



pennsylvania
DEPARTMENT OF EDUCATION



**PENNSYLVANIA
KEYSTONE EXAMS**

Algebra I
Item and Scoring Sampler

2021*

* This is a revised version of the 2017 Item and Scoring Sampler.

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INTRODUCTION

General Introduction

The Pennsylvania Department of Education (PDE) provides districts and schools with tools to assist in delivering focused instructional programs aligned to the Pennsylvania Core Standards. These tools include the standards, assessment anchor documents, Keystone Exams Test Definition, Classroom Diagnostic Tool, Standards Aligned System, and content-based item and scoring samplers. This 2021 Algebra I Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing students for the Keystone Exams by providing samples of test item types and scored student responses. The Item Sampler is not designed to be used as a pretest, a curriculum, or other benchmark for operational testing.

This Item and Scoring Sampler contains released operational multiple-choice and constructed-response items that have appeared on previously administered Keystone Exams. These items will not appear on any future Keystone Exams. Released items provide an idea of the types of items that have appeared on operational exams and that will appear on future operational Keystone Exams. Each item has been through a rigorous review process to ensure alignment with the Assessment Anchors and Eligible Content. This sampler includes items that measure a variety of Assessment Anchor or Eligible Content statements, but it does not include sample items for all Assessment Anchor or Eligible Content statements.

Typically an item and scoring sampler is released every year to provide students and educators with a resource to assist in delivering focused instructional programs aligned to the PCS. However, due to the cancellation of standardized testing in 2019–2020, the 2021 Item and Scoring Sampler is a revised version of the previously released 2017 Item and Scoring Sampler. This revised version ensures that students and educators have an enhanced item and scoring sampler to use during instruction and/or preparation of students to take the Keystone Exam.

The items in this sampler may be used¹ as samples of item types that students will encounter in operational testing. Classroom teachers may find it beneficial to have students respond to the constructed-response items in this sampler. Educators can then use the sampler as a guide to score the responses either independently or together with colleagues.

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

ABOUT THE KEYSTONE EXAMS

The Keystone Exams are end-of-course assessments currently designed to assess proficiencies in Algebra I, Biology, and Literature. For detailed information about how the Keystone Exams are being integrated into the Pennsylvania graduation requirements, please contact the Pennsylvania Department of Education or visit the PDE website at <http://www.education.pa.gov>.

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Alignment

The Algebra I Keystone Exam consists of questions grouped into **two modules**:

Module 1—Operations and Linear Equations & Inequalities and Module 2—Linear Functions and Data Organizations. Each module corresponds to specific content, aligned to statements and specifications included in the course-specific Assessment Anchor documents. The Algebra I content included in the Keystone Algebra I multiple-choice items will align with the Assessment Anchors as defined by the Eligible Content statements. The process skills, directives, and action statements will also specifically align with the Assessment Anchors as defined by the Eligible Content statements.

The content included in Algebra I constructed-response items aligns with content included in the Eligible Content statements. The process skills, directives, and action statements included in the performance demands of the Algebra I constructed-response items align with specifications included in the Assessment Anchor statements, the Anchor Descriptor statements, and/or the Eligible Content statements. In other words, the verbs or action statements used in the constructed-response items or stems can come from the Eligible Content, Anchor Descriptor, or Assessment Anchor statements.

Depth of Knowledge

Webb’s Depth of Knowledge (DOK) was created by Dr. Norman Webb of the Wisconsin Center for Education Research. Webb’s definition of depth of knowledge is the cognitive expectation demanded by standards, curricular activities, and assessment tasks. Webb’s DOK includes four levels, from the lowest (basic recall) level to the highest (extended thinking) level.

Depth of Knowledge	
Level 1	Recall
Level 2	Basic Application of Skill/Concept
Level 3	Strategic Thinking
Level 4	Extended Thinking

Each Keystone item has been through a rigorous review process and is assigned a DOK level. For additional information about depth of knowledge, please visit the PDE website at http://static.pdesas.org/content/documents/Keystone_Exams_Understanding_Depth_of_Knowledge_and_Cognitive_Complexity.pdf.

Exam Format

The Keystone Exams are delivered in a paper-and-pencil format as well as in a computer-based online format. The multiple-choice items require students to select the best answer from four possible answer options and record their answers in the spaces provided. The correct answer for each multiple-choice item is worth one point. The constructed-response items require students to develop and write (or construct) their responses. Constructed-response items in Algebra I are scored using item-specific scoring guidelines based on a 0–4-point scale. Each multiple-choice item is designed to take about one to one-and-a-half minutes to complete. Each constructed-response item is designed to take about 10 minutes to complete. The estimated time to respond to a test question is the same for both test formats. During an actual exam administration, students are given additional time as necessary to complete the exam.

ITEM AND SCORING SAMPLER FORMAT

This sampler includes the test directions, scoring guidelines, and formula sheet that appear in the Keystone Exams. Each sample multiple-choice item is followed by a table that includes the alignment, the answer key, the DOK, the percentage² of students who chose each answer option, and a brief answer option analysis or rationale. Each constructed-response item is followed by a table that includes the alignment, the DOK, 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 Algebra I* used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs.

Example Multiple-Choice Item Information Table

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

Example Constructed-Response Item Information Table

Alignment	Assigned AAEC	Depth of Knowledge	Assigned DOK	Mean Score	
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² All *p*-value percentages listed in the item information tables have been rounded.

ALGEBRA I EXAM DIRECTIONS

Directions:

Below are the exam directions available to students. These directions may be used to help students navigate through the exam.

Formulas that you may need to solve questions in this module are found on page 7 of this test booklet. You may refer to the formula page at any time during the exam.

You may use a calculator on this module. When performing operations with π (pi), you may use either calculator π or the number 3.14 as an approximation of π .

There are two types of questions in each module.

Multiple-Choice Questions:

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

- First read the question and solve the problem on scratch paper. Then choose the correct answer.
- Only one of the answers provided is correct.
- If none of the choices matches your answer, go back and check your work for possible errors.
- Record your answer in the Algebra I answer booklet.

Constructed-Response Questions:

These questions will require you to write your response.

- These questions have more than one part. Be sure to read the directions carefully.
- You cannot receive the highest score for a constructed-response question without completing all the tasks in the question.
- If the question asks you to show your work or explain your reasoning, be sure to show your work or explain your reasoning. However, not all questions will require that you show your work or explain your reasoning. If the question does not require that you show your work or explain your reasoning, you may use the space provided for your work or reasoning, but the work or reasoning will not be scored.
- All responses must be written in the appropriate location within the response box in the Algebra I answer booklet. Some answers may require graphing, plotting, labeling, drawing, or shading. If you use scratch paper to write your draft, be sure to transfer your final response to the Algebra I answer booklet.

If you finish early, you may check your work in Module 1 [or Module 2] only.

- Do not look ahead at the questions in Module 2 [or back at the questions in Module 1] of your exam materials.
- After you have checked your work, close your exam materials.

You may refer to this page at any time during this portion of the exam.

GENERAL DESCRIPTION OF SCORING GUIDELINES FOR ALGEBRA I

4 Points

- 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 Points

- 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 Points

- 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 Point

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

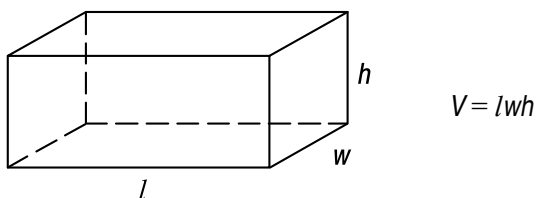
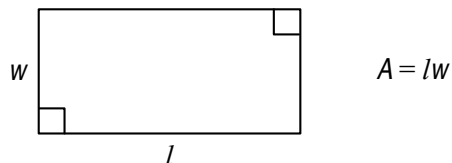
0 Points

- The response has no correct answer and *insufficient* evidence to demonstrate any understanding of the mathematical concepts and procedures required by the task.

FORMULA SHEET

ALGEBRA I FORMULA SHEET

Formulas that you may need to solve questions on this exam are found below.
 You may use calculator π or the number 3.14 as an approximation of π .



Linear Equations

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

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

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

Standard Equation of a Line: $Ax + By = C$

Arithmetic Properties

Additive Inverse: $a + (-a) = 0$

Multiplicative Inverse: $a \cdot \frac{1}{a} = 1$

Commutative Property: $a + b = b + a$
 $a \cdot b = b \cdot a$

Associative Property: $(a + b) + c = a + (b + c)$
 $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Identity Property: $a + 0 = a$
 $a \cdot 1 = a$

Distributive Property: $a \cdot (b + c) = a \cdot b + a \cdot c$

Multiplicative Property of Zero: $a \cdot 0 = 0$

Additive Property of Equality:
 If $a = b$, then $a + c = b + c$

Multiplicative Property of Equality:
 If $a = b$, then $a \cdot c = b \cdot c$

ALGEBRA I MODULE 1

MULTIPLE-CHOICE ITEMS

1. Four expressions are shown below.

$$\sqrt{x} \quad x^2 \quad \frac{1}{x} \quad \frac{x}{2}$$

Which inequality comparing two of the expressions is true when $0.1 \leq x \leq 0.4$?

A. $\sqrt{x} > x^2$

B. $x^2 > \frac{x}{2}$

C. $x > \frac{1}{x}$

D. $\frac{x}{2} > \frac{1}{x}$

Item Information	
Alignment	A1.1.1.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	33% (correct answer)
p-value B	29%
p-value C	18%
p-value D	20%
Option Annotations	<p>A student could determine the correct answer, option A, by substituting 0.1 in for x. Of the given answer choices, only option A is true at 0.1.</p> <p>A student could arrive at an incorrect answer by using one or more test values outside the given range. For example, the student could arrive at option B by testing values greater than 0.5.</p>

2. The greatest common factor (GCF) of x^3y^k and $x^{2k}y^4$ is x^3y^3 . What is the value of k ?
- A. 1
- B. 2
- C. 3
- D. 4

Item Information	
Alignment	A1.1.1.2.1
Answer Key	C
Depth of Knowledge	2
p-value A	26%
p-value B	15%
p-value C	52% (correct answer)
p-value D	7%
Option Annotations	<p>A student could determine the correct answer, option C, by determining that 3 must be the minimum exponent of y (i.e., the minimum of k and 4), which means the value of k must be 3.</p> <p>A student could arrive at an incorrect answer by applying incorrect reasoning about the GCF of monomials. For example, a student could arrive at option A by interpreting the exponents of y to mean $4 - k = 3$.</p>

3. Which equation correctly shows that $(x^2)^4 = x^8$?

A. $(x^2)^4 = (x^2)(x^4) = x^8$

B. $(x^2)^4 = 4(2x) = 8x = x^8$

C. $(x^2)^4 = 4(x^2) = x^2 + x^2 + x^2 + x^2 = x^8$

D. $(x^2)^4 = (x^2)(x^2)(x^2)(x^2) = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^8$

Item Information	
Alignment	A1.1.1.3.1
Answer Key	D
Depth of Knowledge	1
p-value A	27%
p-value B	6%
p-value C	9%
p-value D	58% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by applying the properties of exponents. Of the given answer choices, only $(x^2)^4 = (x^2)(x^2)(x^2)(x^2) = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^8$ correctly follows the properties of exponents.</p> <p>A student could arrive at an incorrect answer by incorrectly applying the properties of exponents. For example, a student could arrive at option A by interpreting a coefficient to a power times the same coefficient to a power as meaning that the two exponents can be multiplied to generate an equivalent value.</p>

4. When factored completely, which is a factor of $6x^3 - 12x^2 - 48x$?
- A. $(x + 2)$
 - B. $(x + 4)$
 - C. $(2x - 3)$
 - D. $(2x - 4)$

Item Information	
Alignment	A1.1.1.5.2
Answer Key	A
Depth of Knowledge	1
p-value A	35% (correct answer)
p-value B	16%
p-value C	25%
p-value D	24%
Option Annotations	<p>A student could determine the correct answer, option A, by factoring the given expression: $6x^3 - 12x^2 - 48x = 6x(x^2 - 2x - 8) = 6x(x + 2)(x - 4)$. Of the given answer options, only $(x + 2)$ is one of the factors of the original expression.</p> <p>A student could arrive at an incorrect answer by incorrectly factoring the given expression. For example, a student could arrive at option C by factoring out $2x$ from each term and subtracting the coefficient of x^2 from $2x$.</p>

5. Anna's Bakery charges a delivery fee of \$10.95 for one delivery order of cupcakes. Each cupcake in the order costs \$1.15. Which equation describes the relationship between the number of cupcakes ordered (x) and the total cost (y), in dollars, of the delivery order?
- A. $y = 1.15x$
- B. $y = 12.10x$
- C. $y = 1.15x + 10.95$
- D. $y = 10.95x + 1.15$

Item Information	
Alignment	A1.1.2.1.1
Answer Key	C
Depth of Knowledge	2
p -value A	6%
p -value B	4%
p -value C	82% (correct answer)
p -value D	8%
Option Annotations	<p>A student could determine the correct answer, option C, by reasoning that the total cost is equal to the price per cupcake times the number of cupcakes plus the delivery fee. Of the given answer options, only $y = 1.15x + 10.95$ matches this description.</p> <p>A student could arrive at an incorrect answer by incorrectly interpreting the meaning of the delivery fee and the cost per cupcake. For example, a student could arrive at option D by switching the meaning of the two values, multiplying the number of cupcakes by the delivery fee and adding the cost per cupcake one time.</p>

6. Kylie and Rhoda are solving the equation $4(x - 8) = 7(x - 4)$.
- Kylie uses a first step that results in $4x - 32 = 7x - 28$.
 - Rhoda uses a first step that results in $4x - 8 = 7x - 4$.

