

# Algebra I

## Item Sampler Scoring Guide

2025–2026



Pennsylvania  
Department of Education

# TABLE OF CONTENTS

<b>INFORMATION ABOUT ALGEBRA I</b> .....	<b>3</b>
Introduction .....	3
General Introduction .....	3
Pennsylvania Core Standards (PCS) .....	3
What Is Included .....	3
Purpose and Uses .....	4
Item Format and Scoring Guidelines .....	4
Item Alignment .....	4
Testing Time and Mode of Exam Delivery for the Keystone .....	5
Item and Scoring Sampler Format .....	6
General Description of Scoring Guidelines for Algebra I .....	7
Algebra I Formula Sheet .....	8
<b>ALGEBRA I MODULE 1</b> .....	<b>9</b>
Algebra I Module 1—Summary Data .....	9
Algebra I Test Directions .....	10
#13 Constructed Response Item-Specific Scoring Guideline .....	12
Top-Scoring Responses .....	14
Sample Student Responses .....	16
#14 Constructed Response Item-Specific Scoring Guideline .....	21
Top-Scoring Responses .....	23
Sample Student Responses .....	24
<b>ALGEBRA I MODULE 2</b> .....	<b>31</b>
Algebra I Module 2—Summary Data .....	31
Algebra I Test Directions .....	32
#13 Constructed Response Item-Specific Scoring Guideline .....	34
Top-Scoring Responses .....	36
Sample Student Responses .....	38
#14 Constructed Response Item-Specific Scoring Guideline .....	44
Top-Scoring Responses .....	46
Sample Student Responses .....	47

# INFORMATION ABOUT ALGEBRA I

## Introduction

### General Introduction

The Pennsylvania Department of Education (PDE) provides districts and schools with tools to assist in delivering focused instructional programs aligned with the Pennsylvania Core Standards (PCS). These tools include Academic Standards, Assessment Anchors and Eligible Content (AAEC) documents, assessment handbooks, content-based online Item Samplers, and Sampler Guides. The online Item Sampler provides examples of actual Keystone questions. The Sampler Guide provides examples of scored student responses. Pennsylvania educators can use the online Item Samplers in conjunction with the Sampler Guides as a tool in preparing local instruction. Questions from the Item Samplers are not designed to serve as a pretest or benchmark assessment.

The online Item Samplers are available in Braille format. For more information regarding a Braille version, call (717) 901-2238.

### Pennsylvania Core Standards (PCS)

The online Item Sampler and this Sampler Guide contain examples of exam questions designed to assess the Pennsylvania Assessment Anchors and Eligible Content aligned to the PCS.

### What Is Included

The online Item Samplers contain test questions aligned to the Assessment Anchors and Eligible Content of the PCS. Teams of Pennsylvania educators thoroughly reviewed each question for alignment to the Assessment Anchors, context, word selection, and difficulty level prior to field testing and operational use on the Keystone. Answer choices and distractor rationales are included for multiple-choice questions. The Sampler Guides contain Scoring Guidelines for open-ended questions, Formula Sheets, and summary data, as well as the Keystone Test Directions for online assessments. Actual responses for each point value (4, 3, 2, 1, and 0) are provided as well. To access the Online Item Sampler, go to <https://portal.te.drcedirect.com/PA>. Select Item Samplers. Then, select the subject and grade levels as needed.

## Purpose and Uses

Pennsylvania educators may use<sup>1</sup> the questions within the Item Samplers as examples when creating classroom-level assessments. Students can answer the multiple-choice and open-ended questions in the testing platform. Classroom teachers can use the Scoring Guidelines as well as sample student responses to the open-ended questions as a guide if they wish to score students' work, either independently or alongside school or district colleagues. Students have access to the *General Description of Scoring Guidelines for Algebra I Open-Ended Questions* during the Keystone. Educators may distribute copies to students for use during classroom assessments.

## Item Format and Scoring Guidelines

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. There are two types of constructed-response items in Algebra I: Extended Constructed Response (ECR) and Short Constructed Response (SCR). ECR items will require students to show or explain their work to support their responses and/or explain their thinking. SCR items will be response only; no support or explanation will be required or scored. The Sampler Guides include the rubric and examples of students' responses for each score point.

## Item 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 eligible content statements reflect the content limits of Algebra I questions. 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.

---

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

## Testing Time and Mode of Exam Delivery for the Keystone

The Keystone is delivered in an online format. The estimated response time for each item type is listed below.

- **Multiple-Choice:** 1 to 1 1/2 minutes
- **Constructed-Response:** 10 minutes

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

## Item and Scoring Sampler Format

The online Item Samplers and the Sampler Guides include the test directions and scoring guidelines that appear in the Keystone Exams. Each MC item contains a table that includes the item alignment, the answer key, the depth of knowledge (DOK) level, points possible, the percentage<sup>2</sup> of students who chose each answer option, and a brief answer-option analysis or rationale. The CR item contains a table that includes the item alignment, the DOK level, points possible, and the mean student score. Additionally, every item-specific scoring guideline included in this Sampler Guide 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 Constructed-Response Questions* used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs. The student responses in this Sampler Guide are actual student responses.

**Example Multiple-Choice Item Information Table**

Item-Specific Information	Item Statistics
Alignment:	$p$ -value A:
Answer Key:	$p$ -value B:
Depth of Knowledge:	$p$ -value C:
Points Possible:	$p$ -value D:

### Option Annotations

Brief answer-option analysis or rationale.

**Example Constructed-Response Item Information Table**

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

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

## General Description of Scoring Guidelines for 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. The 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 a *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.
- The response is marginally correct with a *minimal* understanding of the required mathematical concepts and/or procedures demonstrated and/or explained. The response may contain work that is undeveloped and rudimentary in nature.

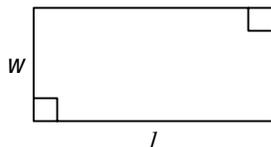
### 0 Points

- The response has no correct answer and *insufficient* evidence to demonstrate any understanding of the mathematical concepts and procedures required by the task.
- The response may show only information copied from the question.

## Algebra I Formula Sheet

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

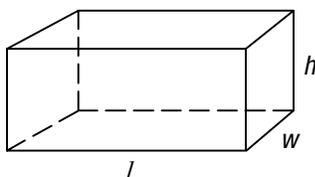
## Rectangle



$$A = lw$$

$$P = 2l + 2w$$

## Rectangular Prism



$$V = lwh$$

## Linear Equations

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

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

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

**Standard Form:**  $Ax + By = C$

## 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:**  $a \cdot (b + c) = a \cdot b + a \cdot c$   
 $a \cdot (b - c) = a \cdot b - a \cdot c$

**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

## Algebra I Module 1—Summary Data

## Multiple-Choice

An asterisk (\*) indicates the key.

