



pennsylvania
DEPARTMENT OF EDUCATION



**PENNSYLVANIA
KEYSTONE EXAMS**

**Algebra I
Module 2
Item and Scoring Sampler**

2024–2025

TABLE OF CONTENTS

INFORMATION ABOUT MATHEMATICS	3
Introduction.....	3
About the Keystone Exams.....	3
Alignment.....	4
Depth of Knowledge.....	4
Exam Format.....	4
Item and Scoring Sampler Format.....	5
Algebra I Exam Directions.....	6
General Description of Scoring Guidelines for Algebra I	8
Formula Sheet	9
ALGEBRA I MODULE 2	10
Multiple-Choice Items.....	10
Constructed-Response Item.....	34
Item-Specific Scoring Guideline	36
Constructed-Response Item.....	56
Item-Specific Scoring Guideline	58
Algebra I Module 2—Summary Data.....	76

INFORMATION ABOUT MATHEMATICS

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 the standards, Assessment Anchor documents, Keystone Exams Test Definition, Classroom Diagnostic Tool, Standards Aligned System, and content-based Item and Scoring Samplers. This 2024 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. This Item and Scoring Sampler is not designed to be used as a pretest, a curriculum, or any other benchmark for operational testing.

This Item and Scoring Sampler 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 Item and Scoring 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.

The items in this Item and Scoring 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 Item and Scoring Sampler. Educators may then use this Item and Scoring Sampler as a guide to score the responses either independently or together with colleagues within a school or district.

This Item and Scoring Sampler 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 <https://www.education.pa.gov/>.

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

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 DOK is the cognitive expectation demanded by standards, curricular activities, and assessment tasks. Webb's DOK includes four levels, from the lowest (recall) level to the highest (extended thinking) level.

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 DOK, please visit the PDE website at [http://static.pdesas.org/content/documents/Keystone Exams Understanding Depth of Knowledge and Cognitive Complexity.pdf](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. 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.

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 ten minutes to complete. The estimated time to respond to a test question is the same for both test formats. During an official exam administration, students are given additional time as necessary to complete the exam.

Item and Scoring Sampler Format

This Item and Scoring 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 item 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 item 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. The student responses in this Item and Scoring Sampler are actual student responses; however, the handwriting has been changed to protect the students' identities and to make this Item and Scoring Sampler accessible to as many people as possible.

Example Multiple-Choice Item Information Table

Category	Item-Specific Information
Alignment	Assigned AAEC
Answer Key	Correct Answer
Depth of Knowledge	Assigned DOK
<i>p</i> -value A	Percentage of students who selected option A
<i>p</i> -value B	Percentage of students who selected option B
<i>p</i> -value C	Percentage of students who selected option C
<i>p</i> -value D	Percentage of students who selected option 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
Mean Score	Average Score

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 9 of this booklet. You may refer to the formula sheet 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 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.
- Read the items carefully and respond to exactly what is being asked. You will only be given credit by responding to what is requested; you will not be given credit for work that is not requested in the questions.
- You cannot receive the highest score for a constructed-response question without completing all the tasks in the question. For example,
 - if the question asks you to show your work or explain your reasoning, be sure to show your work or explain your reasoning in the space provided.
 - if the question asks you to explain, be sure to use words to explain your reasoning in the space provided.
- All responses must be written in the appropriate location within the response box in the Algebra I 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 booklet.

If you finish early, you may check your work in Module 2 only.

- Do not look 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 these directions 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. 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 *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.

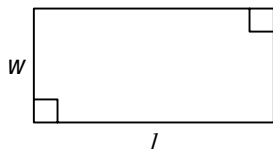
0 Points

- 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

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 .

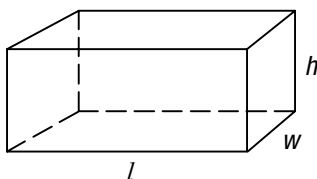
Rectangle



$$A = lw$$

$$P = 2l + 2w$$

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 2

Multiple-Choice Items

1. The first 5 terms of a pattern are shown below.

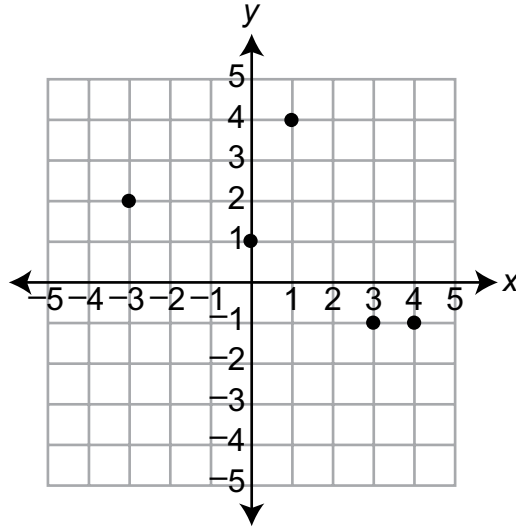
120, 162, 204, 246, 288

Which expression can be used to find the 12th term in the pattern?

- Ⓐ $42(11)$
- Ⓑ $42(12)$
- Ⓒ $120 + 42(11)$
- Ⓓ $120 + 42(12)$

Category	Item-Specific Information
Alignment	A1.2.1.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	5%
p-value B	20%
p-value C	51% (correct answer)
p-value D	24%
Option Annotations	<p>A student could determine the correct answer, option C, by identifying the rate of change in the pattern as “add 42” and then either recognizing that this change must be applied 11 times to go from the first term (120) to the 12th term of the pattern OR using the rule for arithmetic sequences, $a + (n - 1)d$, where a is the first term of the pattern, n is the term number, and d is the common difference, resulting in $120 + (12 - 1)42$, which can be simplified to $120 + 11(42)$ and rewritten as $120 + 42(11)$.</p> <p>A student could arrive at an incorrect answer by not including the first term of the pattern, thinking that the rate of change needs to be applied 12 times, or both. For example, a student could arrive at option D by thinking the rate of change must be applied 12 times without considering that the rate of change is not applied to the first term of the pattern.</p>

2. The graph of a relation is shown below.



Which statement about the relation is true?