Which statement about the first steps Kylie and Rhoda use is true?

- A. Kylie uses the associative property, resulting in a correct first step.
- B. Kylie uses the distributive property, resulting in a correct first step.
- C. Rhoda uses the associative property, resulting in a correct first step.
- D. Rhoda uses the distributive property, resulting in a correct first step.

Item Information	
Alignment	A1.1.2.1.2
Answer Key	B
Depth of Knowledge	1
p-value A	7%
p-value B	84% (correct answer)
p-value C	5%
p-value D	4%
Option Annotations	<p>A student could arrive at the correct answer, option B, by correctly distributing both sides of the given equation to $4x - 32 = 7x - 28$ and correctly identifying the property used to justify this step as the distributive property.</p> <p>A student could arrive at an incorrect answer by incorrectly identifying the property being used. For example, a student could arrive at option A by recognizing that Kylie uses a correct first step but using the incorrect property to explain why the step is correct.</p>

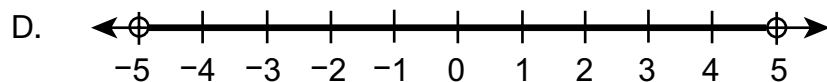
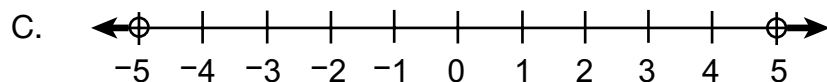
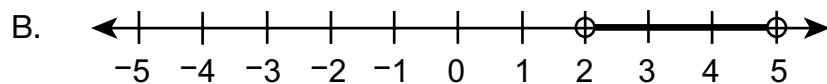
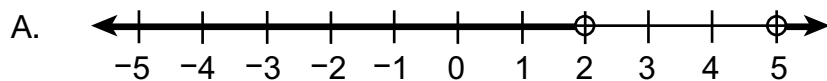
7. Darlene is collecting prize tickets. The equation $y = 2x + 1$ describes the relationship between the number of days (x) since she began collecting and the number of prize tickets (y) she has collected. Which statement correctly describes a solution of the equation?
- A. Darlene has collected 2 prize tickets at the end of 1 day.
 - B. Darlene has collected 4 prize tickets at the end of 9 days.
 - C. Darlene has collected 22 prize tickets at the end of 10 days.
 - D. Darlene has collected 25 prize tickets at the end of 12 days.

Item Information	
Alignment	A1.1.2.1.3
Answer Key	D
Depth of Knowledge	2
p -value A	27%
p -value B	12%
p -value C	7%
p -value D	54% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by substituting the given numbers of days for x in the given equation and determining which number of days is correctly paired with a number of tickets. Of the given answer options, only option D gives a correct pair: $2(12) + 1 = 25$.</p> <p>A student could arrive at the incorrect answer by incorrectly interpreting the given equation. For example, a student could arrive at option A by substituting 1 for x and not adding the 1 because only one day has passed.</p>

8. Mary measured the heights of two different plants every day. Plant A was 1 inch tall when Mary began her measuring, and it grew 0.5 inch per day. Plant B was 3 inches tall, and it grew 0.25 inch per day. On which day were plant A and plant B the same height?
- A. day 5
 - B. day 8
 - C. day 12
 - D. day 16

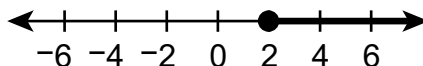
Item Information	
Alignment	A1.1.2.2.1
Answer Key	B
Depth of Knowledge	2
p-value A	9%
p-value B	75% (correct answer)
p-value C	11%
p-value D	5%
Option Annotations	<p>A student could determine the correct answer, option B, by creating expressions for the height of each plant after x days ($1 + 0.5x$ and $3 + 0.25x$), setting the two expressions equal to each other ($1 + 0.5x = 3 + 0.25x$), and then solving for x ($0.25x = 2$; $x = 8$).</p> <p>A student could arrive at an incorrect answer by using an incorrect starting height. For example, a student could arrive at option C by leaving out the 1 inch starting height of the first plant, treating the situation as if the first plant started with a height of 0 inches.</p>

9. Which graph shows the solution set of the inequality $|2x - 7| > 3$?



Item Information	
Alignment	A1.1.3.1.1
Answer Key	A
Depth of Knowledge	1
p-value A	43% (correct answer)
p-value B	27%
p-value C	19%
p-value D	11%
Option Annotations	<p>A student could determine the correct answer, option A, by converting the given inequality to a pair of inequalities ($2x - 7 > 3$ or $2x - 7 < -3$), then solving both inequalities for x ($2x > 10$, so $x > 5$; $2x < 4$, so $x < 2$), and correctly identifying the corresponding graph on the number lines.</p> <p>A student could arrive at an incorrect answer by converting the given inequality to a compound inequality using the same operator for both comparisons. For example, a student could arrive at option B by changing the given inequality to a compound inequality using only less than comparisons ($-3 < 2x - 7 < 3$).</p>

10. The solution set of an inequality is shown below.



Which inequality has the solution set shown in the graph?

A. $-\frac{x}{4} \geq -\frac{1}{2}$

B. $-\frac{x}{4} \geq \frac{1}{2}$

C. $\frac{x}{4} \geq -\frac{1}{2}$

D. $\frac{x}{4} \geq \frac{1}{2}$

Item Information	
Alignment	A1.1.3.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	11%
p-value B	10%
p-value C	12%
p-value D	67% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by solving the inequalities in the answer options. Of the given answer options, only option D results in an inequality that matches the inequality shown on the number line (by multiplying both sides by 4, arrive at $x \geq 2$).</p> <p>A student could arrive at an incorrect answer by incorrectly working with negative signs. For example, a student could arrive at option A by multiplying both sides of the inequality by -1 but not reversing the inequality in the process.</p>

11. A T-shirt company has a goal to earn a monthly profit of more than \$3,500.

- The company charges \$20 per T-shirt.
- The company has \$1,500 in monthly costs.

The inequality $20x - 1,500 > 3,500$ models this situation. Which **best** describes the meaning of x in the inequality?

- the profit made from the sale of 20 T-shirts
- the profit made from 1 month of T-shirt sales
- the number of T-shirts that need to be sold for the company to meet its goal
- the number of T-shirts that need to be sold for the company to recover its monthly costs

Item Information	
Alignment	A1.1.3.1.3
Answer Key	C
Depth of Knowledge	2
p -value A	8%
p -value B	9%
p -value C	68% (correct answer)
p -value D	15%
Option Annotations	<p>A student could determine the correct answer, option C, by correctly interpreting the inequality. The 20 represents the sale price of each T-shirt, the x represents the number of T-shirts sold, the 1,500 represents the monthly costs, and the 3,500 represents the goal. When assembled into the inequality, x represents the number of T-shirts that need to be sold to meet the goal.</p> <p>A student could arrive at an incorrect answer by misinterpreting the meaning of the inequality. For example, a student could arrive at option D by interpreting the inequality as representing the point where expenses are equal to income.</p>

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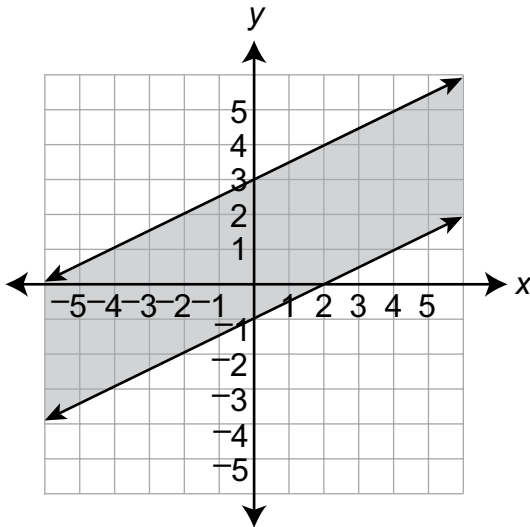
12. A system of inequalities is shown below.

$$y \leq -\frac{1}{2}x + 3$$

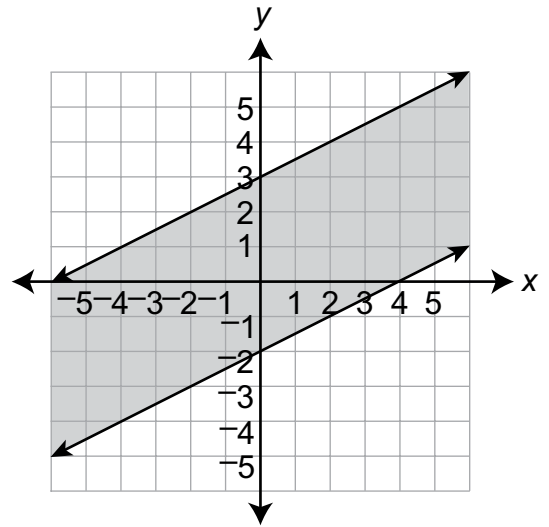
$$x + 2y \geq -2$$

Which graph represents the system?

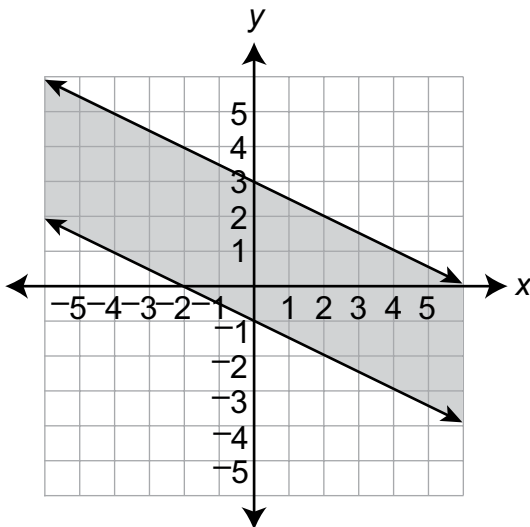
A.



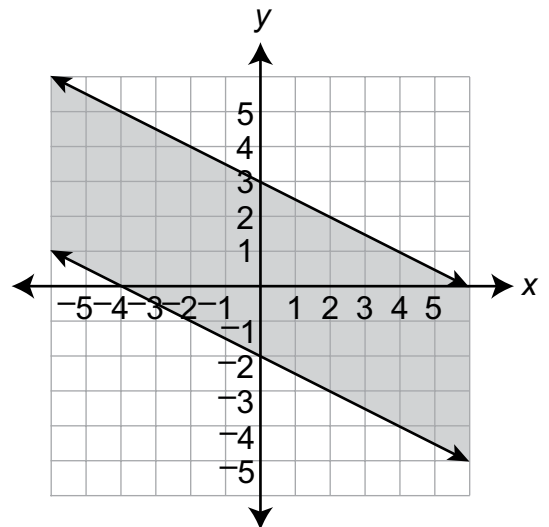
B.



C.



D.



Item Information	
Alignment	A1.1.3.2.1
Answer Key	C
Depth of Knowledge	2
p-value A	15%
p-value B	18%
p-value C	42% (correct answer)
p-value D	25%
Option Annotations	<p>A student could determine the correct answer, option C, by determining that the boundary lines of the solution are $y = \frac{-1}{2}x + 3$ and $y = \frac{-1}{2}x - 1$. Of the given answer options, only option C has these as the boundary lines of the solution region.</p> <p>A student could arrive at an incorrect answer by incorrectly determining the y-intercept for one of the boundary equations. For example, a student could arrive at option D by using -2 as the y-intercept of the second equation.</p>

CONSTRUCTED-RESPONSE ITEM

13. Small baskets of tomatoes are sold at a vegetable stand for \$3 per basket. Large baskets of tomatoes are sold at the stand for \$5 per basket. Only whole numbers of baskets may be purchased.