Sample Number	Alignment	Answer Key	Depth of Knowledge	Points	p-value A	p-value B	p-value C	p-value D
1	A1.1.1.1.1	D	2	1	19%	23%	24%	33%*
2	A1.1.1.2.1	A	2	1	43%*	7%	28%	22%
3	A1.1.1.4.1	A	2	1	61%*	12%	14%	13%
4	A1.1.1.5.3	B	1	1	21%	40%*	14%	24%
5	A1.1.2.1.1	D	2	1	11%	13%	7%	69%*
6	A1.1.2.1.3	B	2	1	38%	42%*	9%	10%
7	A1.1.2.2.1	C	2	1	8%	16%	70%*	6%
8	A1.1.2.2.2	B	2	1	14%	70%*	7%	9%
9	A1.1.3.1.1	A	1	1	48%*	22%	17%	12%
10	A1.1.3.1.2	D	2	1	7%	12%	28%	52%*
11	A1.1.3.2.1	B	1	1	17%	42%*	14%	26%
12	A1.1.3.2.2	C	2	1	4%	6%	83%*	7%

## Constructed-Response

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
13	A1.1.1	4	3	1.10
14	A1.1.2	4	2	1.98

## Algebra I Test Directions

Read these directions carefully before beginning the assessment. To look at these directions again, select the ? **[Help]** button and choose the **Test Directions** tab.

This test has multiple-choice questions and constructed-response questions. Each multiple-choice question has four answer choices. Each constructed-response question has one or more areas in which to enter your response(s). The constructed-response questions may have multiple pages. These page numbers will be shown below the question number, for example, “Page 1 of 3.”

### Answering Questions

Read each question carefully and choose your answer or enter your response.

1. For the multiple-choice questions, numbers 1–12, first, find the answer to the question. Then, choose the correct answer by clicking on the answer bubble using the **Pointer** tool.
  - Only one of the answer choices provided is correct.
  - If none of the choices matches your answer, go back and check your work for possible errors.
  - To change an answer, use the **Pointer** tool to choose a different answer.
  - Click on the ‘**Flag**’ button if you are not sure of the answer to a question. It will mark the question so you know to go back and answer the question later.
2. For the constructed-response questions, numbers 13 and 14, use the keyboard, the **Equation Builder**, and other online tools to enter your response in the areas provided.
  - For questions that require using the **Equation Builder** or constructing a graph, click on the question mark icon **[?]** in the upper-right corner of those features. This will open **Help**, which offers descriptions on how to use these features.
  - An example of the scoring guidelines that professional scorers will use to evaluate your responses to constructed-response questions can be found by clicking on the ‘?’ **[Help]** button and choosing the “**Scoring**” tab. You may refer to the Scoring Guidelines at any time while responding to constructed-response questions.
3. Use tools such as the **Cross-Off**, **Highlighter**, **Notepad**, **Magnifier**, **Line Guide**, **Calculator**, **Graphing Tool**, and **Formula Sheet** to assist you during the test.

### Navigation

1. Use the **Next** and **Back** buttons to move from question to question or page to page.
2. Finally, when you have answered all the questions, click on the **Review/End Test** button at the top-right of the screen.
  - You may check your work by selecting questions from the list that appears on the screen.
  - When you have finished and have checked your answers, follow the directions on the screen to exit.

### Helpful Hints

- There is no time limit to finish the test.
- If you need to take a break from the assessment, select the **Pause Test** button. Select the **Resume** button to continue. If you are away from the assessment for more than 20 minutes, you will need to log back in.
- To see your progress on the test, select the **Review/End Test** button. You may go to any question by selecting it from the list that appears on the screen.
- Select the ? **[Help]** button to find more information.

## #13 Constructed Response Item-Specific Scoring Guideline

### #13 Item Information

Category	Item-Specific Information
Alignment	A1.1.1
Depth of Knowledge	3
Points Possible	4
Mean Score	1.10

### Assessment Anchor this item will be reported under:

A1.1.1 Operations with Real Numbers and Expressions

### Specific Anchor Descriptor addressed by this item:

A1.1.1.3 Use exponents, roots, and/or absolute values to solve problems.

A1.1.1.5 Simplify expressions involving polynomials.

### Item-Specific Scoring Guideline

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

**Top-Scoring Responses****Part A (1 point):**

1 point for correct answer

**OR** 1/2 point for  $|30|$

**What?**

30

**Part B (1 point):**

1 point for correct and complete support

**OR** 1/2 point for incomplete support (must be at least partially correct)

**Why?****Sample Work:**

$$|12 - 3(-5)| = |12 + 15| = 27$$

$$|12 - 3(5)| = |12 - 15| = |-3| = 3$$

$$27 \neq 3$$

**OR****Sample Explanation:**

By substituting 5 for  $x$ , I get a value of 3. By substituting  $-5$  for  $x$ , I get a value of 27. Since 3 does not equal 27, Emilio's claim is not correct.

**OR equivalent**

**Part C (2 points):**

1 point for correct answer

**OR** 1/2 point for correct but incomplete answer (either  $x < 4$  or  $x = 4$  or 4) and no incorrect values listed

1 point for correct and complete explanation

**OR** 1/2 point for incomplete explanation (must be at least partially correct)

**What?**

$$x \leq 4$$

**Why?****Sample Explanation:**

Emilio's claim can only be true when the value of the *interior* expression is greater than or equal to 0.

$$12 - 3x \geq 0$$

$$12 \geq 3x$$

$$4 \geq x$$

So Emilio's claim is true only when  $x \leq 4$ .

**OR equivalent**

## Sample Student Responses

Item 13 – 4 points

Part A – Student Response	Part A – Annotations
30	<p>The student provided a correct answer (30). While support is not required, the student may have determined the answer by substituting <math>-6</math> for <math>x</math> in the expression <math> 12 - 3x </math> and then simplifying the expression as <math> 12 - 3(-6)  =  12 + 18  =  30  = 30</math>.</p> <p>[1 point]</p>

Part B – Student Response	Part B – Annotations
<p>He is incorrect because when you put <math>-5</math> for <math>x</math> and multiply it by <math>3</math> you get <math>-15</math>, and <math>12</math> minus <math>-15</math> is <math>27</math>. And when you put in a positive <math>5</math> for <math>x</math> and multiply it by <math>3</math> you get <math>15</math>, and <math>12 - 15</math> is <math>-3</math>, but you then have to do the absolute value of <math>-3</math> which is <math>3</math>. Therefore, he is incorrect.</p>	<p>The student provided a correct and complete explanation as to why Emilio's claim is not correct even though <math> -5  =  5  = 5</math> (<i>He is incorrect because when you put <math>-5</math> for <math>x</math> and multiply it by <math>3</math> you get <math>-15</math>, and <math>12</math> minus <math>-15</math> is <math>27</math>. And when you put in a positive <math>5</math> for <math>x</math> and multiply it by <math>3</math> you get <math>15</math>, and <math>12 - 15</math> is <math>-3</math>, but you then have to do the absolute value of <math>-3</math> which is <math>3</math>. Therefore, he is incorrect</i>).</p> <p>[1 point]</p>

Part C – Student Response	Part C – Annotations
<p>the values <math>1, 2, 3, 4</math>, and all negative numbers would work because the highest positive number you can put in would be <math>4</math> because <math>4</math> times <math>3</math> is <math>12</math>, and <math>12 - 12</math> is <math>0</math> which is the lowest number you can go without the answer being negative, so any value under that would work, including all negative numbers.</p>	<p>The student provided the correct values of <math>x</math> for which Emilio's claim is true (<i>the values <math>1, 2, 3, 4</math>, and all negative numbers</i>). The student also provided a correct and complete explanation of how they determined which values of <math>x</math> made Emilio's claim true (<i>would work because the highest positive number you can put in would be <math>4</math> because <math>4</math> times <math>3</math> is <math>12</math>, and <math>12 - 12</math> is <math>0</math> which is the lowest number you can go without the answer being negative, so any value under that would work, including all negative numbers</i>). [2 points]</p>