- Ⓐ Because the points are not linear, the relation is not a function.
- Ⓑ Because the points are not connected, the relation is not a function.
- Ⓒ Because each x -value corresponds to exactly one y -value, the relation is a function.
- Ⓓ Because there are two x -values that have the same y -value, the relation is a function.

Category	Item-Specific Information
Alignment	A1.2.1.1.2
Answer Key	C
Depth of Knowledge	1
p-value A	31%
p-value B	12%
p-value C	43% (correct answer)
p-value D	14%
Option Annotations	<p>A student could determine the correct answer, option C, by recognizing that the five points on the graph have different x-coordinates, so each x-coordinate is paired with only one y-coordinate, which defines the relation as a function.</p> <p>A student could arrive at an incorrect answer by misunderstanding what prevents a relation from being a function or defines why a relation is a function. For example, a student could arrive at option A by thinking that the only way for a relation to be a function is if the points all lie on the same line (i.e., the student confuses a linear relationship and a functional relationship).</p>

3. A piece of wood fell into a river. The equation shown below can be used to determine the distance (d), in meters, the piece of wood has floated down the river t minutes after it fell into the river.

$$d = \frac{11}{5}t$$

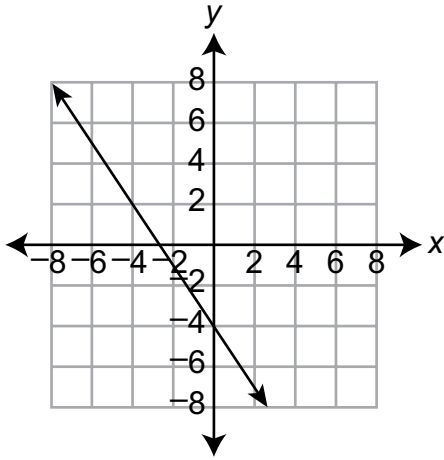
Based on the equation, which statement is true?

- Ⓐ The piece of wood will have floated a distance of 5 meters in 11 minutes.
- Ⓑ The piece of wood will have floated a distance of 11 meters in 5 minutes.
- Ⓒ The piece of wood will have floated a distance of 1 meter in 5 minutes and 2 meters in 11 minutes.
- Ⓓ The piece of wood will have floated a distance of 5 meters in 1 minute and 11 meters in 2 minutes.

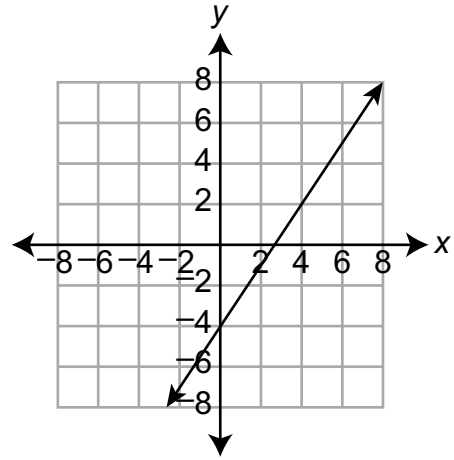
Category	Item-Specific Information
Alignment	A1.2.1.2.1
Answer Key	B
Depth of Knowledge	2
p-value A	14%
p-value B	66% (correct answer)
p-value C	10%
p-value D	10%
Option Annotations	<p>A student could determine the correct answer, option B, by recognizing that the slope, $\frac{11}{5}$, represents distance divided by time, meaning that the piece of wood will float a distance of 11 meters over a time period of 5 minutes.</p> <p>A student could arrive at an incorrect answer by reversing what the slope represents or misinterpreting what the values within the slope represent. For example, a student could arrive at option A by thinking that the slope represents time over distance since the slope is the coefficient for the time variable (t).</p>

4. Which graph represents the equation $y = -\frac{2}{3}x - 4$?

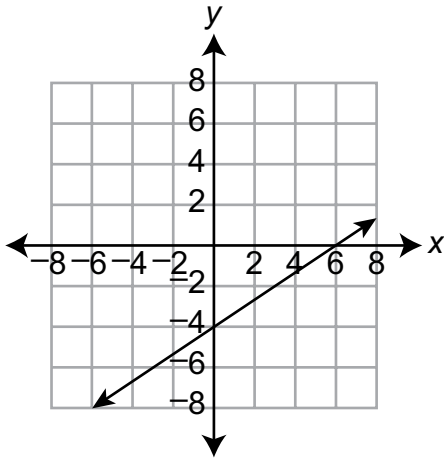
Ⓐ



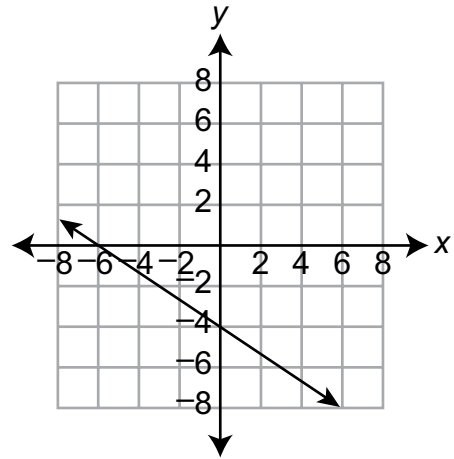
Ⓑ



Ⓒ



Ⓓ



Category	Item-Specific Information
Alignment	A1.2.1.2.2
Answer Key	D
Depth of Knowledge	1
p-value A	13%
p-value B	4%
p-value C	8%
p-value D	75% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by recognizing that the slope, $-\frac{2}{3}$, represents a line that goes down 2 units and right 3 units and the y-intercept, -4, represents a line that passes through $(0, -4)$. Although all four graphs pass through $(0, -4)$, only the graph in option D has a slope of $-\frac{2}{3}$.</p> <p>A student could arrive at an incorrect answer by using the reciprocal of the slope, not applying the negative sign, or both.</p> <p>For example, a student could arrive at option A by recognizing that the slope is negative but starting at $(0, -4)$ and moving left 2 units and up 3 units rather than identifying the line with a rate of change that goes down 2 units and right 3 units.</p>

5. The tables below show the numbers of pounds of potatoes that are needed to make French fries for different numbers of people and the costs, in dollars, for different numbers of pounds of potatoes.