A customer purchases a total of 8 baskets of tomatoes and pays \$36.

- A. Write and solve a system of equations that models the number of small baskets (x) and the number of large baskets (y) that the customer purchases. Show or explain all your work.

Go to the next page to finish question 13.



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

Another customer claims that he can purchase a total of 10 baskets of tomatoes and pay \$45.

- B.** Use a system of equations that describes this other customer's purchase to explain why the claim is incorrect.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



Item-Specific Scoring Guideline

#13 Item Information

Alignment	A1.1.2	Depth of Knowledge	2	Mean Score	1.58
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Assessment Anchor this item will be reported under:

A1.1.2—Linear Equations

Specific Anchor Descriptor addressed by this item:

A1.1.2.2—Write, solve, and/or graph systems of linear equations using various methods.

Scoring Guide

Score	Description
4	The student demonstrates a thorough understanding of linear equations by correctly solving problems with clear and complete procedures and explanations when required.
3	The student demonstrates a general understanding of linear equations by solving problems and providing procedures and explanations with only minor errors or omissions.
2	The student demonstrates a partial understanding of linear equations by providing a portion of the correct problem solving, procedures, and explanations.
1	The student demonstrates a minimal understanding of linear equations.
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 linear equations.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Top-Scoring Response

Part A (3 points):

$\frac{1}{2}$ point for each correct equation

$\frac{1}{2}$ point for each correct value of the solution

OR $\frac{1}{2}$ point for embedded solution

1 point for complete support

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

What?	Why?
<p> $x + y = 8$ $3x + 5y = 36$ </p> <p>AND</p> <p> $x = 2$ (small baskets) $y = 6$ (large baskets) </p>	<p>Sample Work:</p> $\begin{array}{rcl} x + y = 8 & & \\ 3x + 5y = 36 & \rightarrow & \begin{array}{l} x = 8 - y \\ 3x + 5y = 36 \end{array} \end{array}$ $\begin{array}{rcl} 3(8 - y) + 5y = 36 & & \\ 24 - 3y + 5y = 36 & \rightarrow & \begin{array}{l} x + 6 = 8 \\ x = 2 \end{array} \\ 2y = 12 & & \\ y = 6 & & \end{array}$ <p>OR</p> <p>Sample Explanation:</p> <p>First, I set up my system of equations.</p> $\begin{array}{l} x + y = 8 \\ 3x + 5y = 36 \end{array}$ <p>I then multiplied the first row by 5 and the second row by -1, so I could add them together and cancel out the y-terms. This gave me $2x = 4$, so $x = 2$. I substituted this value into the first equation and solved it for y to get $y = 6$.</p>

Part B (1 point):

1 point for correct and complete explanation

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

What?	Why?
	<p>Sample Explanation:</p> <p>The system of equations that describes this other customer's purchase is shown.</p> $x + y = 10$ $3x + 5y = 45$ <p>The solution of this system of equations exists, but neither x nor y is a whole number, so the customer cannot purchase 10 baskets of tomatoes for \$45.</p>

STUDENT RESPONSE

Response Score: 4 points



PARTS A AND B

Question 13
Page 1

Item ID

Small baskets of tomatoes are sold at a vegetable stand for \$3 per basket. Large baskets of tomatoes are sold at the stand for \$5 per basket. Only whole numbers of baskets may be purchased.

A customer purchases a total of 8 baskets of tomatoes and pays \$36.

A. Write and solve a system of equations that models the number of small baskets (x) and the number of large baskets (y) that the customer purchases. Show or explain all your work.

Eq

$$\begin{array}{rcl} 3x + 5y = 36 & x = 8 - y & 3(8 - y) + 5y = 36 \\ x + y = 8 & & 24 - 3y + 5y = 36 \\ & & 24 + 2y = 36 \\ & & 2y = 12 \\ & & y = 6 \end{array}$$

The student has written a system of equations ($3x + 5y = 36$ and $x + y = 8$) and solved the system of equations that models the number of small and large baskets (this is seen twice; either is acceptable: $y = 6$ and $x = 2$ AND the customer bought 2 small baskets of tomatoes and 6 large baskets of tomatoes). The student also demonstrates complete support by showing the work necessary to arrive at the solutions to both equations. [3 points]

The customer bought 2 small baskets of tomatoes and 6 large baskets of tomatoes.

237 / 1000

Another customer claims that he can purchase a total of 10 baskets of tomatoes and pay \$45.

B. Use a system of equations that describes this other customer's purchase to explain why the claim is incorrect.

Eq

$$\begin{array}{rcl} x + y = 10 & 3(10 - y) + 5y = 45 & 2y = 15 \\ 3x + 5y = 45 & 30 - 3y + 5y = 45 & y = 7.5 \\ x = 10 - y & 30 + 2y = 45 & x = 2.5 \end{array}$$

This other customer's claim is incorrect because in order for it to be true, he would have had to buy 2.5 baskets of tomatoes and 7.5 large baskets of tomatoes. However, this is not possible because only whole numbers of baskets may be purchased.

380 / 1000

The student has provided a correct and complete explanation using a system of equations to explain why the claim is incorrect (he would have had to buy 2.5 baskets of tomatoes and 7.5 large baskets of tomatoes. However, this is not possible because only whole numbers of baskets may be purchased). The system of equations shown ($x + y = 10$ and $3x + 5y = 45$) is not required in the explanation, but a minimum must be implied. [1 point]

Review/End Test

Pause

Flag

STUDENT RESPONSE

Response Score: 3 points

13. Small baskets of tomatoes are sold at a vegetable stand for \$3 per basket. Large baskets of tomatoes are sold at the stand for \$5 per basket. Only whole numbers of baskets may be purchased.

A customer purchases a total of 8 baskets of tomatoes and pays \$36.

- A. Write and solve a system of equations that models the number of small baskets (x) and the number of large baskets (y) that the customer purchases. Show or explain all your work.

$$\$3x^{(2)} + \$5y^{(6)} = \$36$$

$$\begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 5 \\ \times 6 \\ \hline 30 \end{array}$$

$$\begin{array}{r} 30 \\ + 6 \\ \hline 36 \end{array}$$

2 small baskets
6 large baskets

The student has provided one correct equation ($3x + 5y = 36$), both correct values of the solution (2 small baskets, 6 large baskets), and correct but incomplete support: the support shows that the solution works for the equation given ($5 \times 6 + 3 \times 2 = 36$) but does not show how the solution was determined. [2 points]

Go to the next page to finish question 13.



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

Another customer claims that he can purchase a total of 10 baskets of tomatoes and pay \$45.

- B. Use a system of equations that describes this other customer's purchase to explain why the claim is incorrect.

5,5
6,4
7,3
8,2
9,1

$$\$3x + \$5y = \$45$$

This customer's claim is incorrect because if you plug in any pair of numbers adding up to 10 and plugging them into (x) and (y) , you couldn't get 45. To get ~~45~~ this number, you would have to plug in decimals, but you could only use whole numbers.

The student has provided a correct and complete explanation using a system of equations to explain why the claim is incorrect (*to get this number, you would have to plug in decimals, but you could only use whole numbers*). The $x + y = 10$ portion of the system of equations is sufficiently implied (*if you plug in any pair of numbers adding up to 10 and plugging them into (x) and (y) you couldn't get 45*). [1 point]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 2 points



PARTS A AND B

Question 13
Page 1

Item ID

X+Y

Line Guide

Small baskets of tomatoes are sold at a vegetable stand for \$3 per basket. Large baskets of tomatoes are sold at the stand for \$5 per basket. Only whole numbers of baskets may be purchased.

A customer purchases a total of 8 baskets of tomatoes and pays \$36.

A. Write and solve a system of equations that models the number of small baskets (x) and the number of large baskets (y) that the customer purchases. Show or explain all your work.

Eq

$$5x + 3y + 3 \times 2 = 36$$

$$6 + 2 = 8$$

(2,6)

23 / 1000

The student has not provided a correct system of equations but has provided a correct solution (2,6) and correct but incomplete support: the support shows that the solution works ($5 \times 6 + 3 \times 2 = 36$ and $6 + 2 = 8$) but does not show how the solution was determined. [1.5 points]

Another customer claims that he can purchase a total of 10 baskets of tomatoes and pay \$45.

B. Use a system of equations that describes this other customer's purchase to explain why the claim is incorrect.

Eq

$$x + y = 10$$

$$3x + 5y = 45$$

15 / 1000

The student has provided a correct but incomplete explanation. A correct system of equations is shown, but there is no explanation why the claim will not work for this system. [0.5 points]

Next

Review/End Test

Pause

Flag

Options

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STUDENT RESPONSE

Response Score: 1 point

13. Small baskets of tomatoes are sold at a vegetable stand for \$3 per basket. Large baskets of tomatoes are sold at the stand for \$5 per basket. Only whole numbers of baskets may be purchased.

A customer purchases a total of 8 baskets of tomatoes and pays \$36.

- A. Write and solve a system of equations that models the number of small baskets (x) and the number of large baskets (y) that the customer purchases. Show or explain all your work.

$$3x + 5y = 36$$

$$\frac{3x}{3} = \frac{36}{3}$$
$$x = 12$$

$$\frac{5y}{5} = \frac{36}{5}$$

$$y = 7.1$$

The student has provided one correct equation ($3x + 5y = 36$), an incorrect solution ($x = 12, y = 7.1$), and incorrect support. The incorrect support sets $3x$ and $5y$ separately to 36 and attempts to solve for x and y . [0.5 points]

Go to the next page to finish question 13.



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

Another customer claims that he can purchase a total of 10 baskets of tomatoes and pay \$45.

- B. Use a system of equations that describes this other customer's purchase to explain why the claim is incorrect.

$$3x = 5y = 45$$

$$\frac{3x}{3} = \frac{45}{3}$$

$$x = 15$$

$$\frac{5y}{5} = \frac{45}{5}$$

$$5y = 9$$

$$3 \times 15 + 5 \times 9 = 105$$

The student has provided an incorrect explanation that shows no understanding of using a system of equations that describes the other customer's purchase to explain why the claim is incorrect. [0 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 0 points



PARTS A AND B

Question 13
Page 1

Item ID

X+Y

Line Guide

Small baskets of tomatoes are sold at a vegetable stand for \$3 per basket. Large baskets of tomatoes are sold at the stand for \$5 per basket. Only whole numbers of baskets may be purchased.

A customer purchases a total of 8 baskets of tomatoes and pays \$36.

A. Write and solve a system of equations that models the number of small baskets (x) and the number of large baskets (y) that the customer purchases. Show or explain all your work.

EG

$(x)(y) = 36$
 $(3)(5) = 36$

He/She would have to purchase 12 small baskets and 0 large baskets.

93 / 1000

Another customer claims that he can purchase a total of 10 baskets of tomatoes and pay \$45.

B. Use a system of equations that describes this other customer's purchase to explain why the claim is incorrect.

EG

if you take 45/10 you would get 4.5 so his answer was hypothetical or not logical because its impossible

107 / 1000

The student has provided no correct equations, solutions, or support. [0 points]

The student has provided an incorrect explanation that shows no understanding of using a system of equations that describes the other customer's purchase to explain why the claim is incorrect. [0 points]

Next

Options

Flag

Pause

Review/End Test

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CONSTRUCTED-RESPONSE ITEM

14. Tammy and Keith each work two part-time jobs in the summer mowing lawns and raking yards. Tammy earns \$10 for each lawn she mows and \$5 for each yard she rakes. She wants to earn more than \$200 from her part-time jobs. Keith earns \$12 for each lawn he mows and \$3 for each yard he rakes. He wants to earn more than \$180 from his part-time jobs.

- A. Write a system of linear inequalities to model the number of lawns they each mow (x) and the number of yards they each rake (y).

Tammy: _____

Keith: _____

Go to the next page to finish question 14.



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

By the end of the summer, Tammy and Keith had mowed the same number of lawns and raked the same number of yards. Keith had met his goal of earning more than \$180, but Tammy did not meet her goal of earning more than \$200.

- B.** What is a possible combination of the number of lawns they could have each mowed and the number of yards they could have each raked?

_____ lawns mowed

_____ yards raked

**AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER
BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW
YOU ARE FINISHED.**



Item-Specific Scoring Guideline

#14 Item Information

Alignment	A1.1.3	Depth of Knowledge	3	Mean Score	1.41
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Assessment Anchor this item will be reported under:

A1.1.3—Linear Inequalities

Specific Anchor Descriptor addressed by this item:

A1.1.3.2.1—Write and/or solve a system of linear inequalities using graphing (limit systems to 2 linear inequalities).