Item 13 – 3 points

Part A – Student Response	Part A – Annotations
30	The student provided a correct answer (30). While support is not required, the student may have determined the answer by substituting $-6$ for $x$ in the expression $ 12 - 3x $ and then simplifying the expression as $ 12 - 3(-6)  =  12 + 18  =  30  = 30$ . [1 point]

Part B – Student Response	Part B – Annotations
$ 12 - 3(-5) $ $ 12 + 15 $ 27 $ 12 - 3(5) $ $ 12 - 15 $ 3	The student provided correct and complete support showing why Emilio's claim is not correct even though $ -5  =  5  = 5$ . The student first substituted $-5$ for the variable $x$ and solved the expression $ 12 - 3(-5)  =  12 + 15  = 27$ . Then, the student substituted (positive) $5$ for the variable $x$ and solved the expression $ 12 - 3(5)  =  12 - 15  = 3$ . The work shows that two different solutions are found when $x = -5$ and when $x = 5$ . [1 point]

Part C – Student Response	Part C – Annotations
all numbers $\leq 4$	The student provided the correct values of $x$ for which Emilio's claim is true ( <i>all numbers <math>\leq 4</math></i> ). No explanation was provided for how the student determined which values of $x$ made Emilio's claim true. [1 point]

Item 13 – 2 points

Part A – Student Response	Part A – Annotations
30	The student provided a correct answer (30). While support is not required, the student may have determined the answer by substituting $-6$ for $x$ in the expression $ 12 - 3x $ and then simplifying the expression as $ 12 - 3(-6)  =  12 + 18  =  30  = 30$ . [1 point]

Part B – Student Response	Part B – Annotations
Emilio is not correct because when $-5$ is multiplied by $-3$ , it becomes a positive number. That positive number is $15$ . $15 + 12 = 27$ . even when its in the absolute value $-5$ and $5$ are not correct in this problem.	The student provided a partially correct explanation as to why Emilio's claim is not correct even though $ -5  =  5  = 5$ ( <i>Emilio is not correct because when <math>-5</math> is multiplied by <math>-3</math>, it becomes a positive number. That positive number is <math>15</math>. <math>15 + 12 = 27</math></i> ). The student also needed to explain what the result would be of substituting positive $5$ for the variable $x$ in the expression for a complete comparison. [0.5 points]

Part C – Student Response	Part C – Annotations
$x = 1, 2, 3, 4$ To explain, the only way for the two expressions to be equal is if the number inside the absolute value lines are positive. As soon as you start experimenting numbers like $5$ or above, the number from absolute value doesn't equal the other equation. when I was experimenting I found that $1-4$ would work as solutions. But after the regular equation hit $0$ the two separate equations wouldn't be equal anymore.	The student provided an incomplete list of the correct values of $x$ for which Emilio's claim is true ( $x = 1, 2, 3, 4$ ). The student also provided a partially correct explanation of how they determined which values of $x$ made Emilio's claim true ( <i>As soon as you start experimenting numbers like <math>5</math> or above, the number from absolute value doesn't equal the other equation. when I was experimenting I found that <math>1-4</math> would work as solutions [work as solutions], correctly explaining how the student found the upper boundary. The last sentence of the provided explanation is incorrect (<i>But after the regular equation hit <math>0</math> the two separate equations wouldn't be equal anymore</i>). [1 point]</i>

Note: The student's response earned a total of 2.5 points ( $1 + 0.5 + 1 = 2.5$ ). Since the response met the 2-point threshold but did not achieve the 3-point threshold, the score of 2.5 points was truncated to 2 points.

Item 13 – 1 point

Part A – Student Response	Part A – Annotations
$ 12 - 3(-6) $ $ 12 + 18 $ $ 30 $	<p>The student provided a partially correct answer (<math> 30 </math>). The work shown is correct, though not necessary for credit. The student substituted <math>-6</math> for the variable <math>x</math> in the expression</p> $ 12 - 3(-6)  =  12 + 18  =  30 $ ; however, the student did not complete the last step of finding the value of $ 30 $ , which is 30. [0.5 points]

Part B – Student Response	Part B – Annotations
<p>Emilio's claim is incorrect because you can't move the <math> blocks </math> after you solve an equation that has them within it.</p>	<p>The student provided an incorrect explanation as to why Emilio's claim is not correct even though <math> -5  =  5  = 5</math> (<i>Emilio's claim is incorrect because you can't move the <math> blocks </math> after you solve an equation that has them within it</i>). [0 points]</p>

Part C – Student Response	Part C – Annotations
$x = -4$ $x = 4$	<p>The student provided the upper boundary of the correct values of <math>x</math> for which Emilio's claim is true (<math>x = 4</math>). No explanation was provided for how the student determined which values of <math>x</math> made Emilio's claim true. [0.5 points]</p>

Item 13 – 0 points

Part A – Student Response	Part A – Annotations
-30	The student provided an incorrect answer (-30). No support (work or explanation) is required, so it is unclear where an error was made. The student may have determined the answer by substituting $-6$ for $x$ in the expression $ 12 - 3x $ , simplifying the expression as $ 12 - 3(-6)  =  12 + 18  =  30 $ , then incorrectly interpreting the absolute value bars as meaning “take the opposite of” and listing the value of $ 30 $ as $-30$ . [0 points]
Part B – Student Response	Part B – Annotations
cause subtracting negatives or positives leads to different answers	The student provided an incorrect explanation as to why Emilio’s claim is not correct even though $ -5  =  5  = 5$ (cause subtracting negatives or positives leads to different answers). [0 points]
Part C – Student Response	Part C – Annotations
its the same equation?	The student did not provide any of the values of $x$ for which Emilio’s claim is true. The student provided an incorrect explanation as to how the values of $x$ made Emilio’s claim true were determined ( <i>its the same equation?</i> ). [0 points]

## #14 Constructed Response Item-Specific Scoring Guideline

### #14 Item Information

Category	Item-Specific Information
Alignment	A1.1.2
Depth of Knowledge	2
Points Possible	4
Mean Score	1.98

### Assessment Anchor this item will be reported under:

A1.1.2 Linear Equations

### Specific Anchor Descriptor addressed by this item:

A1.1.2.1 Write, solve, and/or graph linear equations using various methods.

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

### Item-Specific Scoring Guideline

Score	In this item, the student . . .
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 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 Responses****Part A (1 point):**

1 point for correct answer

**What?**

510 (calories)

**Part B (1 point):**

1 point for correct answer

**What?**

$$c = 1.5x + y$$

**OR equivalent****Part C (1 point):**

1 point for correct answer

**What?**

$$x + y = 10$$

**OR equivalent****AND**

$$120x + 90y = 1,000$$

**OR equivalent****Part D (1 point):**

1 point for correct answer

**What?**

6.5 (cups)

## Sample Student Responses

Item 14 – 4 points

Part A – Student Response	Part A – Annotations
510	The student provided the correct answer (510). While support is not required for Part A, the student likely multiplied $2 \times 120 = 240$ and $3 \times 90 = 270$ . Then the student likely added the two products together to find the total calories $240 + 270 = 510$ . [1 point]

Part B – Student Response	Part B – Annotations
$1.50x + 1.00y = c$	The student provided the correct answer ( $1.50x + 1.00y = c$ ). While support is not required, the student correctly matched the cost per cup of each type of powder to the corresponding variable for the number of cups and used the addition sign to have both types of powder equal $c$ , which is the total cost. [1 point]

