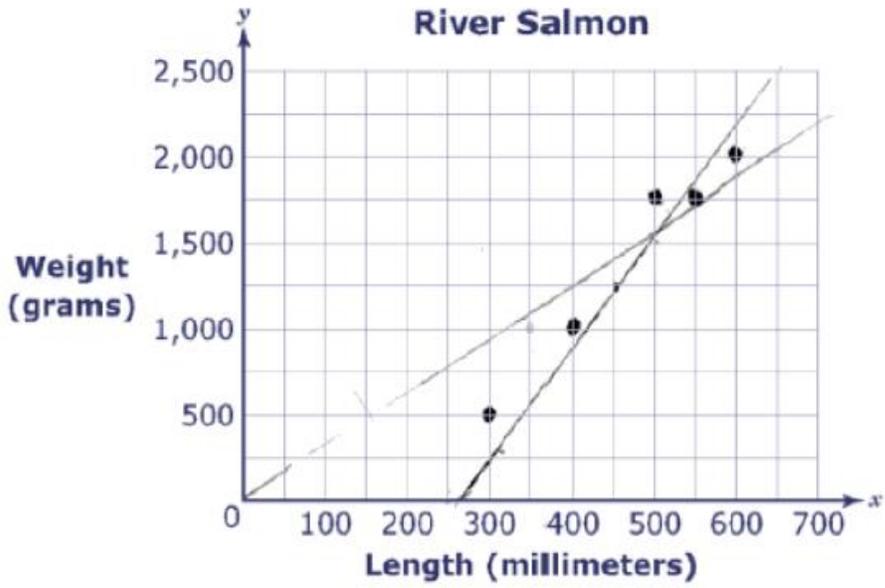
A biologist studied a population of salmon in a river. He recorded the lengths and weights of a group of salmon, as shown in the table.

River Salmon

Length (millimeters)	Weight (grams)
300	500
400	1,000
500	1,500
550	1,500
550	2,000
600	2,000
650	2,500

Part A

On the coordinate grid, create a scatter plot that shows the data the biologist collected.



Part B

Based on the data, describe how the weight of a salmon relates to its length.

They weight varies from the length of the salmon

Part C

Circle the equation that BEST models the data.

$y = 5x - 1,000$

$y = -5x + 3,500$

$y = x - 1,000$

$y = -x + 2,000$

Part D

Use the equation selected in Part C to predict the weight of a salmon, in grams, if the length of the salmon is 850 millimeters.

Show All Work

$y = 5x + 1900$

Answer 3,500 grams

Scoring Notes: The response indicates little or no understanding of data analysis, statistics, and probability by accurately plotting only three of the seven points in Part A and providing an incorrect explanation of the relationship between them in Part B. The response indicates limited or no understanding of the mathematical process by finding an incorrect equation in Part C as well as incorrectly calculating the predicted weight in Part D. This response receives zero points for content and zero points for process.

Item #4
Extended-Response

Extended-Response
Standard 3: Algebra and Functions
Standard 6: Mathematical Process

Question 4

4. During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables _____

Equation _____

Part B

What are the slope and y -intercept in your equation and what do they represent in this situation?

Slope _____

y -intercept _____

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

Answer _____ liters

Exemplary Response:

Part A

Let d = the number of days the water has evaporated from the tank

Let V = the volume (in liters) of the water remaining in the tank after d days of evaporation

$$V = 500 - 2.6d$$

Part B

Slope = -2.6 This represents the daily rate of the water evaporating from the tank. This equals 2.6 liters per day.

y-intercept = 500 This represents how many liters of water are in the tank (500) before any of the evaporation occurs.

- Sample Process:

Part C

$$V = 500 - 2.6d$$

$$V = 500 - 2.6(20)$$

$$V = 500 - 52$$

$$V = 448 \text{ liters}$$

OR

- Other valid process

**Question 4, Sample A – Algebra and Functions Score Point 3;
Process Score Point 3**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables let x = number of days of evaporation
let y = how much water is left

Equation $y = -2.6x + 500$

Part B

What are the slope and y -intercept in your equation and what do they represent in this situation?

Slope The slope is -2.6 and it represents how much water evaporates per day

y -intercept The y -intercept is 500 and it represents the starting amount of water in the tank.

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$\begin{aligned}y &= -2.6x + 500 \\y &= -2.6(20) + 500 \\y &= -52 + 500 \\y &= 448\end{aligned}$$

Answer 448 liters

Scoring Notes: The response indicates a thorough understanding of algebra and functions by giving a correct equation in Part A and describing the slope and y -intercept appropriately in Part B. The response indicates a thorough understanding of the mathematical process by correctly defining the variables in Part A and providing a correct setup and solution to Part C. This response receives three points for content and three points for process.

**Question 4, Sample B – Algebra and Functions Score Point 3;
Process Score Point 2**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables Number of days, Amount of water

Equation $500 - 2.6(d) = w$

Part B

What are the slope and y-intercept in your equation and what do they represent in this situation?

Slope -2.6; this means that everyday the bucket will lose 2.6 liters.

y-intercept 500; this means the bucket starts with 500 liters of rainwater.

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$\begin{array}{r}
 500 - 2.6(20) \\
 \begin{array}{r}
 4910 \\
 500 \\
 -52 \\
 \hline
 448
 \end{array}
 \end{array}$$

Answer 448 liters

Scoring Notes: The response indicates a thorough understanding of algebra and functions by giving a correct equation in Part A and describing the slope and y-intercept appropriately in Part B. The response indicates a partial understanding of the mathematical process by being too vague when defining the variables in Part A but providing a correct setup and solution to Part C. This response receives three points for content and two points for process.