A1.1.3.2.2—Interpret solutions to problems in the context of the problem situation (systems of 2 linear inequalities only).

Scoring Guide

Score	Description
4	Demonstrates a thorough understanding of writing and/or solving a system of linear inequalities and interpreting solutions to problems in the context of the problem situation by correctly solving problems and clearly explaining procedures.
3	Demonstrates a general understanding of writing and/or solving a system of linear inequalities and interpreting solutions to problems in the context of the problem situation by correctly solving problems and clearly explaining procedures with only minor errors or omissions.
2	Demonstrates a partial understanding of writing and/or solving a system of linear inequalities and interpreting solutions to problems in the context of the problem situation by correctly performing a significant portion of the required task.
1	Demonstrates minimal understanding of writing and/or solving a system of linear inequalities and interpreting solutions to problems in the context of the problem situation.
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 points.
2	Student earns 2 points.
1	Student earns 1 point.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Top-Scoring Response

Part A (2 points):

1 point for each correct answer

OR

1 total point for correct inequalities but on incorrect answer spaces

What?	Why?
Tammy: $10x + 5y > 200$ AND Keith: $12x + 3y > 180$	OR equivalent

Part B (2 points):

2 points for one of the following combinations:

(11, 17), (11, 18)
 (12, 13), (12, 14), (12, 15), (12, 16)
 (13, 9), (13, 10), (13, 11), (13, 12), (13, 13), (13, 14)
 (14, 5), (14, 6), (14, 7), (14, 8), (14, 9), (14, 10), (14, 11), (14, 12)
 (15, 1), (15, 2), (15, 3), (15, 4), (15, 5), (15, 6), (15, 7), (15, 8), (15, 9), (15, 10)
 (16, 0), (16, 1), (16, 2), (16, 3), (16, 4), (16, 5), (16, 6), (16, 7), (16, 8)
 (17, 0), (17, 1), (17, 2), (17, 3), (17, 4), (17, 5), (17, 6)
 (18, 0), (18, 1), (18, 2), (18, 3), (18, 4)
 (19, 0), (19, 1), (19, 2)
 (20, 0)

1 point for one of the following combinations:

(10, 20)
 (11, 16)
 (12, 12)
 (13, 8)
 (14, 4)
 (15, 0)

What?	Why?
<p>Answers will vary. All answers must be whole numbers.</p> <p>Students display answers in separate answer spaces, but answer combinations are listed above in (x, y) format, where x and y are defined as follows:</p> <p>x = number of lawns mowed y = number of yards raked</p>	

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STUDENT RESPONSE

Response Score: 4 points

14. Tammy and Keith each work two part-time jobs in the summer mowing lawns and raking yards. Tammy earns \$10 for each lawn she mows and \$5 for each yard she rakes. She wants to earn more than \$200 from her part-time jobs. Keith earns \$12 for each lawn he mows and \$3 for each yard he rakes. He wants to earn more than \$180 from his part-time jobs.

- A. Write a system of linear inequalities to model the number of lawns they each mow (x) and the number of yards they each rake (y).

$$n = 10x + 5y$$

$$200 < 10x + 5y$$

$$n = 12x + 3y$$

$$180 < 12x + 3y$$

Tammy: $200 < 10x + 5y$

Keith: $180 < 12x + 3y$

The student has provided two correct inequalities (Tammy: $200 < 10x + 5y$; Keith: $180 < 12x + 3y$). The work shown is not required or assessed. [2 points]

Go to the next page to finish question 14.



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

By the end of the summer, Tammy and Keith had mowed the same number of lawns and raked the same number of yards. Keith had met his goal of earning more than \$180, but Tammy did not meet her goal of earning more than \$200.

B. What is a possible combination of the number of lawns they could have each mowed and the number of yards they could have each raked?

$$\begin{aligned} 200 &< 10x + 5y \\ 180 &< 12x + 3y \end{aligned}$$

$$\begin{array}{r} 15 \\ \times 5 \\ \hline 75 \end{array}$$

$$\begin{array}{r} 12 \\ \times 10 \\ \hline 120 \\ + 75 \\ \hline 195 \end{array}$$

Tammy
didn't meet
her goal

$$200 < 10(12) + 5(15)$$

$$200 > 195$$

$$\begin{array}{r} 15 \\ \times 3 \\ \hline 45 \end{array}$$

$$180 < 12(12) + 3(15)$$

Keith
did

$$180 < 144 + 45$$

$$180 < 189$$

12 lawns mowed

15 yards raked

The student has provided a correct combination (12, 15) that results in Keith meeting his goal of earning more than \$180 (he earned \$189) but Tammy not meeting her goal of earning more than \$200 (she earned \$195). The support shown is not required or assessed. [2 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 3 points



PARTS A AND B

Question 14
Page 1

Item ID

?

A. Write a system of linear inequalities to model the number of lawns they each mow (x) and the number of yards they each rake (y).

Ed

10x + 5y > 200

14 / 50

Keith:

Ed

12x + 3y > 180

14 / 50

By the end of the summer, Tammy and Keith had mowed the same number of lawns and raked the same number of yards. Keith had met his goal of earning more than \$180, but Tammy did not meet her goal of earning more than \$200.

B. What is a possible combination of the number of lawns they could have each mowed and the number of yards they could have each raked?

Ed

10

2 / 50

lawns mowed

Ed

20

2 / 50

yards raked

Next

The student has provided two correct inequalities (Tammy: $10x + 5y > 200$; Keith: $12x + 3y > 180$). [2 points]

The student has provided a one-point combination (10, 20). It correctly shows that Tammy did not meet her goal of earning more than \$200 mowing 10 lawns and raking 20 yards (she earned exactly \$200, not more than \$200). However, this combination also shows that Keith did not meet his goal of earning more than \$180 (he earns exactly \$180 mowing 10 lawns and raking 20 yards). [1 point]

Tammy and Keith each work two part-time jobs in the summer mowing lawns and raking yards. Tammy earns \$10 for each lawn she mows and \$5 for each yard she rakes. She wants to earn more than \$200 from her part-time jobs. Keith earns \$12 for each lawn he mows and \$3 for each yard he rakes. He wants to earn more than \$180 from his part-time jobs.

Options

Flag

Pause

Review/End Test

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STUDENT RESPONSE

Response Score: 2 points

14. Tammy and Keith each work two part-time jobs in the summer mowing lawns and raking yards. Tammy earns \$10 for each lawn she mows and \$5 for each yard she rakes. She wants to earn more than \$200 from her part-time jobs. Keith earns \$12 for each lawn he mows and \$3 for each yard he rakes. He wants to earn more than \$180 from his part-time jobs.

- A. Write a system of linear inequalities to model the number of lawns they each mow (x) and the number of yards they each rake (y).

$$\underline{\$200 \geq \$10x + \$5y} \rightarrow \text{Tammy's model}$$

$$\underline{\$180 \geq \$12x + \$3y} \rightarrow \text{Keith's model}$$

Tammy: $\$200 \geq \$10x + \$5y$

Keith: $\$180 \geq \$12x + \$3y$

The student has provided two incorrect inequalities (both inequalities used \geq instead of $<$). [0 points]

Go to the next page to finish question 14.



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

By the end of the summer, Tammy and Keith had mowed the same number of lawns and raked the same number of yards. Keith had met his goal of earning more than \$180, but Tammy did not meet her goal of earning more than \$200.

- B. What is a possible combination of the number of lawns they could have each mowed and the number of yards they could have each raked?

$$\begin{aligned} \$200 &> 10x + 5y \\ \$180 &< 12x + 3y \end{aligned}$$

12 lawns mowed

13 yards raked

The student has provided a correct combination (12, 13). This combination results in Keith meeting his goal of earning more than \$180 (he earned \$183 mowing 12 lawns and raking 13 yards) but Tammy not meeting her goal of earning more than \$200 (she earned \$185 mowing 12 lawns and raking 13 yards). The inequalities shown are not assessed. [2 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 1 point



PARTS A AND B

Question 14
Page 1

Item ID ?

A. Write a system of linear inequalities to model the number of lawns they each mow (x) and the number of yards they each rake (y).

Tammy:

$$10x + 5y = 200$$

10 / 50

Keith:

$$12x + 3y \leq 100$$

10 / 50

By the end of the summer, Tammy and Keith had mowed the same number of lawns and raked the same number of yards. Keith had met his goal of earning more than \$180, but Tammy did not meet her goal of earning more than \$200.

B. What is a possible combination of the number of lawns they could have each mowed and the number of yards they could have each raked?

12 lawns mowed

2 / 50

12 yards raked

2 / 50

The student has provided two incorrect inequalities (Tammy: = instead of >; Keith: ≤ 100 instead of > 180). [0 points]

The student has provided a one-point combination (12, 12). This combination correctly shows that Tammy did not meet her goal of earning more than \$200 mowing 12 lawns and raking 12 yards (she earned \$180). However, this combination also shows that Keith earns exactly \$180, not greater than \$180, mowing 12 lawns and raking 12 yards. [1 point]

Review/End Test

Pause

Flag

Options

Next

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STUDENT RESPONSE

Response Score: 0 points

14. Tammy and Keith each work two part-time jobs in the summer mowing lawns and raking yards. Tammy earns \$10 for each lawn she mows and \$5 for each yard she rakes. She wants to earn more than \$200 from her part-time jobs. Keith earns \$12 for each lawn he mows and \$3 for each yard he rakes. He wants to earn more than \$180 from his part-time jobs.

- A. Write a system of linear inequalities to model the number of lawns they each mow (x) and the number of yards they each rake (y).

2

Tammy: $10x + 5y$

Keith: $12x + 3y$

The student has not provided any inequalities ($10x + 5y$ and $12x + 3y$ are expressions). [0 points]

Go to the next page to finish question 14.



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

By the end of the summer, Tammy and Keith had mowed the same number of lawns and raked the same number of yards. Keith had met his goal of earning more than \$180, but Tammy did not meet her goal of earning more than \$200.

- B.** What is a possible combination of the number of lawns they could have each mowed and the number of yards they could have each raked?

15 lawns mowed

15 yards raked

The student has provided an incorrect combination (15, 15). With this combination, Tammy did meet her goal of earning more than \$200 mowing 15 lawns and raking 15 yards (*she earned \$225*). The combination also shows that Keith met his goal of earning more than \$180 (*he earned \$225*). [0 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



ALGEBRA I MODULE 1—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	A1.1.1.1.1	A	2	33%	29%	18%	20%
2	A1.1.1.2.1	C	2	26%	15%	52%	7%
3	A1.1.1.3.1	D	1	27%	6%	9%	58%
4	A1.1.1.5.2	A	1	35%	16%	25%	24%
5	A1.1.2.1.1	C	2	6%	4%	82%	8%
6	A1.1.2.1.2	B	1	7%	84%	5%	4%
7	A1.1.2.1.3	D	2	27%	12%	7%	54%
8	A1.1.2.2.1	B	2	9%	75%	11%	5%
9	A1.1.3.1.1	A	1	43%	27%	19%	11%
10	A1.1.3.1.2	D	2	11%	10%	12%	67%
11	A1.1.3.1.3	C	2	8%	9%	68%	15%
12	A1.1.3.2.1	C	2	15%	18%	42%	25%

Constructed-Response

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
13	A1.1.2	4	2	1.58
14	A1.1.3	4	3	1.41

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ALGEBRA I MODULE 2**MULTIPLE-CHOICE ITEMS**

1. The table below shows a pattern in the cost of online data storage for different numbers of terabytes of data stored.

Online Data Storage

Number of Terabytes (t)	Cost in Dollars (c)
3	240
4	315
5	390
6	465

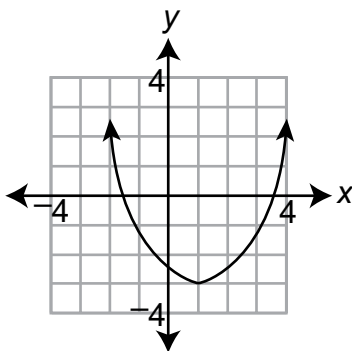
The pattern continues. Which equation describes the pattern in the cost of online data storage?