Part C – Student Response	Part C – Annotations
equation 1: $120x + 90y = 1000$ equation 2: $x + y = 10$	The student provided two correct linear equations ( $120x + 90y = 1000$ and $x + y = 10$ ). While support is not required for Part C, the student likely used $x$ to represent the number of cups of Type I powder and $y$ to represent the number of cups of Type II powder. For the first equation, 10 cups containing 100 calories per cup are needed, which would be a total 1,000 calories; to get 1,000 calories, the student likely added the two types of drink mix, resulting in $120x + 90y = 1000$ . For the second equation, the student likely added the two types of powder to yield 10 cups. The student likely added Type I ( $x$ ) + Type II ( $y$ ) = 10 cups, resulting in $x + y = 10$ . [1 point]

Part D – Student Response	Part D – Annotations
6.5	The student provided the correct answer (6.5). While support is not required for Part D, the student likely solved the given system of equations by multiplying the first equation ( $x + y = 20$ ) by 8, resulting in $8x + 8y = 160$ , and then subtracted $8x + 6y = 133$ from $8x + 8y = 160$ , resulting in $2y = 27$ , which simplifies to $y = 13.5$ . The student then likely substituted 13.5 for $y$ in the equation $x + y = 20$ and then solved for $x$ , resulting in $x + 13.5 = 20$ , which simplifies to $x = 6.5$ . [1 point]

Item 14 – 3 points

Part A – Student Response	Part A – Annotations
Type I = 120 Type II = 90 $120 \times 2 \quad 90 \times 3$ $240 + 270 = 510$  510	The student provided the correct answer (510). The student provided work, although the work is not required or assessed. The student first found the total calories for each type of drink mix ( $120 \times 2$ and $90 \times 3$ ) and then added the products together to find the total calories ( $240 + 270 = 510$ ). [1 point]

Part B – Student Response	Part B – Annotations
Type I = $1.50x$ Type II = $1.00y$  $c = 1.50x + 1.00y$	The student provided the correct answer ( $c = 1.50x + 1.00y$ ). The student provided work, although the work is not required or assessed. The student rewrote the given information $Type I = 1.50x$ and $Type II = 1.00y$ . [1 point]

Part C – Student Response	Part C – Annotations
equation 1: $10 = y + x$ equation 2: $1000 = 120x + 90y$	The student provided two correct linear equations ( $10 = y + x$ and $1000 = 120x + 90y$ ). While support is not required for Part C, the student likely used $x$ to represent the number of cups of Type I powder and $y$ to represent the number of cups of Type II powder. For the first equation, the student likely added the two types of powder to yield 10 cups, resulting in $10 = y + x$ . For the second equation, 10 cups containing 100 calories per cup are needed, which would be a total 1,000 calories; to get 1,000 calories, the student likely added the two types of drink mix, resulting in $1000 = 120x + 90y$ . [1 point]

Part D – Student Response	Part D – Annotations
$6x + 6y = 120$ $8x + 6y = 133$ $2x = 13$ <i>III</i> $x = 6.5$ <i>IV</i> $y = 13.5$ $13\frac{1}{2}$ (13.5)	<p>The student provided an incorrect answer (<math>13\frac{1}{2}</math> (13.5)). The student provided work, although the work is not required or assessed. The student started solving the system of equations by multiplying the first equation (<math>x + y = 20</math>) by 6, resulting in <math>6x + 6y = 120</math>, and then subtracted <math>6x + 6y = 120</math> from <math>8x + 6y = 133</math>, resulting in <math>2x = 13</math>, which simplifies to <math>x = 6.5</math>. The student then likely substituted 6.5 for <math>x</math> in the equation <math>x + y = 20</math> and then solved for <math>y</math>, resulting in <math>6.5 + y = 20</math>, which simplifies to <math>y = 13.5</math>. In the student's work, the student identified <i>III</i> <math>x = 6.5</math> and <i>IV</i> <math>y = 13.5</math>; however, the student then put the Type IV (variable <math>y</math>) result on the answer line rather than the Type III (variable <math>x</math>) result. [0 points]</p>

Item 14 – 2 points

Part A – Student Response	Part A – Annotations
$2 \cdot 120 = 240$ $3 \cdot 90 = 270$ $270 + 240 = 510$ 510	The student provided the correct answer (510). The student provided work, although the work is not required or assessed. The student first found the total calories for each type of drink mix ( $2 \cdot 120 = 240$ and $3 \cdot 90 = 270$ ). The student then added the products together to find the total calories ( $270 + 240 = 510$ ). [1 point]

Part B – Student Response	Part B – Annotations
$1.50x \cdot 1y = c$	The student provided an incorrect answer ( $1.50x \cdot 1y = c$ ). In the equation, the student used a multiplication sign ( $\cdot$ ) rather than an addition sign ( $+$ ) on the left side of the equation. [0 points]

Part C – Student Response	Part C – Annotations
equation 1: $x + y = 10$ equation 2: $120x + 90y = 100$	The student provided one correct linear equation ( $x + y = 10$ ) and one incorrect linear equation ( $120x + 90y = 100$ ). While support is not required for Part C, the student likely used $x$ to represent the number of cups of Type I powder and $y$ to represent the number of cups of Type II powder. For the first equation, the student likely added the two types of powder to yield 10 cups, resulting in the equation $x + y = 10$ . For the second equation, 10 cups containing 100 calories per cup are needed, which would be a total of 1,000 calories; however, the student used the number of calories per cup (100), rather than the total number of calories (1,000). [0 points]

Part D – Student Response	Part D – Annotations
$y = 20 - x$ $8x + 6(20 - x) = 133$ $8x + 120 - 6x = 133$ $2x + 120 = 133$ $\begin{array}{r} -120 \quad -120 \\ 2x \quad 13 \\ \hline 2 \quad 2 \end{array}$ $x = 6.5$ 6.5	The student provided the correct answer (6.5). The student provided work, although the work is not required or assessed. Based on the work provided, the student correctly solved the system of equations by substituting $20 - x$ for $y$ in the second equation, resulting in $8x + 6(20 - x) = 133$ , which the student simplified to $2x + 120 = 133$ ; the student then subtracted 120 from both sides of the equation, resulting in $2x = 13$ , which the student simplified to $x = 6.5$ . [1 point]

Item 14 – 1 point

Part A – Student Response	Part A – Annotations
$120(2) + 90(3)$ $240 + 270$ 510	The student provided the correct answer (510). The student provided work, although the work is not required or assessed. The student first found the total calories for each type of drink mix ( $120(2) + 90(3)$ ) and then added the products together to find the total calories ( $240 + 270 = 510$ ). [1 point]

Part B – Student Response	Part B – Annotations
$c = 1.50y + 1.00x$	The student provided an incorrect answer ( $c = 1.50y + 1.00x$ ). In the equation, the student switched the $x$ and $y$ variables. [0 points]

Part C – Student Response	Part C – Annotations
equation 1: $x + y = 10$ equation 2: $120x + 90y = 100$	The student provided one correct linear equation ( $x + y = 10$ ) and one incorrect linear equation ( $120x + 90y = 100$ ). While support is not required for Part C, the student likely used $x$ to represent the number of cups of Type I powder and $y$ to represent the number of cups of Type II powder. For the first equation, the student likely added the two types of powder to yield 10 cups, resulting in the equation $x + y = 10$ . For the second equation, 10 cups containing 100 calories per cup are needed, which would be a total 1,000 calories; however, the student used the number of calories per cup (100) rather than the total number of calories (1,000). [0 points]