Potatoes Needed for French Fries

Number of People	Pounds of Potatoes
16	12
36	27

Cost of Potatoes

Pounds of Potatoes	Total Cost
10	\$8
25	\$20

The linear pattern in each table continues. Based on the tables, how much will it cost to buy enough potatoes to make French fries for 200 people?

- Ⓐ \$120
- Ⓑ \$150
- Ⓒ \$160
- Ⓓ \$213

Category	Item-Specific Information
Alignment	A1.2.2.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	41% (correct answer)
p-value B	16%
p-value C	31%
p-value D	12%
Option Annotations	<p>A student could determine the correct answer, option A, by dividing the number of pounds of potatoes by the number of people (either $12 \div 16$ or $27 \div 36$) to determine the pounds of potatoes per person, which is $\frac{3}{4}$, dividing the total cost by the number of pounds of potatoes (either $\\$8 \div 10$ or $\\$20 \div 25$) to determine the total cost per pound of potatoes, which is \$0.80, and then recognizing that the total cost of the potatoes needed for 200 people can be found by first finding the number of pounds of potatoes for 200 people by multiplying 200 by $\frac{3}{4}$, which is 150 pounds of potatoes, and then multiplying that product by \$0.80, which is \$120.</p> <p>A student could arrive at an incorrect answer by applying the rate from only one of the tables or by using the reciprocal of one of the relationships. For example, a student could arrive at option C by multiplying 200 by the cost per pound of potatoes (\$0.80), resulting in \$160, which is the cost of 200 pounds of potatoes rather than the cost of the potatoes needed for 200 people.</p>

6. A store sells pre-owned books.

- The store makes the same amount of money for each pre-owned book sold.
- The store makes \$19.05 from selling 3 pre-owned books.

How much **more** money does the store make from selling 47 pre-owned books than from selling only 18 pre-owned books?

- Ⓐ \$86.15
- Ⓑ \$184.15
- Ⓒ \$465.45
- Ⓓ \$552.45

Category	Item-Specific Information
Alignment	A1.2.2.1.2
Answer Key	B
Depth of Knowledge	2
p-value A	5%
p-value B	82% (correct answer)
p-value C	7%
p-value D	6%
Option Annotations	<p>A student could determine the correct answer, option B, by dividing \$19.05 by 3, which is \$6.35 per book, and then multiplying that quotient by the difference between the number of books, resulting in $\\$6.35(47 - 18) = \\$6.35(29) = \\$184.15$.</p> <p>A student could arrive at an incorrect answer by finding the earnings per book incorrectly or applying the earnings per book incorrectly. For example, a student could arrive at option C by subtracting 3 from \$19.05, resulting in a difference of \$16.05, and using that as the earnings per book, resulting in $\\$16.05(47 - 18) = \\$16.05(29) = \\$465.45$.</p>

7. What is the slope of the line represented by the equation $7x - 3y = 5$?

(A) $-\frac{7}{3}$

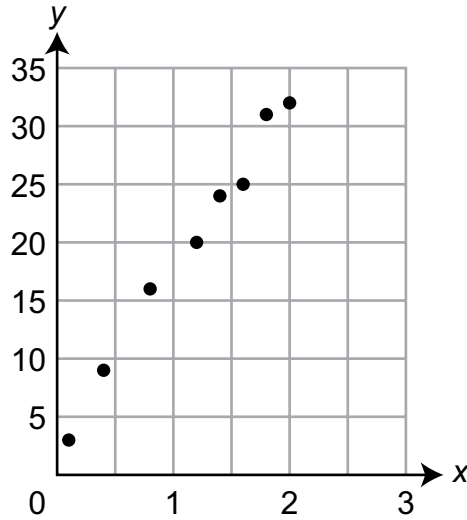
(B) $-\frac{3}{7}$

(C) $\frac{3}{7}$

(D) $\frac{7}{3}$

Category	Item-Specific Information
Alignment	A1.2.2.1.4
Answer Key	D
Depth of Knowledge	1
p-value A	21%
p-value B	19%
p-value C	9%
p-value D	51% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, either by subtracting $7x$ from both sides of the equation, resulting in $-3y = -7x + 5$, dividing each term by -3, resulting in $y = \frac{7}{3}x - \frac{5}{3}$, and recognizing that the coefficient of the x term $\left(\frac{7}{3}\right)$ represents the slope of the line OR by recognizing that the slope of a line written in standard form ($Ax + By = C$) can be determined using $m = -\frac{A}{B}$, resulting in $-\frac{7}{-3} = \frac{7}{3}$.</p> <p>A student could arrive at an incorrect answer by solving for y incorrectly or switching how to apply the coefficients of x and y.</p> <p>For example, a student could arrive at option A by solving for y incorrectly by subtracting $7x$ from the left side of the equation but adding $7x$ to the right side of the equation and then multiplying both sides of the equation by the reciprocal of -3, which is $-\frac{1}{3}$, resulting in a slope of $-\frac{7}{3}$ OR by using $m = -\frac{A}{B}$ but substituting 3 in for B rather than -3.</p>

8. A scatter plot is shown below.



Which equation represents a line of best fit for the scatter plot?

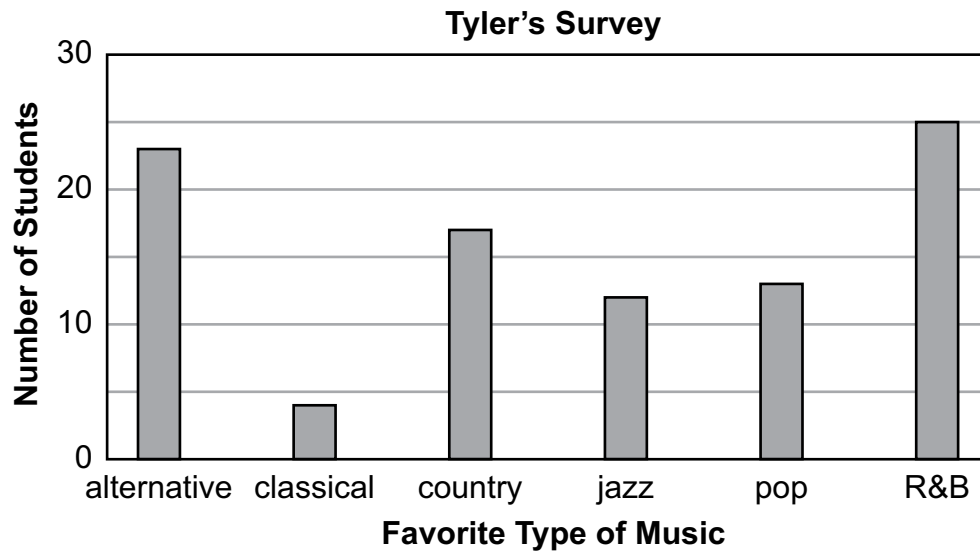
- Ⓐ $y = \frac{1}{15}x$
- Ⓑ $y = 15x$
- Ⓒ $y = \frac{1}{15}x + 2\frac{1}{2}$
- Ⓓ $y = 15x + 2\frac{1}{2}$