- A. $c = 3t + 225$
- B. $c = 5t + 225$
- C. $c = 50t + 90$
- D. $c = 75t + 15$

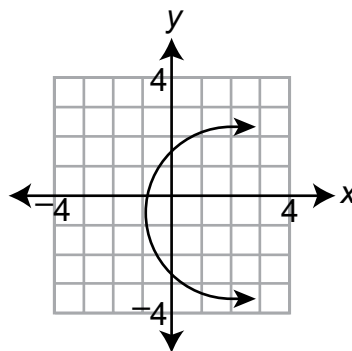
Item Information	
Alignment	A1.2.1.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	9%
p-value B	9%
p-value C	7%
p-value D	75% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by finding the slope and intercept of the line defined by the given data (slope: $315 - 240 = 75$, $4 - 3 = 1$, $\frac{75}{1} = 75$; y-intercept: $240 - 75 \cdot 3 = 15$). Only option D has the required slope and y-intercept.</p> <p>A student could arrive at an incorrect answer by testing only one of the given rows in the table. For example, a student could arrive at option B by testing the first row ($5 \cdot 3 + 225 = 240$).</p>

2. Which graph represents a function?

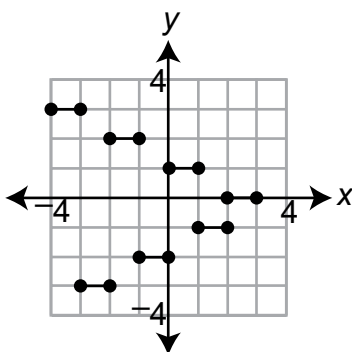
A.



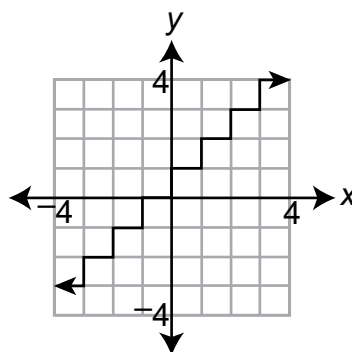
B.



C.



D.



Item Information

Alignment	A1.2.1.1.2
Answer Key	A
Depth of Knowledge	1
p-value A	69% (correct answer)
p-value B	12%
p-value C	9%
p-value D	10%
Option Annotations	<p>A student could determine the correct answer, option A, by applying the definition of a function: for each input (x), there is one output (y).</p> <p>A student could arrive at an incorrect answer by reversing the input and the output. For example, a student could arrive at option B by considering y as the input and x as the output.</p>

3. The set of ordered pairs below is a relation.

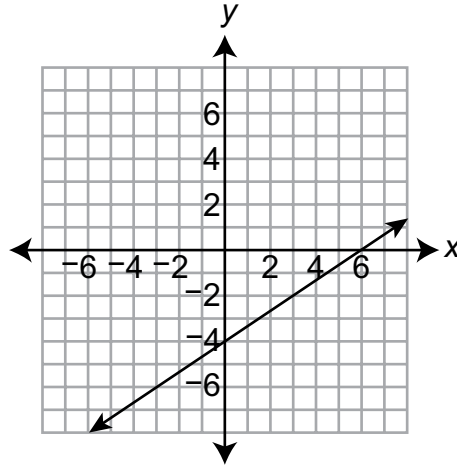
$$\{(1, 5), (0, 2), (-1, -1), (-2, -4)\}$$

What is the range of the relation?

- A. $\{-4, -1, 2, 5\}$
- B. $\{-2, -1, 0, 1\}$
- C. $\{\text{all real numbers from } -4 \text{ through } 5\}$
- D. $\{\text{all real numbers from } -2 \text{ through } 1\}$

Item Information	
Alignment	A1.2.1.1.3
Answer Key	A
Depth of Knowledge	1
p-value A	56% (correct answer)
p-value B	17%
p-value C	22%
p-value D	5%
Option Annotations	<p>A student could determine the correct answer, option A, by applying the definition of the range of a relation to determine the range of the given relation $\{-4, -1, 2, 5\}$.</p> <p>A student could arrive at an incorrect answer by incorrectly applying the definition of “range.” For example, a student could arrive at option C by treating the definition of “range” as all real numbers between the smallest and largest output of the relation.</p>

4. A function of x is graphed on the coordinate plane below.



Which equation describes the function?

- A. $y = \frac{2}{3}x - 4$
- B. $y = \frac{2}{3}x + 6$
- C. $y = \frac{3}{2}x - 4$
- D. $y = -4x + \frac{2}{3}$

Item Information	
Alignment	A1.2.1.2.2
Answer Key	A
Depth of Knowledge	1
p-value A	72% (correct answer)
p-value B	9%
p-value C	10%
p-value D	9%
Option Annotations	<p>A student could determine the correct answer, option A, by finding the slope $\left(\frac{4}{6} = \frac{2}{3}\right)$ and the y-intercept (-4) of the graphed function and substituting these values into the equation $y = mx + b$ ($y = \frac{2}{3}x - 4$).</p> <p>A student could arrive at an incorrect answer by incorrectly calculating the slope or y-intercept of the graphed function. For example, a student could arrive at option C by calculating the slope as run divided by rise.</p>

5. A student completes math problems at an average rate of 2 problems every 5 minutes. At this rate, how many math problems does the student complete in 65 minutes?
- A. 13
- B. 26
- C. 30
- D. 52

Item Information	
Alignment	A1.2.2.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	13%
p-value B	78% (correct answer)
p-value C	7%
p-value D	2%
Option Annotations	<p>A student could determine the correct answer, option B, by first determining the number of 5-minute intervals in 65 minutes ($65 \div 5 = 13$) and then multiplying the number of 5-minute intervals by the number of problems completed every 5 minutes ($13 \cdot 2 = 26$).</p> <p>A student could arrive at an incorrect answer by calculating with an incorrect rate. For example, a student could arrive at answer A by finding the number of math problems completed in 65 minutes at a rate of 1 problem every 5 minutes.</p>

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6. Sonya is baking cookies. The table below shows the relationship between the number of batches of cookies she bakes and the number of cups of sugar she uses.

Cookie Batches

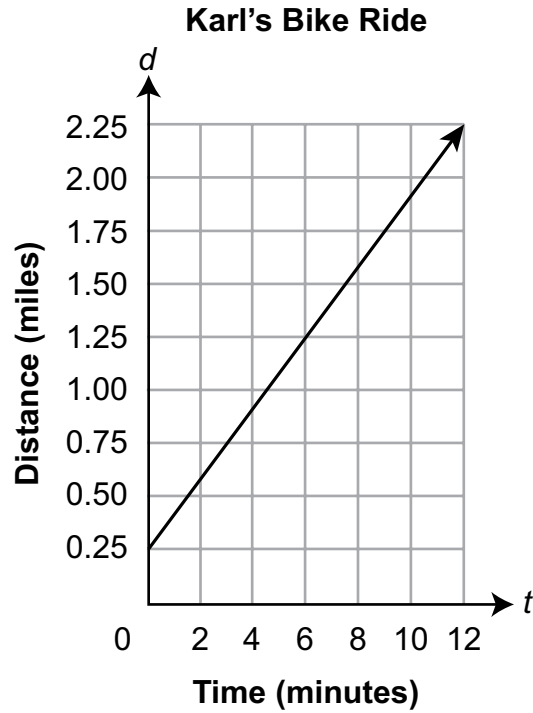
Number of Batches	Number of Cups of Sugar
1	$2\frac{1}{4}$
2	$4\frac{1}{2}$
3	$6\frac{3}{4}$

Based on the relationship shown in the table, how many more cups of sugar does Sonya use to bake 9 batches of cookies than to bake 3 batches of cookies?

- A. 6
- B. 12
- C. $13\frac{1}{2}$
- D. $20\frac{1}{4}$

Item Information	
Alignment	A1.2.2.1.2
Answer Key	C
Depth of Knowledge	2
p-value A	6%
p-value B	13%
p-value C	46% (correct answer)
p-value D	35%
Option Annotations	<p>A student could determine the correct answer, option C, by finding the number of cups of sugar needed to make the number of batches that is the difference between 9 and 3: $(9 - 3)\left(2\frac{1}{4}\right) = (6)\left(2\frac{1}{4}\right) = 13\frac{1}{2}$.</p> <p>A student could arrive at an incorrect answer by finding a different value than what is required. For example, a student could arrive at option D by finding the amount of sugar needed for 9 batches.</p>

7. Karl starts biking at some distance from his house and rides his bike away from his house. The graph below shows the relationship between the amount of time Karl rides and his distance from his house.

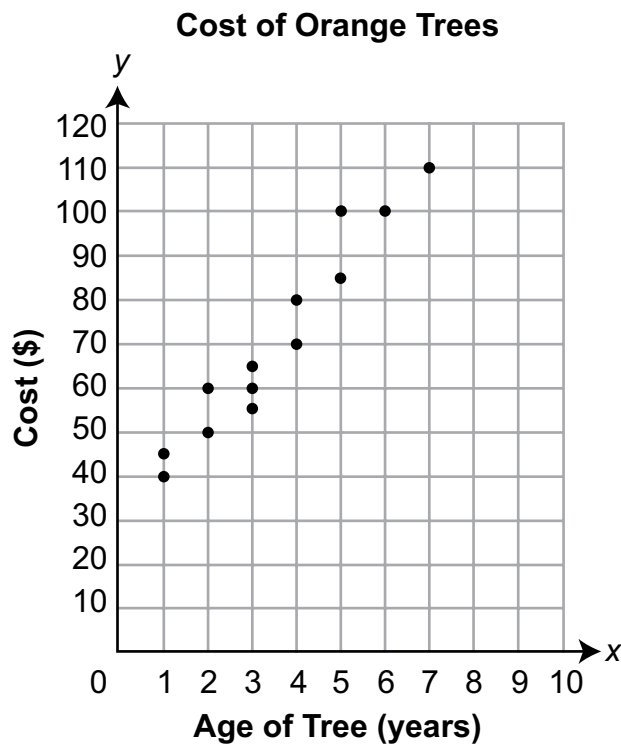


What distance, in miles, is Karl from his house when he starts biking?

- A. 0.17
- B. 0.25
- C. 2.25
- D. 5.33

Item Information	
Alignment	A1.2.2.1.4
Answer Key	B
Depth of Knowledge	2
p -value A	3%
p -value B	86% (correct answer)
p -value C	9%
p -value D	2%
Option Annotations	<p>A student could determine the correct answer, option B, by reading the y-intercept from the graph (0.25).</p> <p>A student could arrive at an incorrect answer by reading the wrong value from the graph. For example, a student could arrive at option C by using the largest labeled distance (2.25) as Karl's starting point.</p>

8. The scatter plot below shows the cost (y), in dollars, of orange trees based on their ages (x), in years.



Based on the scatter plot, which equation represents the line of best fit for the cost of the orange trees?

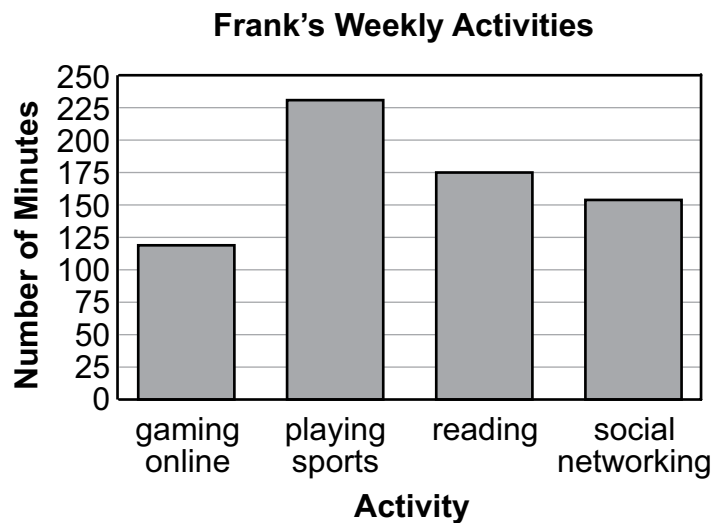
- A. $y = 11.8x$
- B. $y = 11.8x + 29.2$
- C. $y = 15.7x$
- D. $y = 15.7x + 40.0$

Item Information	
Alignment	A1.2.2.2.1
Answer Key	B
Depth of Knowledge	2
p-value A	13%
p-value B	54% (correct answer)
p-value C	11%
p-value D	22%
Option Annotations	<p>A student could arrive at the correct answer, option B, by estimating the slope $\left(\frac{110 - 40}{6} \approx 11.7\right)$ and y-intercept (~ 30) of a line of best fit. The best match among the given answer options is B.</p> <p>A student could arrive at an incorrect answer by calculating an incorrect slope or y-intercept. For example, a student could arrive at option D by finding the slope by dividing the y-value of the highest point by its x-value and using the y-value of the lowest point as the y-intercept.</p>

9. A teacher measures the time it takes each student in a class to complete a puzzle. The first quartile value of the teacher's data is 4 minutes. The third quartile value is 6 minutes. Which statement **must** be true?
- A. About 25% of the students completed the puzzle in 4 minutes or less.
 - B. About 50% of the students completed the puzzle in 6 minutes or more.
 - C. Exactly 25% of the students completed the puzzle in exactly 4 minutes.
 - D. Exactly 50% of the students completed the puzzle in 5 minutes or less.