Part D – Student Response	Part D – Annotations
$8x + 8y = 160$ $8x + 6y = 133$ $2y = 27$ $y = 13.5$ 14	The student provided an incorrect answer (14). The student provided work, although the work is not required or assessed. Based on the work provided, the student solved for $y$ (the cups of Type IV powder needed) rather than for $x$ (the cups of Type III powder needed) and also rounded the answer rather than leaving it as the exact value. The student started solving the system of equations by multiplying the first equation ( $x + y = 20$ ) by 8, resulting in $8x + 8y = 160$ , and then subtracted $8x + 6y = 133$ from $8x + 8y = 160$ , resulting in $2y = 27$ , which simplifies to $y = 13.5$ . The student then rounded 13.5 to 14 for the final answer. To find the cups of Type III powder needed, the student should have solved for $x$ by substituting 13.5 back into the first equation, resulting in $x + 13.5 = 20$ , which simplifies to $x = 6.5$ . [0 points]

Item 14 – 0 points

Part A – Student Response	Part A – Annotations
$120 \times 2 = 240$ $90 \times 3 = 210$ 450	The student provided an incorrect answer (450). The student provided work, although the work is not required or assessed. The student started by calculating the total calories for the Type I powder ( $120 \times 2 = 240$ ) but then incorrectly calculated the total calories for the Type II powder ( $90 \times 3 = 210$ ) before adding the two products together for a total of 450. [0 points]

Part B – Student Response	Part B – Annotations
$c = \$150x + \$1.00y$	The student provided an incorrect answer ( $c = \$150x + \$1.00y$ ). No support (work or explanation) is required, so it is unclear where an error was made. The student likely omitted the decimal point for the cost per cup of the Type I powder, using \$150 rather than \$1.50 for the coefficient of $x$ . [0 points]

Part C – Student Response	Part C – Annotations
equation 1: $x + y = 1000$ cal equation 2: $120x + 90y = 1000$	The student provided one correct linear equation ( $120x + 90y = 1000$ ) and one incorrect linear equation ( $x + y = 1000$ ). While support is not required for Part C, the student likely used $x$ to represent the number of cups of Type I powder and $y$ to represent the number of cups of Type II powder. For the first equation, the student likely added the two types of powder to yield 10 cups. This would result in the equation $x + y = 10$ ; however, the student's equation incorrectly used 1000 for the total rather than 10. For the second equation, 10 cups containing 100 calories per cup are needed, which would be a total of 1,000 calories; to get 1,000 calories, the student likely added the two types of drink mix, resulting in $120x + 90y = 1000$ . [0 points]

Part D – Student Response	Part D – Annotations
7	The student provided an incorrect answer (7). No support (work or explanation) is required for Part D, so it is unclear where an error was made. The student likely solved the system of equations correctly for the variable $x$ (Type III powder) but then rounded 6.5 to 7. [0 points]

**THIS PAGE IS  
INTENTIONALLY BLANK.**

# ALGEBRA I MODULE 2

## Algebra I Module 2—Summary Data

### Multiple-Choice

An asterisk (\*) indicates the key.

Sample Number	Alignment	Answer Key	Depth of Knowledge	Points	p-value A	p-value B	p-value C	p-value D
1	A1.2.1.1.1	C	2	1	9%	20%	53%*	17%
2	A1.2.1.1.2	D	1	1	13%	11%	10%	66%*
3	A1.2.1.2.1	A	2	1	48%*	21%	16%	15%
4	A1.2.1.2.2	A	1	1	68%*	15%	6%	10%
5	A1.2.2.1.1	A	2	1	64%*	19%	8%	8%
6	A1.2.2.1.2	D	2	1	25%	24%	18%	33%*
7	A1.2.2.1.3	B	1	1	19%	48%*	16%	17%
8	A1.2.2.1.4	C	1	1	21%	7%	65%*	8%
9	A1.2.3.1.1	B	1	1	23%	35%*	29%	12%
10	A1.2.3.2.2	B	1	1	17%	38%*	29%	16%
11	A1.2.3.2.3	D	2	1	10%	10%	20%	59%*
12	A1.2.3.3.1	D	2	1	42%	8%	9%	41%*

### Constructed-Response

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
13	A1.2.2	4	3	1.34
14	A1.2.3	4	2	1.23

## Algebra I Test Directions

Read these directions carefully before beginning the assessment. To look at these directions again, select the ? **[Help]** button and choose the **Test Directions** tab.

This test has multiple-choice questions and constructed-response questions. Each multiple-choice question has four answer choices. Each constructed-response question has one or more areas in which to enter your response(s). The constructed-response questions may have multiple pages. These page numbers will be shown below the question number, for example, “Page 1 of 3.”

### Answering Questions

Read each question carefully and choose your answer or enter your response.

1. For the multiple-choice questions, numbers 1–12, first, find the answer to the question. Then, choose the correct answer by clicking on the answer bubble using the **Pointer** tool.
  - Only one of the answer choices provided is correct.
  - If none of the choices matches your answer, go back and check your work for possible errors.
  - To change an answer, use the **Pointer** tool to choose a different answer.
  - Click on the ‘**Flag**’ button if you are not sure of the answer to a question. It will mark the question so you know to go back and answer the question later.
2. For the constructed-response questions, numbers 13 and 14, use the keyboard, the **Equation Builder**, and other online tools to enter your response in the areas provided.
  - For questions that require using the **Equation Builder** or constructing a graph, click on the question mark icon **[?]** in the upper-right corner of those features. This will open **Help**, which offers descriptions on how to use these features.
  - An example of the scoring guidelines that professional scorers will use to evaluate your responses to constructed-response questions can be found by clicking on the ‘?’ **[Help]** button and choosing the “**Scoring**” tab. You may refer to the Scoring Guidelines at any time while responding to constructed-response questions.
3. Use tools such as the **Cross-Off**, **Highlighter**, **Notepad**, **Magnifier**, **Line Guide**, **Calculator**, **Graphing Tool**, and **Formula Sheet** to assist you during the test.

### Navigation

1. Use the **Next** and **Back** buttons to move from question to question or page to page.
2. Finally, when you have answered all the questions, click on the **Review/End Test** button at the top-right of the screen.
  - You may check your work by selecting questions from the list that appears on the screen.
  - When you have finished and have checked your answers, follow the directions on the screen to exit.

**Helpful Hints**

- There is no time limit to finish the test.
- If you need to take a break from the assessment, select the **Pause Test** button. Select the **Resume** button to continue. If you are away from the assessment for more than 20 minutes, you will need to log back in.
- To see your progress on the test, select the **Review/End Test** button. You may go to any question by selecting it from the list that appears on the screen.
- Select the ? **[Help]** button to find more information.

## #13 Constructed Response Item-Specific Scoring Guideline

### #13 Item Information

Category	Item-Specific Information
Alignment	A1.2.2
Depth of Knowledge	3
Points Possible	4
Mean Score	1.34

### 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.

### Item-Specific Scoring Guideline

Score	In this item, the student . . .
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	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

## Top-Scoring Responses

### Part A (1 point):

1 point for correct and complete explanation

**OR** 1/2 point for incomplete explanation (must be at least partially correct)

#### Why?

##### Sample Explanation:

The length of a fence cannot be a negative number.