Category	Item-Specific Information
Alignment	A1.2.2.2.1
Answer Key	D
Depth of Knowledge	1
p-value A	15%
p-value B	18%
p-value C	26%
p-value D	41% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by seeing that the points are increasing at an approximate rate of 15 vertical units for every 1 horizontal unit, resulting in an approximate slope of 15 (i.e., $\frac{\text{rise}}{\text{run}} = \frac{15}{1} = 15$), and noticing that the points are each a little above the line $y = 15x$, resulting in the need for a y-intercept greater than 0. Of the four answer choices, only option D uses a slope of 15 with a y-intercept greater than 0.</p> <p>A student could arrive at an incorrect answer by using the reciprocal of the slope, not using a constant term, or both. For example, a student could arrive at option C by recognizing that the y-intercept is greater than 0 but then using the reciprocal of the slope and using $\frac{\text{run}}{\text{rise}}$ rather than $\frac{\text{rise}}{\text{run}}$.</p>

9. A teacher gave a quiz that was worth 50 points. The range of quiz scores was 35 points. Based on the range of quiz scores, which conclusion is **most likely** true?
- Ⓐ Every quiz score was 35 points.
 - Ⓑ The lowest quiz score was 35 points.
 - Ⓒ Half of the quiz scores were between 10 points and 45 points.
 - Ⓓ The highest quiz score was 50 points and the lowest quiz score was 15 points.

Category	Item-Specific Information
Alignment	A1.2.3.1.1
Answer Key	D
Depth of Knowledge	2
p-value A	3%
p-value B	7%
p-value C	22%
p-value D	68% (correct answer)
Option Annotations	<p>A student could determine the correct answer, option D, by recognizing that 50 points could be the highest score and that $50 - 35 = 15$ could be the lowest score since the range represents the difference between the maximum and minimum values.</p> <p>A student could arrive at an incorrect answer by misinterpreting how to apply the range or confusing range and interquartile range. For example, a student could arrive at option C by confusing range and interquartile range, which is the difference between the third quartile value (Q3) and the first quartile value (Q1), and then using values that seem reasonable for these quartile values (Q3 = 45 points and Q1 = 10 points) while also having a difference of 35 points ($45 - 10 = 35$).</p>

10. Tyler randomly surveyed 94 of the ninth-grade students at his school on their favorite type of music. The bar graph shown below displays the results of his survey.

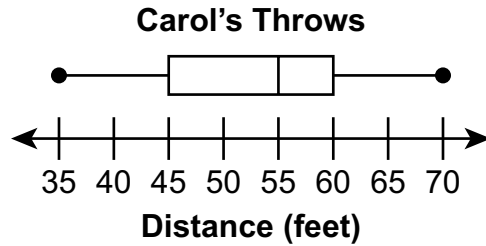


Tyler will survey 28 more ninth-grade students to select their favorite type of music. Based on the bar graph, how many of the 28 students will **most likely** select jazz as their favorite type of music?

- Ⓐ 4
- Ⓑ 7
- Ⓒ 13
- Ⓓ 16

Category	Item-Specific Information
Alignment	A1.2.3.2.1
Answer Key	A
Depth of Knowledge	2
p-value A	50% (correct answer)
p-value B	21%
p-value C	20%
p-value D	9%
Option Annotations	<p>A student could determine the correct answer, option A, by finding the fraction of the 94 students represented in the bar graph who selected jazz, which is approximately $\frac{12}{94}$, multiplying this fraction by 28, resulting in a product of $3\frac{27}{47}$ (which has an approximate value of 3.574), and then rounding this value to the nearest whole number (4) since the final answer represents a number of students.</p> <p>A student could arrive at an incorrect answer by misinterpreting how to apply the fraction, by using the wrong data, or by using an incorrect data set. For example, a student could arrive at option B either by using the fraction of students who selected alternative, which is approximately $\frac{23}{94}$, since alternative is the first bar, resulting in $28 \cdot \frac{23}{94} \approx 6.85106$, which rounds to 7 OR by using the fraction of students who selected R&B, which is approximately $\frac{25}{94}$, since R&B is the tallest bar, resulting in $28 \cdot \frac{25}{94} \approx 7.4468$, which rounds to 7.</p>

11. Carol is throwing a baseball. For each of her throws, the baseball travels a different distance. The box-and-whisker plot shown below represents the distances, in feet, the baseball travels for each of her first 40 throws.



Based on the box-and-whisker plot, for how many of Carol's next 80 throws should she expect the baseball to travel more than 60 feet?

- Ⓐ 10
- Ⓑ 20
- Ⓒ 25
- Ⓓ 30

Category	Item-Specific Information
Alignment	A1.2.3.2.2
Answer Key	B
Depth of Knowledge	2
p-value A	26%
p-value B	46% (correct answer)
p-value C	19%
p-value D	9%
Option Annotations	<p>A student could determine the correct answer, option B, by identifying 60 as the third quartile value of the box-and-whisker plot since the right whisker starts at 60, recognizing that 25% of the data points represented by the box-and-whisker plot are greater than 60, and then determining 25% of 80 by multiplying 80 by 0.25, resulting in a product of 20.</p> <p>A student could arrive at an incorrect answer by misinterpreting the box-and-whisker plot, by not applying the percentage, or by using an incorrect data set. For example, a student could arrive at option A either by finding the difference between the maximum value (70) and the given value (60), resulting in a difference of 10 OR by determining 25% of the original 40 throws rather than the next 80 throws, resulting in $0.25 \cdot 40 = 10$.</p>