Item Information	
Alignment	A1.2.3.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	47% (correct answer)
p-value B	18%
p-value C	16%
p-value D	19%
Option Annotations	<p>A student could determine the correct answer, option A, by correctly interpreting the meanings of the given quartiles.</p> <p>A student could arrive at an incorrect answer by misinterpreting the meanings of the quartiles. For example, a student could arrive at option D by interpreting the median (second quartile) as always dividing the interquartile range into equal halves.</p>

10. The bar graph below shows the average number of minutes Frank spends each week participating in four activities.

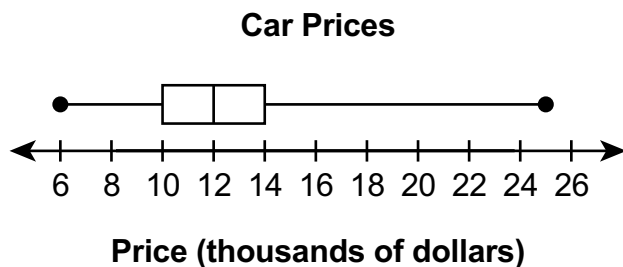


Based on the information shown in the bar graph, which value is **most likely** the difference between the number of minutes Frank will spend reading the next 4 weeks and the number of minutes Frank will spend gaming online the next 4 weeks?

- A. 56
- B. 168
- C. 224
- D. 295

Item Information	
Alignment	A1.2.3.2.1
Answer Key	C
Depth of Knowledge	2
p-value A	40%
p-value B	9%
p-value C	45% (correct answer)
p-value D	6%
Option Annotations	<p>A student could determine the correct answer, option C, by estimating the difference for one week ($175 - 120 = 55$) and then multiplying the difference by 4 weeks ($55 \cdot 4 = 220$). Among the given answer options, the closest value to the estimate is option C (224).</p> <p>A student could arrive at an incorrect answer by finding a different value than is required. For example, a student could arrive at option A by finding the predicted difference in one week.</p>

11. The box-and-whisker plot below represents the prices of all the cars for sale at a dealership.



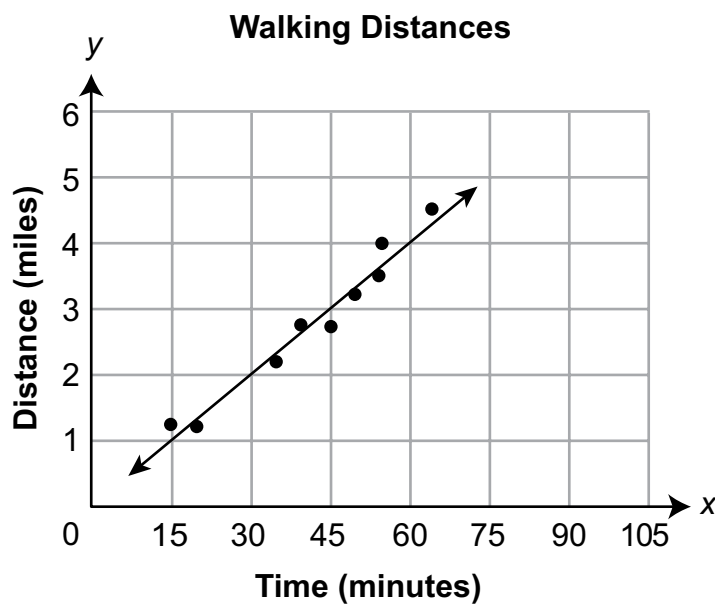
Based on the box-and-whisker plot, which statement about the prices of the cars is **most likely** true?

- A. One-half of the cars are priced at \$12,000.
- B. All of the cars are priced no lower than \$10,000.
- C. One-half of the cars are priced between \$14,000 and \$25,000.
- D. One-fourth of the cars are priced between \$12,000 and \$14,000.

Item Information	
Alignment	A1.2.3.2.2
Answer Key	D
Depth of Knowledge	2
<i>p</i> -value A	24%
<i>p</i> -value B	10%
<i>p</i> -value C	17%
<i>p</i> -value D	49% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by interpreting the quartiles as the points that divide the set into fourths.</p> <p>A student could arrive at an incorrect answer by misinterpreting the values marked in the box-and-whisker plot. For example, a student could arrive at option A by interpreting the median to be the value at which half of the data set is found.</p>

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12. The scatter plot below shows the relationship between the time, in minutes, and the distance, in miles, that Julie walked on several occasions.



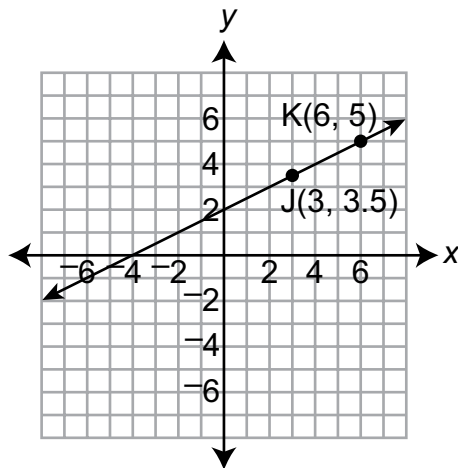
Based on the line of best fit, which is **most likely** the number of miles Julie would walk in 105 minutes?

- A. 4
- B. 5
- C. 6
- D. 7

Item Information	
Alignment	A1.2.3.2.3
Answer Key	D
Depth of Knowledge	2
p-value A	3%
p-value B	5%
p-value C	15%
p-value D	77% (correct answer)
Option Annotations	<p>A student could arrive at the correct answer, option D, by determining the unit rate (1 mile per 15 minutes) from the graph, determining the number of 15-minute intervals in 105 minutes ($\frac{105}{15} = 7$), and multiplying the number of 15-minute intervals by the unit rate ($7 \cdot 1 = 7$).</p> <p>A student could arrive at an incorrect answer by finding an incorrect number based on the graph. For example, a student could arrive at option C by extending the line of best fit to the top of the graph and reading the y-value at that point.</p>

CONSTRUCTED-RESPONSE ITEM

13. Points J and K lie on the same line, as shown on the coordinate plane below.



- A. What is the slope of the line passing through points J and K? Show or explain all your work.

Go to the next page to finish question 13.



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

- B.** Write the equation of the line passing through points J and K. Show or explain all your work.

Points L and M are added to the coordinate plane. The slope of \overleftrightarrow{JK} is equal to the slope of \overleftrightarrow{LM} .

- C.** Describe two ways the lines could be related.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



Item-Specific Scoring Guideline

#13 Item Information

Alignment	A1.2.2	Depth of Knowledge	2	Mean Score	1.66
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Assessment Anchor this item will be reported under:

A1.2.2—Coordinate Geometry

Specific Anchor Descriptor addressed by this item:

A1.2.2.1—Describe, compute, and/or use the rate of change (slope) of a line.

Scoring Guide

Score	Description
4	The student demonstrates a thorough understanding of coordinate geometry by correctly solving problems with clear and complete procedures and explanations when required.
3	The student demonstrates a general understanding of coordinate geometry by solving problems and providing procedures and explanations with only minor errors or omissions.
2	The student demonstrates a partial understanding of coordinate geometry by providing a portion of the correct problem solving, procedures, and explanations.
1	The student demonstrates a minimal understanding of coordinate geometry.
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 coordinate geometry.
0	The 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):

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

What?	Why?
$\frac{1}{2}$ OR 0.5	Sample Work: $\frac{5 - 3.5}{6 - 3} = \frac{1.5}{3} = \frac{1}{2}$ OR Sample Explanation: <p>To determine the slope, I found the difference in the y-coordinates and divided that by the difference in the x-coordinates. The difference in the y-coordinates is $5 - 3.5 = 1.5$. The difference in the x-coordinates is $6 - 3 = 3$. So the slope is 1.5 divided by 3, which is $\frac{1}{2}$ (or 0.5).</p>

Part B (1 point):

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

$\frac{1}{2}$ point for complete support

What?	Why?
<p>$y = \frac{1}{2}x + 2$</p> <p>OR equivalent</p> <p>Note: carry-through possible based on part A</p>	<p>Sample Work:</p> $y - 5 = \frac{1}{2}(x - 6)$ $y = \frac{1}{2}x - 3 + 5$ $y = \frac{1}{2}x + 2$ <p>OR</p> <p>Sample Explanation:</p> <p>To determine the equation, I used the point-slope formula: $y - y_1 = m(x - x_1)$. Since the slope is $\frac{1}{2}$ (part A), I substituted that for m. I picked point K (6, 5) to substitute in for x_1 and y_1. I then simplified the equation so it would be in slope-intercept form.</p>

Part C (2 points):

1 point for each correct answer

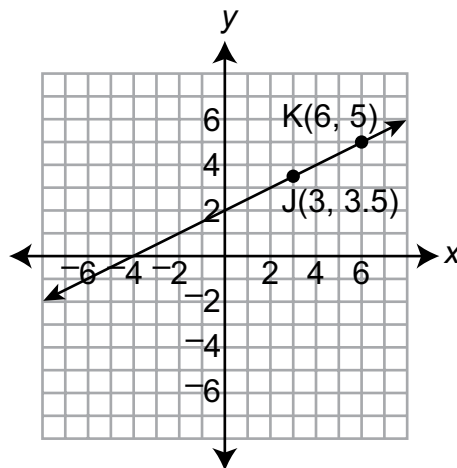
What?	Why?
<p>Line JK and line LM could be parallel lines.</p> <p>OR equivalent</p> <p>AND</p> <p>Line JK and line LM could be the same line (or collinear lines).</p> <p>OR equivalent</p>	

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STUDENT RESPONSE

Response Score: 4 points

13. Points J and K lie on the same line, as shown on the coordinate plane below.



- A. What is the slope of the line passing through points J and K? Show or explain all your work.

$$K = (6, 5)$$

$$J = (3, 3.5)$$

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

$$m = \frac{3.5 - 5}{3 - 6}$$

$$m = \frac{-1.5}{-3}$$

$$m = 1/2$$

The slope of this line is $1/2$

The student has provided a correct answer (*this is seen twice; either is acceptable: $m = \frac{1}{2}$ AND The slope of this line is $\frac{1}{2}$*) and complete support (*work*) using the slope formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$. [1 point]

Go to the next page to finish question 13.

GO ON 

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

B. Write the equation of the line passing through points J and K. Show or explain all your work.

$$y = mx + b$$

$$y = \frac{1}{2}x + b$$

$$5 = \frac{1}{2}(6) + b$$

$$5 = 3 + b$$

$$-3 \quad -3$$

$$2 = b$$

$$y = \frac{1}{2}x + 2$$

First, I wrote the slope-intercept Formula, then I plugged in the slope. I also plugged in the x and y values and solved for b

The student has provided a correct equation ($y = \frac{1}{2}x + 2$) and complete support using the slope determined in part A ($\frac{1}{2}$) and the slope-intercept formula, $y = mx + b$. [1 point]

Points L and M are added to the coordinate plane. The slope of \overleftrightarrow{JK} is equal to the slope of \overleftrightarrow{LM} .

C. Describe two ways the lines could be related.

1. If both lines had the same y-intercept they will be identical
2. If the lines had different y-intercepts they would be parallel

The student has provided two correct answers (*identical* and *parallel*) that describe ways that the lines could be related. [2 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 3 points



PART A

Question 13
Page 1 of 2

Eq

A. What is the slope of the line passing through points J and K? Show or explain all your work.

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{5 - 3.5}{6 - 3} = \frac{1.5}{3} = .5$$

Answer = .50

37 / 1000

Next

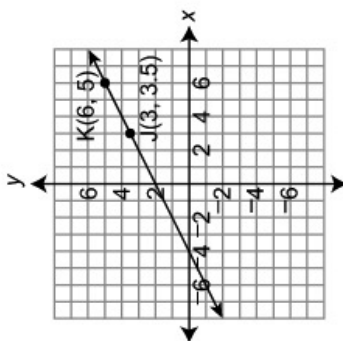
Review/End Test

Pause

Flag

Options

Points J and K lie on the same line, as shown on the coordinate plane below.



The student has provided a correct answer (.50) and complete support (work) using the slope formula: slope = $\frac{y_2 - y_1}{x_2 - x_1}$. [1 point]

PARTS B AND C

Question 13
Page 2 of 2

Item ID ?