**OR equivalent**

### Part B (1 1/2 points):

1/2 point for correct answer

1 point for correct and complete support

**OR** 1/2 point for incomplete support (must be at least partially correct)

#### What?

(\$)560

#### What?

##### Sample Work:

$$\frac{464 - 432}{24 - 22} = \frac{32}{2} = 16$$

$$464 = 16(24) + b \rightarrow 464 = 384 + b \rightarrow b = 80$$

$$80 + 16(30) = 560$$

**OR**

##### Sample Explanation:

Since the second person charges \$464 for a 24-foot fence and \$432 for a 22-foot fence, he charges \$16 per foot. This means he charges an initial fee of \$80 ( $464 - 16 \cdot 24$ ). So the second person would charge \$560 for a 30-foot fence ( $80 + 16 \cdot 30 = 560$ ).

**OR equivalent**

**Part C (1 1/2 points):**

1/2 point for correct answer

1 point for correct and complete support

**OR** 1/2 point for incomplete support (must be at least partially correct)

**What?**

3 (dollars per foot)

**Why?****Sample Work:**

$$882 - 90 = 792 \rightarrow 792 \div 22 = 36$$

$$774 - 90 = 684 \rightarrow 684 \div 36 = 19$$

$$22 - 19 = 3$$

**OR**

**Sample Explanation:**

Since the third person would normally charge \$882 for the job with an initial fee of \$90, she charged \$792 for the length of the fence. At \$22 per foot, the fence is 36 feet long. The total charge with the discount is \$774, so she would now charge \$684 for the length of the fence. Since the fence is 36 feet long, the third person is now charging \$19 per foot. So the discount saves her customers \$3 per foot.

**OR equivalent**

## Sample Student Responses

Item 13 – 4 points

Part A – Student Response	Part A – Annotations
It isn't a solution because you can't instal a negative number of feet of a fence.	The student provided a correct explanation as to why the ordered pair $(-2, 29)$ is not a solution for this situation ( <i>you can't instal a negative number of feet of a fence</i> ). [1 point]

Part B – Student Response	Part B – Annotations
$\frac{464 - 432}{24 - 22} = \frac{32}{2} = 16$ $y = 16x + b$ $432 = 16(22) + b$ $432 = 352 + b$ $80 = b$ $y = 16x + 80$ $y = 16(30) + 80$ $y = 480 + 80$ $y = 560$ <p>\$560</p>	The student provided the correct cost to install a 30-foot fence (\$560). The student provided correct and complete work used to determine the installation cost. The student first determined the amount per foot by finding the difference between the total charges divided by the difference between the lengths and then simplifying the expression, resulting in $\frac{464 - 432}{24 - 22} = \frac{32}{2} = 16$ . Next, the student wrote the slope-intercept form of an equation ( $y = mx + b$ ), using \$16 for $m$ , substituted 432 for $y$ and 22 for $x$ , resulting in $432 = 16(22) + b$ , and then solved for $b$ by multiplying 16 by 22 and subtracting this product (352) from both sides of the equation, resulting in $80 = b$ . Finally, the student rewrote the slope-intercept form using 16 for $m$ and 80 for $b$ , substituted 30 for $x$ , and then solved for $y$ by multiplying 16 by 30 and then adding 80 to the product, resulting in $y = 560$ . [1.5 points]

Part C – Student Response	Part C – Annotations
<p>Without: <math>y = 22x + 90</math> <math>882 = 22x + 90</math> <math>792 = 22x</math> <math>36 = x</math></p> <p>With: <math>y = mx + 90</math> <math>774 = m(36) + 90</math> <math>684 = 36m</math> <math>19 = m</math> <math>22 - 19 = 3</math> \$3 per foot</p>	<p>The student provided the correct discount savings (\$3 per foot). The student also provided complete and correct work to find the saving. First, the student calculated the length of the non-discounted fence by writing the slope-intercept form of an equation (<math>y = mx + b</math>), using the cost of \$22 per foot as <math>m</math> and the initial fee of \$90 as <math>b</math>; substituting 882 for <math>y</math>; and then solving for <math>x</math>, resulting in <math>36 = x</math>. Next, the student calculated the price per foot of the discounted fence by writing the slope-intercept form of an equation (<math>y = mx + b</math>), using the initial fee of \$90 as <math>b</math>; substituting 774 for <math>y</math> and 36 for <math>x</math>; and then solving for <math>m</math>, resulting in <math>19 = m</math>. Finally, the student subtracted the discounted price per foot (\$19) from the non-discounted price per foot (\$22), resulting in a total saving of \$3 per foot. [1.5 points]</p>

Item 13 – 3 points

Part A – Student Response	Part A – Annotations
Someone can't install $-2$ feet	The student provided a correct explanation as to why the ordered pair $(-2, 29)$ is not a solution for this situation <i>(Someone can't install <math>-2</math> feet).</i> [1 point]

Part B – Student Response	Part B – Annotations
$464 - 432 = 32$ $2\overline{)32} = 16$ \$ per foot $16 \times 22 = 352$ $432 - 352 = 80$ (fee) $y = 80 + 16x$ $y = 80 + 16(30)$ $y = 80 + 480$ $y = 560$ \$560	The student provided the correct cost to install a 30-foot fence (\$560). The student provided correct and complete work used to determine the installation cost. First, the student calculated the cost per foot by subtracting 432 from 464, resulting in a difference of 32, and then divided 32 by 2 to get 16 dollars per foot. Next, the student multiplied the cost per foot (16) by the length of the fence (22), resulting in $16 \times 22 = 352$ . Then, the student subtracted 352 from the total cost (432), resulting in $432 - 352 = 80$ . Finally, the student wrote the slope-intercept form of an equation ( $y = b + mx$ ), using 80 for $b$ and 16 for $m$ , substituted 30 for $x$ , and then solved for $y$ by multiplying 16 by 30 and then adding 80 to the product, resulting in $y = 560$ . [1.5 points]

Part C – Student Response	Part C – Annotations
$882 - 90 = 792$ $22\overline{)792} = 36$ feet $774 - 90 = 684 \div 36 = 19$ $\begin{array}{r} 22 \\ -19 \\ \hline 3 \end{array}$ It saves them 3 dollars per foot.	The student provided the correct discount saving ( <i>It saves them 3 dollars per foot</i> ). The student also provided complete work to find the saving. First, the student calculated the length of the non-discounted fence by subtracting the initial fee (\$90) from the total cost (\$882), resulting in $882 - 90 = 792$ . Then, the student divided the 792 by the cost per foot of the fence (22), resulting in a quotient of 36 feet. Next, the student calculated the price per foot of the discounted fence by taking the discounted total price (\$774), subtracting the initial fee (\$90), and then dividing this difference (684) by the 36-foot length of fence, resulting in a cost of \$19 per foot. Finally, the student subtracted the discounted price per foot (\$19) from the non-discounted price per foot (\$22), resulting in a total saving of \$3 per foot. [1.5 points]

Note: Although the student's response earned a total of 4 points ( $1 + 1.5 + 1.5 = 4$ ), the support in Part C contains a run-on equation ( $774 - 90 = 684 \div 36 = 19$ ) that is mathematically incorrect—the left-hand side of the equation ( $774 - 90$ ) does not equal the right-hand side (19). Because of this run-on equation, the student did not demonstrate a thorough understanding and the score of 4 points was lowered to 3 points. The use of a run-on equation can, at best, demonstrate a general understanding and would not affect a student's score if the response earns less than 4 points.