12. A radio station will randomly select 1 of 5 playlists, each containing 8 songs, to play over the next hour. The station will then play the songs on the selected list in a random order. Josh's favorite song is on 3 of those playlists. What is the probability that the first song in the next hour is Josh's favorite song?
- Ⓐ 0.025
 - Ⓑ 0.075
 - Ⓒ 0.375
 - Ⓓ 0.475

Category	Item-Specific Information
Alignment	A1.2.3.3.1
Answer Key	B
Depth of Knowledge	2
p-value A	15%
p-value B	53% (correct answer)
p-value C	24%
p-value D	8%
Option Annotations	<p>A student could determine the correct answer, option B, by finding the probability of the station selecting a playlist containing the favorite song, which is 3 of 5 or $\frac{3}{5}$, finding the probability that the favorite song is played first, which is $\frac{1}{8}$, and then multiplying these probabilities together, resulting in $\frac{3}{5} \cdot \frac{1}{8} = \frac{3}{40} = 0.075$.</p> <p>A student could arrive at an incorrect answer by incorrectly applying the two probabilities or by applying only one of the two probabilities. For example, a student could arrive at option C by multiplying the probability that the favorite song is played first by the number of playlists with the favorite song rather than the probability of selecting a playlist containing the favorite song, resulting in $\frac{1}{8} \cdot 3 = \frac{3}{8} = 0.375$.</p>

Constructed-Response Item

13. Jaime and Robyn are cross-country skiers.

Jaime skied a certain distance the first week the cross-country ski trails were opened for the winter. He then increased the distance he skied by the same amount each week. The table below shows the distances Jaime skied for different numbers of weeks since the cross-country ski trails opened.

Jaime's Cross-Country Skiing

Weeks Since Trails Opened	Distance (kilometers)
3	27
5	34
9	48

- A.** Based on the information in the table, what is the rate of change? Explain what this value represents in the context of the situation.

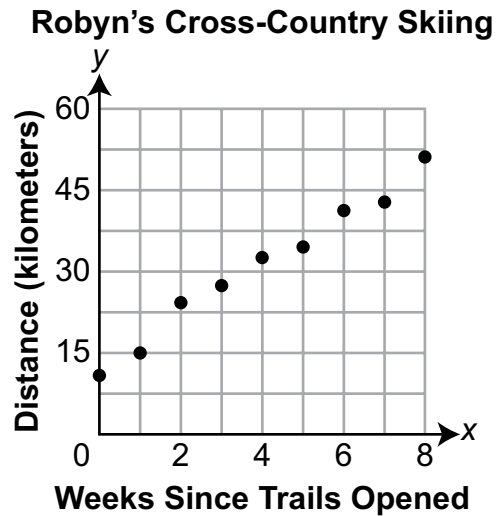
- B.** Explain why the pattern in the table in **part A** might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases.

Go to the next page to finish question 13.



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

Robyn changes the distance she skis each week, but she always skis a whole number of kilometers. The scatter plot below shows the distances Robyn has skied for different numbers of weeks since the cross-country ski trails opened.



For her line of best fit, Robyn uses the equation $y = 4\frac{3}{4}x + 12\frac{1}{3}$.

- C. Explain why her line of best fit, although accurate, will never predict an exact distance that Robyn will ski.

GO ON 

Item-Specific Scoring Guideline

#13 Item Information

Category	Item-Specific Information
Alignment	A1.2.2
Depth of Knowledge	3
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.

A1.2.2.2 Analyze and/or interpret data on a scatter plot.

Item-Specific Scoring Guideline

Score	In this item, . . .
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 Response**Part A (2 points):**

1 point for correct answer

1 point for correct and complete explanation

OR 1/2 point for correct but incomplete explanation

Note: 1/2 point (out of 2 score points) for 3.5 with an incorrect unit OR for 3.5 embedded correctly in an equation or expression

What?

3.5

OR

$3\frac{1}{2}$

OR

$\frac{7}{2}$

Why?**Sample Explanations:**

The rate of change represents the increase, in kilometers, in the distance Jaime skis each week.

OR

Jaime increases the distance he skis by 3.5 kilometers each week.

OR equivalent

Part B (1 point):

1 point for correct and complete explanation

OR 1/2 point for correct but incomplete explanation

Why?**Sample Explanations:**

Since there are only so many weeks that the ski trails will remain open, the x -values will only increase to a certain point.

OR

There are only so many kilometers Jaime can ski in a week. Once the y -value for the line of best fit exceeds the maximum distance Jaime can ski in a week, it stops being a reliable predictor of the distance Jaime skis.

OR equivalent

Part C (1 point):

1 point for correct and complete explanation

OR 1/2 point for correct but incomplete explanation

Why?**Sample Explanation:**

Since the week must be a whole number, the line of best fit will only predict a distance with a fractional amount included $\left(\text{either } \frac{1}{12}, \frac{4}{12}, \frac{7}{12}, \text{ or } \frac{10}{12}\right)$ and never a whole number.

Robyn only skis a whole number of kilometers each week, so the line of best fit will never predict an exact distance that Robyn will ski.

OR equivalent

STUDENT RESPONSE

Response Score: 4 points

13. Jaime and Robyn are cross-country skiers.

Jaime skied a certain distance the first week the cross-country ski trails were opened for the winter. He then increased the distance he skied by the same amount each week. The table below shows the distances Jaime skied for different numbers of weeks since the cross-country ski trails opened.

Jaime's Cross-Country Skiing

Weeks Since Trails Opened	Distance (kilometers)
3	27
5	34
9	48

- A. Based on the information in the table, what is the rate of change? Explain what this value represents in the context of the situation.

$$(5, 34) (9, 48)$$

$$\frac{48 - 34}{9 - 5} = \frac{14}{4} = \boxed{\frac{7}{2}} \text{ rate of change}$$

For every two weeks since the trails opened, he skied 7 kilometers more.

- B. Explain why the pattern in the table in **part A** might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases.

Eventually he won't be able to keep up with the rate of change and he won't keep increasing the number of kilometers he skis.

Go to the next page to finish question 13.