X+Y

Line Guide

Eq

Eq

B. Write the equation of the line passing through points J and K. Show or explain all your work.

$y = mx + b$
 $5 = .50(6) + b$
 $5 = 3 + b$
 $2 = b$
 Answer $y = .50x + 2$

44 / 1000

The student has provided a correct equation ($y = .50x + 2$) and complete support using the slope determined in part A (.50) and the slope-intercept formula, $y = mx + b$. [1 point]

Points L and M are added to the coordinate plane. The slope of \overleftrightarrow{JK} is equal to the slope of \overleftrightarrow{LM} .

C. Describe two ways the lines could be related.

1) If they fall on the same line
 2) If they land on coordinates that simplify.

78 / 1000

The student has provided one correct answer that describes a way that the lines could be related (if they fall on the same line). The second description (if they land on coordinates that simplify) does not describe a way that the lines could be related. [1 point]

Points J and K lie on the same line, as shown on the coordinate plane below.

Review/End Test

Pause

Flag

Options

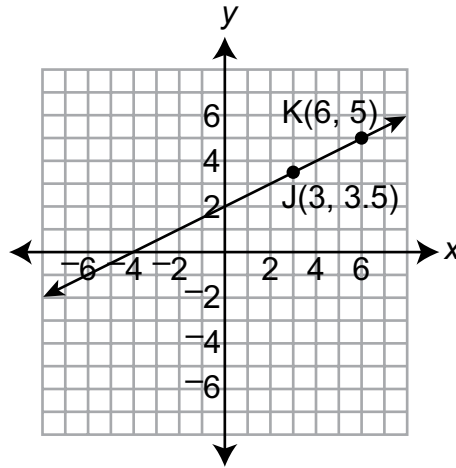
Back

Next

STUDENT RESPONSE

Response Score: 2 points

13. Points J and K lie on the same line, as shown on the coordinate plane below.



- A. What is the slope of the line passing through points J and K? Show or explain all your work.

$$\text{equation}$$

$$y = \frac{1.5x}{3} + 2$$

$$(6, 5), (3, 3.5) \quad m = \frac{y_1 - y_2}{x_1 - x_2}$$

$$m = \frac{5 - 3.5}{6 - 3}$$

$$\frac{1.5}{3}$$

The slope is

$$\frac{1.5}{3}$$

The student has provided a correct answer (The slope is $\frac{1.5}{3}$) and complete support (work) using the slope formula: $m = \frac{y_1 - y_2}{x_1 - x_2}$. [1 point]

Go to the next page to finish question 13.

GO ON 

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

- B. Write the equation of the line passing through points J and K. Show or explain all your work.

$$y = \frac{1.5x}{3} + 2$$

The student has provided a correct equation ($y = \frac{1.5x}{3} + 2$) but no support is shown (work or explanation). [0.5 points]

Points L and M are added to the coordinate plane. The slope of \overleftrightarrow{JK} is equal to the slope of \overleftrightarrow{LM} .

- C. Describe two ways the lines could be related.

① They could be parallel to one another

② They could be perpendicular to one another

The student has provided one correct answer (*They could be parallel to one another*). The other answer (*They could be perpendicular to one another*) is incorrect since the slope would be different. [1 point]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 1 point



PART A

Question 13
Page 1 of 2

Next

Eq

256 / 1

Line Guide

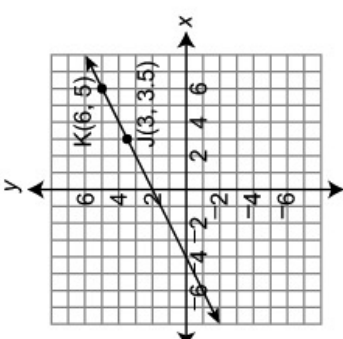
X+Y

Item ID

?

A. What is the slope of the line passing through points J and K? Show or explain all your work.

Points J and K lie on the same line, as shown on the coordinate plane below.



The slope of the line passing points J and K are $\frac{1}{2}$. How I found that is that I counted the spaces up and then i counted the spaces to the right. I started with J and then i moved to K. That is how i found the slope of the line while passing points J and K.

The student has provided a correct answer ($\frac{1}{2}$) but the support (explanation) is insufficient for credit. There is no description of how I counted the spaces up and then i counted the spaces to the right would result in a slope of $\frac{1}{2}$. [0.5 points]

Review/End Test

Pause

Flag

Options

PARTS B AND C

Question 13
Page 2 of 2

Item ID ?

X+Y

Line Guide

EQ

EQ

57 / 1000

39 / 1000

Review/End Test

Pause

Flag

Options

Back

Next

B. Write the equation of the line passing through points J and K. Show or explain all your work.

The equation of the line through points J and K is $y = j/k$.

The student has provided an incorrect equation ($y = j/k$) and no support (work or explanation). [0 points]

Points L and M are added to the line. The slope of LM is equal to the slope of LM.

C. Describe two ways the lines could be related.

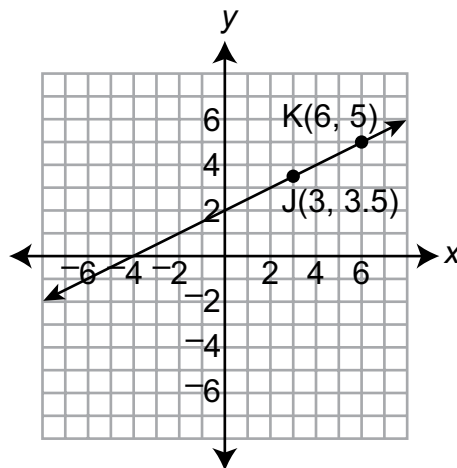
The student has provided no correct answers. [0 points]

Points J and K lie on the same line, as shown on the coordinate plane below.

STUDENT RESPONSE

Response Score: 0 points

13. Points J and K lie on the same line, as shown on the coordinate plane below.



- A. What is the slope of the line passing through points J and K? Show or explain all your work.

$$\frac{4}{4}$$

The student has provided an incorrect answer $\left(\frac{4}{4}\right)$ and no support. [0 points]

Go to the next page to finish question 13.



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

- B. Write the equation of the line passing through points J and K. Show or explain all your work.

$$\frac{4}{4} = \frac{1}{1} / 1$$

The student has provided an incorrect equation of the line $\left(\frac{4}{4} = \frac{1}{1} / 1\right)$ and no support. [0 points]

Points L and M are added to the coordinate plane. The slope of \overleftrightarrow{JK} is equal to the slope of \overleftrightarrow{LM} .

- C. Describe two ways the lines could be related.

One could be fractions could be the same and because they may be on the same side.

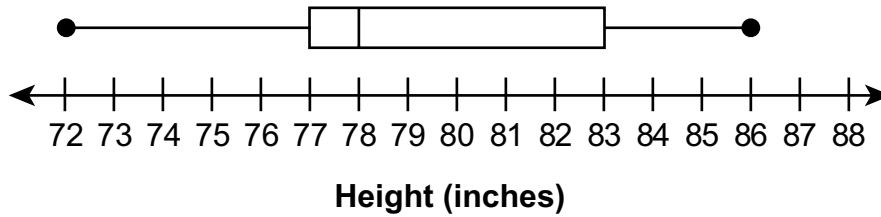
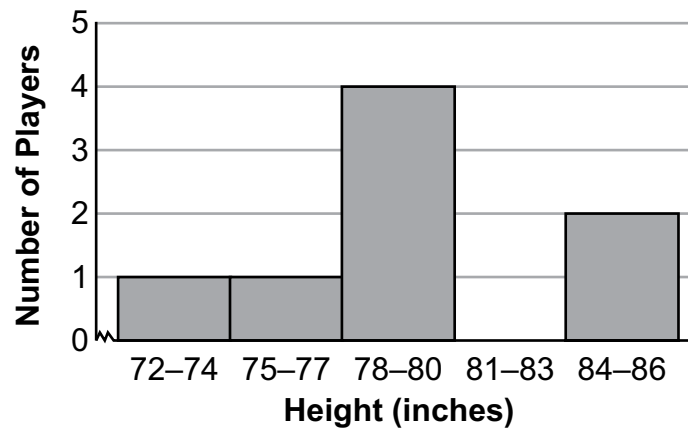
The student has provided no correct answers. [0 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



CONSTRUCTED-RESPONSE ITEM

14. Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.

Heights of Basketball Players**Heights of Basketball Players**

- A.** Based on the two data displays, what is the range of the heights?

range: _____ inches

- B.** Based on the two data displays, what is the interquartile range of the heights?

interquartile range: _____ inches

Go to the next page to finish question 14.



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

- C. Based on the two data displays, how many of the basketball players are 78 inches tall?

_____ basketball players

- D. Based on the two data displays, what is the mean of the heights?

mean: _____ inches

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



Item-Specific Scoring Guideline

#14 Item Information

Alignment	A1.2.3	Depth of Knowledge	3	Mean Score	1.23
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Assessment Anchor this item will be reported under:

A1.2.3—Data Analysis

Specific Anchor Descriptor addressed by this item:

A1.2.3.1—Use measures of dispersion to describe a set of data.

A1.2.3.2—Use data displays in problem-solving settings and/or to make predictions.

Scoring Guide

Score	Description
4	The student demonstrates a thorough understanding of data analysis by correctly solving problems with clear and complete procedures and explanations when required.
3	The student demonstrates a general understanding of data analysis by solving problems and providing procedures and explanations with only minor errors or omissions.
2	The student demonstrates a partial understanding of data analysis by providing a portion of the correct problem solving, procedures, and explanations.
1	The student demonstrates a minimal understanding of data analysis.
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 points.
2	Student earns 2 points.
1	Student earns 1 point.
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?
14 (inches) OR [72, 86] OR 72 to 86 OR 72–86 OR 86 to 72 OR equivalent	

Part B (1 point):

1 point for correct answer

What?	Why?
6 (inches) OR [77, 83] OR 77 to 83 OR 77–83 OR 83–77 OR equivalent	

Part C (1 point):

1 point for correct answer

What?	Why?
3 (basketball players)	

Part D (1 point):

1 point for correct answer

What?	Why?
79.25 (inches)	

STUDENT RESPONSE

Response Score: 4 points



PARTS A AND B

Part A: The student has provided a correct answer for the range of the heights (14). No support (work or explanation) is required, but the student most likely subtracted the minimum number of inches (72) from the maximum number of inches (86). [1 point]

Question 14
Page 1 of 2

Item ID

?

X+Y

Line Guide

Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.

Heights of Basketball Players

Heights of Basketball Players

A. Based on the two data displays, what is the range of the heights?

EQ

range: 14 inches

2 / 50

B. Based on the two data displays, what is the interquartile range of the heights?

EQ

interquartile range: 6 inches

1 / 50

Next

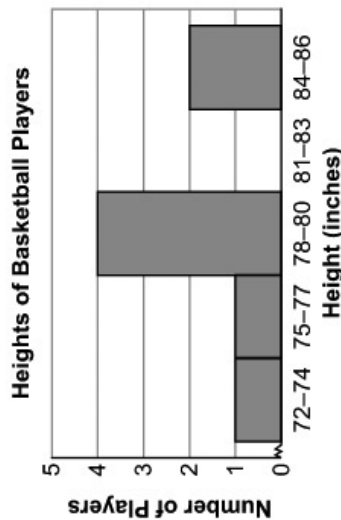
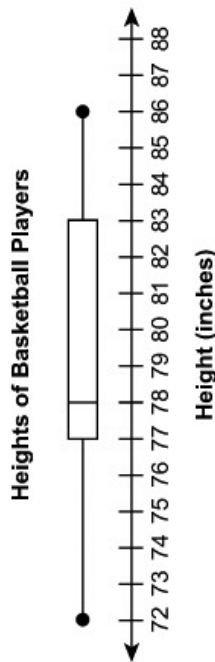
Part B: The student has provided a correct answer for the interquartile range of the heights (6). No support (work or explanation) is required, but the student most likely subtracted the first quartile value (77) from the third quartile value (83). [1 point]

PARTS C AND D

Part C: The student has provided a correct answer for how many of the basketball players are 78 inches tall (3). No support (work or explanation) is required, but the student most likely used the information from both displays to determine the answer. Based on the histogram, there are 8 players and the heights of the 3rd, 4th, 5th, and 6th players are in the 78–80 inches interval. Based on the box-and-whisker plot, the average height of the 4th and 5th players is 78 inches, so their heights must each be 78 inches. The 3rd player's height cannot be more than the 4th player's height, so the 3rd player's height is also 78 inches. Based on the box-and-whisker plot, the average height of the 6th and 7th players is 83 inches. The 6th player's height cannot be 78 inches because the 7th player's height is in the 84–86 inches interval of the histogram and none of these heights can combine with 78 inches to make an average of 83 inches. So there are 3 players who are 78 inches tall. [1 point]

Page 2 of 2

Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.