Item 13 – 2 points

Part A – Student Response	Part A – Annotations
(-2,29) is not the solution for this situation because $x$ =length and you can't have a fence installed for a length of -2.	The student provided a correct explanation as to why the ordered pair $(-2, 29)$ is not a solution for this situation ( <i>you can't have a fence installed for a length of -2</i> ). [1 point]

Part B – Student Response	Part B – Annotations
The second person would charge \$528 to install a fence that is 30 feet long. I took $464 - 432$ and got 32 and then divided 32 by 2 and got 16. After I got 16 I multiplied that by 6 ( $30 - 24 = 6$ ) and got 96. I then added 432 and 96 and got 528.	The student provided an incorrect cost to install a 30-foot fence (\$528). The student provided a complete explanation of how to find the installation cost [ <i>I took <math>464 - 432</math> and got 32 and then divided 32 by 2 and got 16. After I got 16 I multiplied that by 6 (<math>30 - 24 = 6</math>) and got 96. I then added 432 and 96 and got 528</i> ]. The student added the \$96 to the cost of the 22-foot fence (\$432) rather than adding the \$96 to the cost of the 24-foot fence (\$464). Since the procedure is complete, the student earned the full credit for support but did not earn credit for the incorrect answer. [1 point]

Part C – Student Response	Part C – Annotations
The discount saves you \$108 which is rounded to almost 5 dollars per foot. I took 882 and subtracted it by 774 and got 108 and then divided it by 22 and got 4.90 ( $54/11$ ) repeating which rounds to about 5 dollars per foot.	The student provided an incorrect discount saving ( <i>almost 5 dollars per foot</i> ). The student also provided an incorrect explanation that does not provide a correct procedure for finding the discount's saving ( <i>I took 882 and subtracted it by 774 and got 108 and then divided it by 22 and got 4.90 (<math>54/11</math>) repeating which rounds to about 5 dollars per foot</i> ). [0 points]

Item 13 – 1 point

Part A – Student Response	Part A – Annotations
You can't do a negative amount of fence.	The student provided a correct explanation as to why the ordered pair $(-2, 29)$ is not a solution for this situation ( <i>You can't do a negative amount of fence</i> ). [1 point]

Part B – Student Response	Part B – Annotations
For a fence that is 30 feet long it will cost \$605.  $65 + 18(30)$ $65 + 540$ $605$	The student provided an incorrect cost to install a 30-foot fence ( $\$605$ ). The support provided shows an incorrect procedure. The student used the equation given in Part A, substituted 30 for $x$ , and then evaluated the expression [ $65 + 18(30) = 65 + 540 = 605$ ]. [0 points]

Part C – Student Response	Part C – Annotations
It saves the customer 4.9 feet.  $\begin{array}{r} 882 \\ - 774 \\ \hline 108 \end{array} \qquad 22 \overline{)108} \qquad 4.9$	The student provided an incorrect discount saving ( <i>It saves the customer 4.9 feet</i> ). The student also provided insufficient work that does not lead to finding the discount's saving. The student subtracted the discounted total price ( $\$774$ ) from the non-discounted total price ( $\$882$ ), resulting in $882 - 774 = 108$ , and then divided the difference ( $\$108$ ) by the cost per foot ( $\$22$ ), resulting in a quotient of 4.9. [0 points]

Item 13 – 0 points

Part A – Student Response	Part A – Annotations
it doesn't give the total amount of dollars	The student provided an incorrect explanation as to why the ordered pair $(-2, 29)$ is not a solution for this situation ( <i>it doesn't give the total amount of dollars</i> ). [0 points]
Part B – Student Response	Part B – Annotations
the price for a 30 feet long fence would be \$656, the price for each foot is \$32. if you do $32 \times 6 + 464$ , you would get 656	The student provided an incorrect cost to install a 30-foot fence (\$656). The student provided an incorrect explanation of how to find the installation cost ( <i>the price [price] for each foot is \$32. if you do <math>32 \times 6 + 464</math>, you would get 656</i> ). [0 points]
Part C – Student Response	Part C – Annotations
The discount saves the customer \$108, if you take the total number without the discount and subtract it from the total with the discount, it comes out to \$108	The student provided an incorrect discount saving ( <i>The discount saves the customer \$108</i> ). The student also provided an incorrect explanation that does not provide a correct procedure for finding the discount's saving ( <i>if you take the total number without the discount and subtract it from the total with the discount, it comes out to \$108</i> ). [0 points]

## #14 Constructed Response Item-Specific Scoring Guideline

### #14 Item Information

Category	Item-Specific Information
Alignment	A1.2.3
Depth of Knowledge	2
Points Possible	4
Mean Score	1.23

### 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.

### Item-Specific Scoring Guideline

Score	In this item, the student . . .
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**

<b>Score</b>	<b>Description</b>
<b>4</b>	Student earns 4 points.
<b>3</b>	Student earns 3 points.
<b>2</b>	Student earns 2 points.
<b>1</b>	Student earns 1 point.
<b>0</b>	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

**Top-Scoring Responses****Part A (1 point):**

1 point for correct answer

**What?**

6 (people)

**Part B (1 point):**

1 point for correct answer

**What?**

63 (people)

**Part C (1 point):**

1 point for correct answer

**What?**

3 (years)

**Part D (1 point):**

1 point for correct answer

**What?**

4.12 (years)

**OR**

4.13 (years)

## Sample Student Responses

Item 14 – 4 points

Part A – Student Response	Part A – Annotations
6	The student provided the correct answer (6). While support is not required for Part A, the student may have read the histogram, saw that 4 people have an age difference in the 9–11 interval and 2 people have an age difference in the 12–14 interval, and then added $4 + 2$ for a total of 6 people. [1 point]

Part B – Student Response	Part B – Annotations
63	The student provided the correct answer (63). While support is not required for Part B, the student may have read the histogram, saw that 14 of the 50 people surveyed had a sibling with an age difference in the 3–5 interval, set up a proportion to find how many out of 225 people had the same age difference by using the same ratio as Shane’s data, resulting in $\frac{14}{50} = \frac{x}{225}$ , and then solved the proportion for $x$ by multiplying each side of the equation by 225, resulting in $x = 63$ , which would mean that 63 out of 225 people would have a sibling with an age difference of 3 to 5 years. [1 point]

Part C – Student Response	Part C – Annotations
3	The student provided the correct answer (3). While support is not required for Part C, the student may have identified that the median would be the average of the 25th and 26th age differences based on 50 people surveyed, read the histogram, saw that 24 people had a sibling with an age difference in the 0–2 interval, noted that the next interval (3–5) represented more than 2 people, and then concluded that the 25th and 26th age differences would fall in the 3–5 interval, which would make 3 years the smallest possible median. [1 point]

Part D – Student Response	Part D – Annotations
4.12	The student provided a correct answer (4.12). While support is not required for Part D, the student may have calculated the total of the age differences for the 50 people surveyed by multiplying 50 by the mean (3.88), resulting in $50 \cdot 3.88 = 194$ , subtracted the number of people that are a twin (3) from the total number of people (50), resulting in $50 - 3 = 47$ , left the total of the age differences at 194 since twins have an age difference of 0 years, and then divided 194 by 47, resulting in a quotient of approximately 4.12765957 years, which can be truncated to 4.12 when written to the nearest hundredth. [1 point]