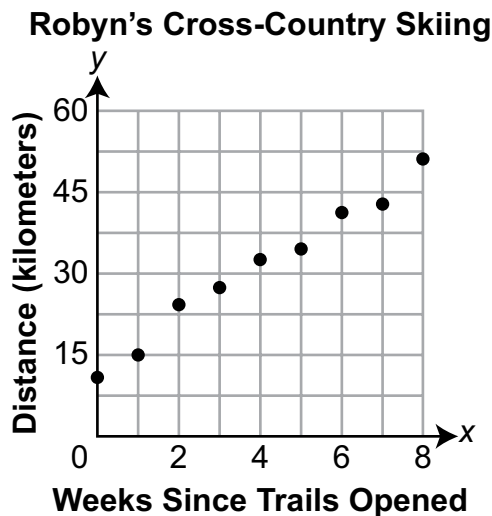
GO ON 

Part A: The student provided the correct rate of change $\left(\frac{7}{2}\right)$. The student provided work for finding the rate of change, although the work is not required or assessed. The student wrote two points from the chart as (5, 34) and (9, 48), substituted the values into the formula for slope $\left(m = \frac{y_2 - y_1}{x_2 - x_1}\right)$, and then simplified the expression $\left(\frac{48 - 34}{9 - 5} [=] \frac{14}{4} = \frac{7}{2}\right)$. The student also provided a correct and complete explanation of what this value represents in the context of the situation (*for every two weeks since the trails opened, he skied 7 kilometers more*). [2 points]

Part B: The student provided a correct and complete explanation as to why the pattern in the table might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases (*Eventually he won't be able to keep up with the rate of change and he won't keep increasing the number of kilometers he skis*). [1 point]

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

Robyn changes the distance she skis each week, but she always skis a whole number of kilometers. The scatter plot below shows the distances Robyn has skied for different numbers of weeks since the cross-country ski trails opened.



For her line of best fit, Robyn uses the equation $y = 4\frac{3}{4}x + 12\frac{1}{3}$.

- C. Explain why her line of best fit, although accurate, will never predict an exact distance that Robyn will ski.

Those numbers will give a decimal answer, not a whole number.

GO ON 

Part C: The student provided a correct and complete explanation as to why Robyn's line of best fit for the graph will never predict an exact distance that Robyn will ski (*Those numbers will give a decimal answer, not a whole number*). [1 point]

STUDENT RESPONSE

 Computer Response Score: 3 points

PARTS A and B

Question 13
Page 1 of 2

Jaime and Robyn are cross-country skiers.

Jaime skied a certain distance the first week the cross-country ski trails were opened for the winter. He then increased the distance he skied by the same amount each week. The table below shows the distances Jaime skied for different numbers of weeks since the cross-country ski trails opened.

Weeks Since Trails Opened	Distance (kilometers)
3	27
5	34
9	48

A. Based on the information in the table, what is the rate of change? Explain what this value represents in the context of the situation.

The rate of change is 7. In the context of this situation, the value of 7 represents the distance in kilometers Jaime increased his skiing by every two weeks.

158 / 1000

B. Explain why the pattern in the table in **part A** might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases.

The pattern in the table might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases, is because Jaime may not be able to increase the distance as much because he may get too worn out or he isn't fit for the adjustment yet.

262 / 1000

Review/End Test Pause Flag Options Next

Part A: The student provided an incorrect rate of change (7). No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have subtracted the distances for 5 weeks and 3 weeks, resulting in $34 - 27 = 7$, without considering that 2 weeks had elapsed and not 1 week. However, the student provided a correct and complete explanation of what this value represents in the context of the situation (*the value of 7 represents the distance in kilometers Jaime increased his skiing by every two weeks*). [1 point]

Part B: The student provided a correct and complete explanation as to why the pattern in the table might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases (*because Jaime may not be able to increase the distance as much because he may get too worn out*). [1 point]

PART C

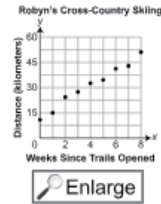
Question 13
Page 2 of 2



Item ID ?

Jaime and Robyn are cross-country skiers.

Robyn changes the distance she skis each week, but she always skis a whole number of kilometers. The scatter plot below shows the distances Robyn has skied for different numbers of weeks since the cross-country ski trails opened.



For her line of best fit, Robyn uses the equation $y = 4\frac{3}{4}x + 12\frac{1}{3}$.

C. Explain why her line of best fit, although accurate, will never predict an exact distance that Robyn will ski.

Robyn's line of best fit will never predict an exact distance that she will ski, is because, she did recorded the information but the slope-intercept form has fractions so the information will not be whole numbers.

214 / 1000

Review/End Test

Pause

Flag

Options

Back

Next

Part C: The student provided a correct and complete explanation as to why Robyn's line of best fit for the graph will never predict an exact distance that Robyn will ski (*the slope-intercept form has fractions so the information will not be whole numbers*). [1 point]

STUDENT RESPONSE

Response Score: 2 points

13. Jaime and Robyn are cross-country skiers.

Jaime skied a certain distance the first week the cross-country ski trails were opened for the winter. He then increased the distance he skied by the same amount each week. The table below shows the distances Jaime skied for different numbers of weeks since the cross-country ski trails opened.

Jaime's Cross-Country Skiing

Weeks Since Trails Opened	Distance (kilometers)
3	27
5	34
9	48

- A. Based on the information in the table, what is the rate of change? Explain what this value represents in the context of the situation.

the rate of change is every two weeks there is 7 kilometers added.

- B. Explain why the pattern in the table in **part A** might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases.

It may stop being a reliable predictor because the distance may start to increase further than what has been predicted.

Go to the next page to finish question 13.