C. Based on the two data displays, how many of the basketball players are 78 inches tall?

Eq: basketball players
1 / 50

D. Based on the two data displays, what is the mean of the heights?

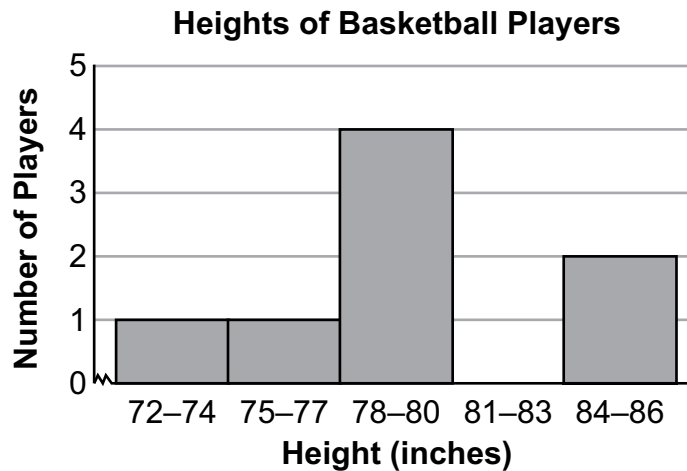
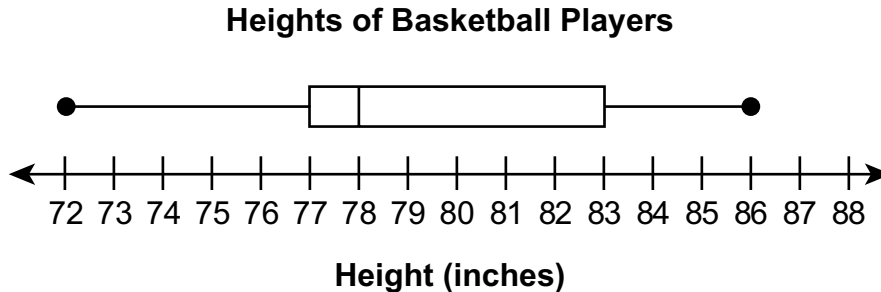
Eq: inches
mean: / 50

Part D: The student has provided a correct answer for the mean of the heights (79.25). No support (work or explanation) is required, but the student most likely used the information from both displays to determine the answer. Based on the histogram, there are 8 players. From the box-and-whisker plot, the shortest player is 72 inches, the average height of the 2nd and 3rd players is 77 inches, the average height of the 4th and 5th players is 78 inches, the average height of the 6th and 7th players is 83 inches, and the tallest player is 86 inches. Since the average height of the 2nd and 3rd players is 77 inches, their combined height is 154 inches. Since the average height of the 4th and 5th players is 78 inches, their combined height is 156 inches. Since the average height of the 6th and 7th players is 83 inches, their combined height is 166 inches. The total height of all 8 players is $72 + 154 + 156 + 166 + 86 = 634$ inches, and the average height is $634 \div 8 = 79.25$ inches. [1 point]

STUDENT RESPONSE

Response Score: 3 points

14. Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.



- A. Based on the two data displays, what is the range of the heights?

range: 14 inches

The student has provided a correct answer for the range of the heights (14). No support (work or explanation) is required, but the student most likely subtracted the minimum number of inches (72) from the maximum number of inches (86). [1 point]

- B. Based on the two data displays, what is the interquartile range of the heights?

interquartile range: 6 inches

The student has provided a correct answer for the interquartile range of the heights (6). No support (work or explanation) is required, but the student most likely subtracted the first quartile value (77) from the third quartile value (83). [1 point]

Go to the next page to finish question 14.

GO ON

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

- C. Based on the two data displays, how many of the basketball players are 78 inches tall?

The student has provided a correct answer for how many of the basketball players are 78 inches tall (3). No support (work or explanation) is required, but the student most likely used the information from both displays to determine the answer. Based on the histogram, there are 8 players and the heights of the 3rd, 4th, 5th, and 6th players are in the 78–80 inches interval. Based on the box-and-whisker plot, the average height of the 4th and 5th players is 78 inches, so their heights must each be 78 inches. The 3rd player's height cannot be more than the 4th player's height, so the 3rd player's height is also 78 inches. Based on the box-and-whisker plot, the average height of the 6th and 7th players is 83 inches. The 6th player's height cannot be 78 inches because the 7th player's height is in the 84–86 inches interval of the histogram and none of these heights can combine with 78 inches to make an average of 83 inches. So there are 3 players who are 78 inches tall. [1 point]

3 basketball players

- D. Based on the two data displays, what is the mean of the heights?

The student has provided an incorrect answer for the mean of the heights (78). No support (work or explanation) is required, so it is unclear where an error was made. The student may have identified the median value instead of calculating the mean value. [0 points]

mean: 78 inches

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 2 points



PARTS A AND B

Part A: The student has provided a correct answer for the range of the heights (14). No support (work or explanation) is required, but the student most likely subtracted the minimum number of inches (72) from the maximum number of inches (86). [1 point]

Question 14
Page 1 of 2

Item ID

X+Y

Line Guide

?

Next

Heights of Basketball Players

Height (inches)

Heights of Basketball Players

Number of Players

A. Based on the two data displays, what is the range of the heights?

EQ

range:

14

inches

2 / 50

B. Based on the two data displays, what is the interquartile range of the heights?

EQ

interquartile range:

6

inches

1 / 50

Review/End Test

Pause

Flag

Options

Part B: The student has provided a correct answer for the interquartile range of the heights (6). No support (work or explanation) is required, but the student most likely subtracted the first quartile value (77) from the third quartile value (83). [1 point]

PARTS C AND D

Part C: The student has provided an incorrect answer for how many of the basketball players are 78 inches tall (4). No support (work or explanation) is required, so it is unclear where an error was made. The student may have noted that four players fall in the 78–80 height interval on the histogram. [0 points]

Question 14
Page 2 of 2

Item ID

X+Y

Line Guide

Eraser

Highlighter

Selection

Back

Next

Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.

Heights of Basketball Players

Heights of Basketball Players

C. Based on the two data displays, how many of the basketball players are 78 inches tall?

4

basketball players

1 / 50

D. Based on the two data displays, what is the mean of the heights?

78.6

inches

4 / 50

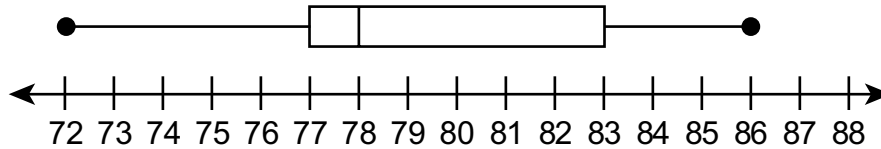
Part D: The student has provided an incorrect answer for the mean of the heights (78.6). No support (work or explanation) is required, so it is unclear where an error was made. The student may have attempted to determine the average of the five-number summary from the box-and-whisker plot but used 80 instead of 83 since no data values exist in the 81–83 height interval on the histogram. [0 points]

STUDENT RESPONSE

Response Score: 1 point

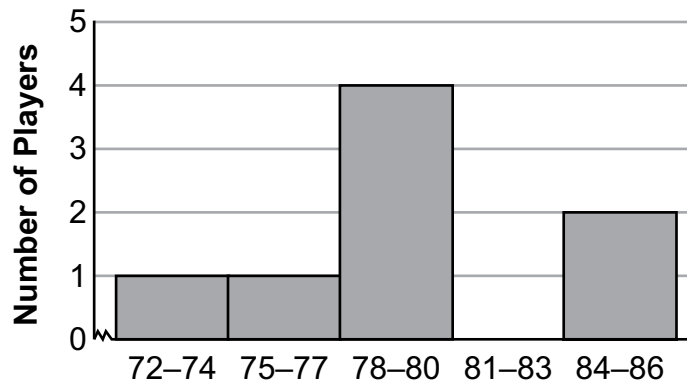
14. Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.

Heights of Basketball Players



Height (inches)

Heights of Basketball Players



Height (inches)

- A. Based on the two data displays, what is the range of the heights?

range: 14 inches

The student has provided a correct answer for the range of the heights (14). No support (work or explanation) is required, but the student most likely subtracted the minimum number of inches (72) from the maximum number of inches (86). [1 point]

- B. Based on the two data displays, what is the interquartile range of the heights?

interquartile range: 5 inches

The student has provided an incorrect answer for the interquartile range of the heights (5). No support (work or explanation) is required, so it is unclear where an error was made. The student may have noted that the difference between the shortest player (72 inches) and the first quartile value (77 inches) is 5. [0 points]

Go to the next page to finish question 14.

GO ON 

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

- C. Based on the two data displays, how many of the basketball players are 78 inches tall?

4 basketball players

The student has provided an incorrect answer for how many of the basketball players are 78 inches tall (4). No support (work or explanation) is required, so it is unclear where an error was made. The student may have noted that four players fall in the 78–80 height interval on the histogram. [0 points]

- D. Based on the two data displays, what is the mean of the heights?

mean: 79 inches

The student has provided an incorrect answer for the mean of the heights (79). No support (work or explanation) is required, so it is unclear where an error was made. The student may have found the midpoint of the minimum value (72) and the maximum value (86). [0 points]

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.



STUDENT RESPONSE

Response Score: 0 points



PARTS A AND B

Part A: The student has provided an incorrect answer for the range of the heights. The student used 88 rather than 86 for the maximum height, so both 88 - 72 and 16 are incorrect. The student may have used 88 since it is the greatest value on the number line. [0 points]

Question 14
Page 1 of 2

Item ID

?

X+Y

Line Guide

Options

Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.

Heights of Basketball Players

Heights of Basketball Players

A. Based on the two data displays, what is the range of the heights?

EQ

range: 88 - 72

16

10 / 50

inches

B. Based on the two data displays, what is the interquartile range of the heights?

EQ

interquartile range: 83 - 74

9

9 / 50

inches

Next

Review/End Test

Pause

Flag

Options

Part B: The student has provided an incorrect answer for the interquartile range of the heights (83 - 74 and 9). The student may have seen these values on the histogram bar labels. [0 points]

PARTS C AND D

Part C: The student has provided an incorrect answer for how many of the basketball players are 78 inches tall (4). No support (work or explanation) is required, so it is unclear where an error was made. The student may have noted that four players fall in the 78–80 height interval on the histogram. [0 points]

Question 14
Page 2 of 2

Item ID

?

X+Y

Line Guide

Both the box-and-whisker plot and the histogram shown below represent the heights, in inches, of the same group of basketball players.

Heights of Basketball Players

Heights of Basketball Players

C. Based on the two data displays, how many of the basketball players are 78 inches tall?

4

basketball players

1 / 50

D. Based on the two data displays, what is the mean of the heights?

1360/17

inches

mean: 80
10 / 50

Review/End Test

Pause

Flag

Options

Back

Next

Part D: The student has provided an incorrect answer for the mean of the heights (1360/17 and 80). No support (work or explanation) is required, so it is unclear where an error was made. The student may have found the sum of the numbers from 72 to 88 (all the values along the number line) to get 1360 and divided this amount by 17 since there are 17 numbers along the number line. [0 points]

ALGEBRA I MODULE 2—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	A1.2.1.1.1	D	2	9%	9%	7%	75%
2	A1.2.1.1.2	A	1	69%	12%	9%	10%
3	A1.2.1.1.3	A	1	56%	17%	22%	5%
4	A1.2.1.2.2	A	1	72%	9%	10%	9%
5	A1.2.2.1.1	B	2	13%	78%	7%	2%
6	A1.2.2.1.2	C	2	6%	13%	46%	35%
7	A1.2.2.1.4	B	2	3%	86%	9%	2%
8	A1.2.2.2.1	B	2	13%	54%	11%	22%
9	A1.2.3.1.1	A	2	47%	18%	16%	19%
10	A1.2.3.2.1	C	2	40%	9%	45%	6%
11	A1.2.3.2.2	D	2	24%	10%	17%	49%
12	A1.2.3.2.3	D	2	3%	5%	15%	77%

Constructed-Response

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
13	A1.2.2	4	2	1.66
14	A1.2.3	4	3	1.23

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INTENTIONALLY BLANK.**

Keystone Exams Algebra I

Item and Scoring Sampler 2021

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