Item 14 – 3 points

Part A – Student Response	Part A – Annotations
$24 + 14 + 6 + 4 + 2 = 50$ $4 + 2 = 6$ 6	The student provided the correct answer (6). The student provided work, although the work is not required or assessed. The student added the number of people in each interval, showing that 50 people were surveyed ( $24 + 14 + 6 + 4 + 2 = 50$ ), and then added the number of people from the 9–11 and 12–14 intervals ( $4 + 2 = 6$ ). [1 point]

Part B – Student Response	Part B – Annotations
$50 \cdot 4.5 = 225$ $14 \cdot 4.5 = 63$ 63	The student provided the correct answer (63). The student provided work, although the work is not required or assessed. The student showed work as a check of the ratio between the number of people that Shane surveyed and the number of people in Brooke’s survey ( $50 \cdot 4.5 = 225$ ). The student then multiplied the number of people who had a sibling with an age difference in the 3–5 interval (14) by the ratio used in the first line of work (4.5), resulting in $14 \cdot 4.5 = 63$ . [1 point]

Part C – Student Response	Part C – Annotations
<del>0, 2, 3, 5, 6, 8, 9, 11, 12, 14</del> $\frac{6 + 8}{2} = 7$ 7	The student provided an incorrect answer (7). The student provided work, although the work is not required or assessed. The student made a list of the interval numbers (0, 2, 3, 5, 6, 8, 9, 11, 12, 14), crossed off the numbers starting from the ends until only two numbers remained (6 and 8), and then found the average of these two numbers by dividing their sum by 2, resulting in an average of 7; however, the student found the median of the interval values rather than finding the interval that would contain the median age difference. [0 points]

Part D – Student Response	Part D – Annotations
$50 \cdot 3.88 = \frac{194}{47} = 4.13$ 4.13	The student provided the correct answer (4.13). The student provided work, although the work is not required or assessed. The student calculated the total of the age differences for the 50 people surveyed by multiplying 50 by the mean (3.88), resulting in $50 \cdot 3.88 = 194$ , divided the total by 47, which is the 50 people surveyed minus the number of people who are a twin (3), and then correctly rounded the quotient to 4.13. The student’s work contains a run-on equation—the left-hand side of the equation ( $50 \cdot 3.88$ ) does not equal the right-hand side (4.13); however, this was ignored since the work was extraneous. [1 point]

Item 14 – 2 points

Part A – Student Response	Part A – Annotations
4	The student provided an incorrect answer (4). No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have considered only the number of people who have an age difference in the 9–11 interval. [0 points]

Part B – Student Response	Part B – Annotations
$3-5 \rightarrow 14$ $\frac{14}{50} = \frac{x}{225}$ $50x = 3150$ $x = 63$ 63	The student provided the correct answer (63). The student provided work, although the work is not required or assessed. The student started by showing the number of people who have an age difference in the 3–5 interval as 14 and then set up the proportion $\frac{14}{50} [=] \frac{x}{225}$ . The student solved the proportion for $x$ by cross multiplying, resulting in $50x = 3150$ , and then dividing both sides by 50, resulting in $x = 63$ . [1 point]

Part C – Student Response	Part C – Annotations
$0-2 \rightarrow 24$ $3-5 \rightarrow 14$ $6-8 \rightarrow 6$ $9-11 \rightarrow 4$ $12-14 \rightarrow 2$ 3	The student provided a correct answer (3). The student provided work, although the work is not required or assessed. The student listed the intervals and the number of people in those intervals. From there, the student may have identified that the median would be the average of the 25th and 26th age differences based on 50 people surveyed and saw that 24 people had a sibling with an age difference in the 0–2 interval, which would place the 25th and 26th age differences in the 3–5 interval, resulting in 3 years as the smallest possible median. [1 point]

Part D – Student Response	Part D – Annotations
$50 \times 3.88 = 194$ $194 - 3 = 191$ $50 - 3 = 47$ $\frac{191}{47} = 4.06$ 4.06	The student provided an incorrect answer (4.06). The student provided work, although the work is not required or assessed. The student correctly calculated the total of the age differences for the 50 people surveyed ( $50 \times 3.88 = 194$ ) and subtracted the 3 people who are a twin from the total of 50 people ( $50 - 3 = 47$ ) but also subtracted 3 from the total ( $194 - 3 = 191$ ), which is an incorrect step, before dividing 191 by 47, resulting in an incorrect quotient of 4.06. [0 points]

Item 14 – 1 point

Part A – Student Response	Part A – Annotations
12	The student provided an incorrect answer (12). No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have included the number of people with an age difference in all the intervals that included the age difference of 8 or more: 6 people for the 6–8 interval, 4 people for the 9–11 interval, and 2 people for the 12–14 interval, resulting in a sum of $6 + 4 + 2 = 12$ . [0 points]

Part B – Student Response	Part B – Annotations
3–5 = 14 people  $\frac{14}{50} = \frac{63}{225}$  63	The student provided the correct answer (63). The student provided work, although the work is not required or assessed. The student started by showing the number of people who have an age difference in the 3–5 interval as 14 and then set up the proportion $\frac{14}{50} = \frac{63}{225}$ , which shows that 63 people would have an age difference in the 3–5 interval in Brooke’s survey. [1 point]

Part C – Student Response	Part C – Annotations
<del>0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14</del>  7	The student provided an incorrect answer (7). The student provided work, although the work is not required or assessed. The student made a list of all the age differences represented by the histogram (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14) and then crossed off the numbers starting from the ends until only one number remained (7); however, the student found the median of the possible age differences rather than finding the interval that would contain the median age difference. [0 points]

Part D – Student Response	Part D – Annotations
1–2 = 21  47 people  5	The student provided an incorrect answer (5). No support (work or explanation) is required, so it is unclear where an error was made. While the student wrote 47 people and adjusted the first interval to 1–2 years and 21 people, it is unclear how the answer was derived. [0 points]

Item 14 – 0 points

Part A – Student Response	Part A – Annotations
4	The student provided an incorrect answer (4). No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have considered only the number of people who have an age difference in the 9–11 interval. [0 points]

Part B – Student Response	Part B – Annotations
14	The student provided an incorrect answer (14). No support (work or explanation) is required for Part B, so it is unclear where an error was made. The student may have read the histogram for Shane's data and seen that 14 people have an age difference in the 3–5 interval but then did not use that information to make a calculation for Brooke's survey. [0 points]

Part C – Student Response	Part C – Annotations
<del>12–14, 9–11, 6–8, 3–5, 0–2</del> 6–8	The student provided an incorrect answer (6–8). The student provided work, although the work is not required or assessed. The student made a list of the intervals of age differences represented by the histogram ( <del>12–14, 9–11, 6–8, 3–5, 0–2</del> ) and then crossed off the intervals starting from the ends until only one interval remained (6–8); however, the student found the median of the intervals rather than finding the interval that would contain the median age difference. [0 points]

Part D – Student Response	Part D – Annotations
1.55	The student provided an incorrect answer (1.55). No support (work or explanation) is required for Part D, so it is unclear where an error was made. The student may have doubled the number of people surveyed who are twins (3) since a set of twins represents two people and then divided the result (6) by the mean of Shane's data (3.88), resulting in an incorrect answer of approximately 1.54639, which can be rounded to 1.55 when written to the nearest hundredth. [0 points]

**THIS PAGE IS  
INTENTIONALLY BLANK.**

# Keystone Exams Algebra I Item Sampler Scoring Guide

---

Copyright © 2025 by the Pennsylvania Department of Education. The materials contained in this publication may be duplicated by Pennsylvania educators for local classroom use. This permission does not extend to the duplication of materials for commercial use.

---