**Question 4, Sample C – Algebra and Functions Score Point 2;
Process Score Point 3**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables let v = volume of water in the tank
let d = # of days water been evaporating

Equation $V = -2.6d + 500$

Part B

What are the slope and y -intercept in your equation and what do they represent in this situation?

Slope The slope 2.6 this represents how many days the water has been evaporating

y -intercept The y -intercept is 500 this is how much water we started out with.

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$\begin{aligned} V &= -2.6d + 500 \\ V &= -2.6(20) + 500 \\ V &= -52 + 500 \\ V &= 448 \end{aligned}$$

Answer 448 liters

Scoring Notes: The response indicates a partial understanding of algebra and functions by giving a correct equation in Part A and an appropriate description of the y -intercept in Part B. However, the description of the slope is incorrect in Part B, and the slope should be negative. The response indicates a thorough understanding of the mathematical process by correctly defining the variables in Part A and providing a correct setup and solution to Part C. This response receives two points for content and three points for process.

**Question 4, Sample D – Algebra and Functions Score Point 2;
Process Score Point 2**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables d = number of days

a = amount of water left

Equation $500 - 2.6d = a$

Part B

What are the slope and y-intercept in your equation and what do they represent in this situation?

Slope The amount of water evaporating per a day.

y-intercept The starting amount of water in the tank.

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$\begin{aligned} 500 - 2.6d &= a \\ 500 - 2.6(20) &= a \\ 500 - 52 &= a \\ 448 &= a \end{aligned}$$

Answer 448 liters

Scoring Notes: The response indicates a partial understanding of algebra and functions by giving a correct equation in Part A and describing the slope and y-intercept appropriately in Part B. However, no values are given for the slope and y-intercept in Part B. The response indicates a partial understanding of the mathematical process by giving vague variable definitions in Part A but providing a correct setup and solution to Part C. This response receives two points for content and two points for process.

**Question 4, Sample E – Algebra and Functions Score Point 1;
Process Score Point 1**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables $S = \text{storm}$

Equation $500 - 2.6 \text{ liter} = S$

Part B

What are the slope and y-intercept in your equation and what do they represent in this situation?

Slope It would be negative 2.6 each day.

y-intercept the y intercept would be 500.

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$\begin{array}{r} 500 \\ - 2.6 \\ \hline \end{array}$$

Answer 448 liters

Scoring Notes: The response indicates a limited understanding of algebra and functions by giving an incorrect equation in Part A and no explanations of what the slope and y-intercept represent in Part B. However, the correct values for slope and y-intercept are given in Part B. The response indicates limited understanding of the mathematical process with incorrect variable definitions in Part A and an incorrect setup in Part C but with a correct solution given in Part C. This response receives one point for content and one point for process.

**Question 4, Sample F – Algebra and Functions Score Point 1;
Process Score Point 0**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables $X = \text{evaporation each day}$

Equation $y = -2.6x + 500$

Part B

What are the slope and y-intercept in your equation and what do they represent in this situation?

Slope $-\frac{2.6}{1}$

y-intercept 500

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$-\frac{2.6}{1} \times 20 = 6.6 \text{ liters}$$

Answer 6.6 liters

Scoring Notes: The response indicates a limited understanding of algebra and functions by giving an incorrect equation in Part A and no explanations of what the slope and y-intercept represent in Part B. However, the correct values for slope and y-intercept are given in Part B based on the incorrect equation from Part A. The response indicates no understanding of the mathematical process by incorrectly defining the variables in Part A and with an incorrect setup and solution in Part C. This response receives one point for content and zero points for process.

**Question 4, Sample G – Algebra and Functions Score Point 0;
Process Score Point 1**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables The amount

Equation $500 = x - 2.6$

Part B

What are the slope and y-intercept in your equation and what do they represent in this situation?

Slope negative slope

y-intercept 500

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work $500 = 20 - 2.6$

Answer 448 liters

Scoring Notes: The response indicates no understanding of algebra and functions by providing an incorrect equation in Part A and an incorrect slope and no explanations for what the slope and y-intercept represent in Part B. However, the correct y-intercept is given in Part B. The response indicates a limited understanding of the mathematical process with vague variable definitions in Part A and an incorrect setup to solve Part C. However, the correct answer for Part C is given. This response receives zero points for content and one point for process.

**Question 4, Sample H – Algebra and Functions Score Point 0;
Process Score Point 0**

During a storm, a 500-liter tank is completely filled with rainwater. After the storm, the water begins to evaporate. The volume of the water decreases by approximately 2.6 liters each day.

Part A

Write an equation to model the relationship between the volume of water in the tank and the number of days the water has been evaporating. Be sure to define your variables.

Define the variables $y =$ the number of days and $x =$
the volume of the water.

Equation $y = x - 2.6$

Part B

What are the slope and y -intercept in your equation and what do they represent in this situation?

Slope The slope is 500

y -intercept The y -intercept is 2.6

Part C

What was the volume of water, in liters, in the tank 20 days after the storm ended?

Show All Work

$$\begin{aligned} y &= x - 2.6 \\ 20 &= x - 2.6 \\ +2.6 & \quad +2.6 \\ 60.0 &= x \end{aligned}$$

Answer 50.0 liters

Scoring Notes: The response indicates no understanding of algebra and functions by providing an incorrect equation in Part A, incorrect values for slope and y -intercept, and no explanations of what the slope and y -intercept represent. The response indicates no understanding of the mathematical process with incorrect variable definitions in Part A and an incorrect setup and solution in Part C. This response receives zero points for content and zero points for process.