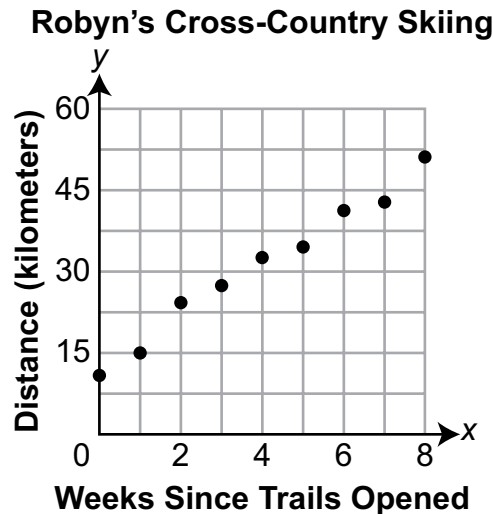
GO ON 

Part A: The student did not provide an answer for the rate of change in a numerical form. No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have thought the explanation was sufficient to answer both parts of the prompt. However, the student provided a correct and complete explanation of what the rate of change represents in the context of the situation (*every two weeks there is 7 kilometers added*). [1 point]

Part B: The student provided a correct and complete explanation as to why the pattern in the table might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases (*because the distance may start to increase further than what has been predicted*). This could mean that Jaime might start to increase the distance skied by more than 7 kilometers every two weeks, which is an acceptable explanation. [1 point]

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

Robyn changes the distance she skis each week, but she always skis a whole number of kilometers. The scatter plot below shows the distances Robyn has skied for different numbers of weeks since the cross-country ski trails opened.



For her line of best fit, Robyn uses the equation $y = 4\frac{3}{4}x + 12\frac{1}{3}$.

- C. Explain why her line of best fit, although accurate, will never predict an exact distance that Robyn will ski.

It will never predict the exact distance because it is a line of best fit which is placed on a scatter plot to get an estimate of how he might do. Estimates are not exact so it will never predict his exact distance.

GO ON

Part C: The student provided an incorrect explanation as to why Robyn's line of best fit for the graph will never predict an exact distance that Robyn will ski (*because it is a line of best fit which is placed on a scatter plot to get an estimate of how he might do. Estimates are not exact so it will never predict his exact distance*). The student does not recognize that some lines of best fit can make accurate predictions; further, the student does not recognize that this line of best fit will never predict an exact distance since the predicted distances will always contain a fraction and the distances Robyn skis are always whole numbers. [0 points]

STUDENT RESPONSE

 Computer Response Score: 1 point

PARTS A and B

Question 13
Page 1 of 2

Jaime and Robyn are cross-country skiers.

Jaime skied a certain distance the first week the cross-country ski trails were opened for the winter. He then increased the distance he skied by the same amount each week. The table below shows the distances Jaime skied for different numbers of weeks since the cross-country ski trails opened.

Weeks Since Trails Opened	Distance (kilometers)
3	27
5	34
9	48

A. Based on the information in the table, what is the rate of change? Explain what this value represents in the context of the situation.

$y = 2/7x + 6$. The y represents the weeks since the trails opened and the x represent the distance in kilometers.

111 / 1000

B. Explain why the pattern in the table in **part A** might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases.

Jaime can go farther than what he said he was doing.

53 / 1000

Review/End Test Pause Flag Options Next

Part A: The student provided an incorrect answer for the rate of change in the form of an equation ($y = 2/7x + 6$). The rate of change of the equation ($2/7$) is incorrect, as the rate of change should have been $7/2$. No support (work or explanation) is required for Part A, so it is unclear where an error was made. The student may have used the reciprocal of the correct rate of change, writing the difference between the independent variables in the numerator and the difference between the dependent variables in the denominator. The student also provided an incorrect explanation of what this value represents in the context of the situation (*The y represents the weeks since the trails opened and the x represent the distance in kilometers*). The student incorrectly associated the independent variable (weeks) with y and the dependent variable (distance) with x . [0 points]

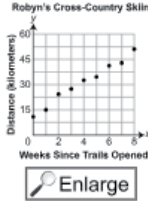
Part B: The student provided a correct and complete explanation as to why the pattern in the table might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases (*Jaime can go farther than what he said he was doing*). This could mean that Jaime may decide at any time to increase his skiing distances rather than follow a preset schedule or that Jaime might be skiing more kilometers than he claimed, either of which is an acceptable explanation. [1 point]

PART C

Question 13
Page 2 of 2

Jaime and Robyn are cross-country skiers.

Robyn changes the distance she skis each week, but she always skis a whole number of kilometers. The scatter plot below shows the distances Robyn has skied for different numbers of weeks since the cross-country ski trails opened.



For her line of best fit, Robyn uses the equation $y = 4\frac{3}{4}x + 12\frac{1}{3}$.

C. Explain why her line of best fit, although accurate, will never predict an exact distance that Robyn will ski.

EC

She is not consistant with her the distance she travels every week.

68 / 1000

Review/End Test Pause Flag Options Back Next

Part C: The student provided an incorrect explanation as to why Robyn's line of best fit for the graph will never predict an exact distance that Robyn will ski (*She is not consistant with her the distance she travels every week*). The student focuses on the points plotted on the scatter plot and notices that the points do not lie on a line; further, the student does not recognize that this line of best fit will never predict an exact distance since the predicted distances will always contain a fraction and the distances Robyn skis are always whole numbers. [0 points]

STUDENT RESPONSE

Response Score: 0 points

13. Jaime and Robyn are cross-country skiers.

Jaime skied a certain distance the first week the cross-country ski trails were opened for the winter. He then increased the distance he skied by the same amount each week. The table below shows the distances Jaime skied for different numbers of weeks since the cross-country ski trails opened.

Jaime's Cross-Country Skiing

Weeks Since Trails Opened	Distance (kilometers)
3	27
5	34
9	48

- A. Based on the information in the table, what is the rate of change? Explain what this value represents in the context of the situation.

$$m = \frac{48 - 34 - 27}{9 - 5 - 3} \Rightarrow \frac{-13}{1}$$

Rate of change: $\textcircled{-13}$

- B. Explain why the pattern in the table in **part A** might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases.

The distance in the table would go off track towards the actual pattern; causing it to be inconsistent.

Go to the next page to finish question 13.

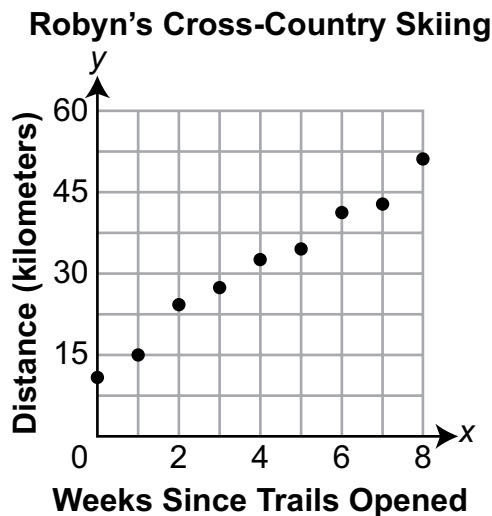
GO ON 

Part A: The student provided an incorrect rate of change (-13). The student provided work, although the work is not required or assessed. Based on the work provided, the student attempted to use the formula for slope $\left(m = \frac{y_2 - y_1}{x_2 - x_1}\right)$ but substituted the information from all three rows of the table $\left(\frac{48 - 34 - 27}{9 - 5 - 3}\right)$ rather than just two rows. The student did not provide an explanation of what this value represents in the context of the situation. [0 points]

Part B: The student provided an incorrect explanation as to why the pattern in the table might stop being a reliable predictor of the distance Jaime skis as the number of weeks increases (*The distance in the table would go off track towards the actual pattern; causing it to be inconsistent*). The student does not recognize that the distances in the table represent the actual pattern. [0 points]

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

Robyn changes the distance she skis each week, but she always skis a whole number of kilometers. The scatter plot below shows the distances Robyn has skied for different numbers of weeks since the cross-country ski trails opened.



For her line of best fit, Robyn uses the equation $y = 4\frac{3}{4}x + 12\frac{1}{3}$.

- C. Explain why her line of best fit, although accurate, will never predict an exact distance that Robyn will ski.

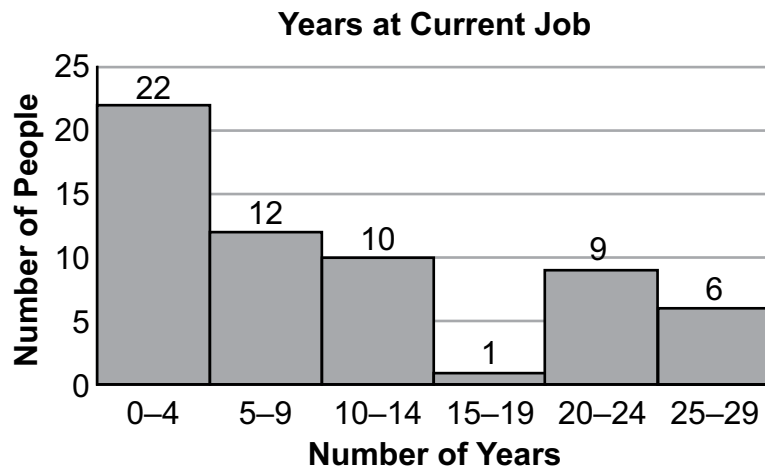
Robyn's line of best fit, although accurate, will never predict Robyn's distance because she could suddenly decrease her skiing distances.

GO ON

Part C: The student provided an incorrect explanation as to why Robyn's line of best fit for the graph will never predict an exact distance that Robyn will ski (*because she could suddenly decrease her skiing distances*). The student provided a situation in which the line of best fit might not accurately predict distances for some future dates rather than explaining why the line of best fit will never predict an exact distance: the predicted distances will always contain a fraction and the distances Robyn skis are always whole numbers. [0 points]

Constructed-Response Item

14. Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.



- A. How many of the 60 adults have been at their current job for 15 years or more?

number of adults: _____

- B. In which of the given intervals does the median of Terry's data lie?

interval: _____

Go to the next page to finish question 14.



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

The first quartile of Terry's data is 3.5.

- C. How many of the 60 adults Terry surveyed gave a response of 4 years?

number of adults: _____

Terry used his data to make a prediction about the next 150 adults he will survey at the mall.

- D. What is the best estimate of the number of adults in the next 150 surveyed who will have been at their current job for less than 10 years?

number of adults: _____

**AFTER YOU HAVE FINISHED YOUR WORK, CLOSE THIS BOOKLET
SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.**



Item-Specific Scoring Guideline

#14 Item Information

Category	Item-Specific Information
Alignment	A1.2.3
Depth of Knowledge	2
Mean Score	1.36

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, . . .
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?

16 (adults)

Part B (1 point):

1 point for correct answer

What?

5–9 (years)

OR equivalent

Part C (1 point):

1 point for correct answer

What?

7 (adults)

Part D (1 point):

1 point for correct answer

What?

85 (adults)

OR

84 (adults)

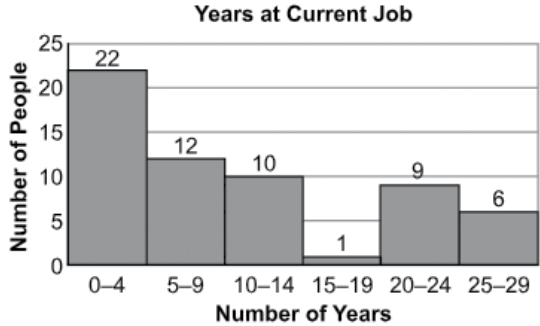
STUDENT RESPONSE

 Computer Response Score: 4 points

PARTS A and B

Question 14
Page 1 of 2

Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.



Number of Years	Number of People
0-4	22
5-9	12
10-14	10
15-19	1
20-24	9
25-29	6

A. How many of the 60 adults have been at their current job for 15 years or more?

number of adults:

B. In which of the given intervals does the median of Terry's data lie?

interval:

Review/End Test Pause Flag Options Next

Part A: The student provided the correct answer (16). While support is not required, the student may have found the number of adults who had worked 15 years or more at their current job by adding the totals for the 15–19, 20–24, and 25–29 intervals ($1 + 9 + 6 = 16$). [1 point]

Part B: The student provided the correct interval (5-9). While support is not required, the student may have recognized that the median would be the average of the middle two values, which are the 30th and 31st values since there are 60 data points, and then identified that both values reside in the 5–9 interval, which contains the 23rd through 34th values. [1 point]

PARTS C and D

Question 14
Page 2 of 2

Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.

Number of Years	Number of People
0-4	22
5-9	12
10-14	10
15-19	1
20-24	9
25-29	6

The first quartile of Terry's data is 3.5.

C. How many of the 60 adults Terry surveyed gave a response of 4 years?

number of adults:

Terry used his data to make a prediction about the next 150 adults he will survey at the mall.

D. What is the best estimate of the number of adults in the next 150 surveyed who will have been at their current job for less than 10 years?

number of adults:

Review/End Test Pause Flag Options Back Next

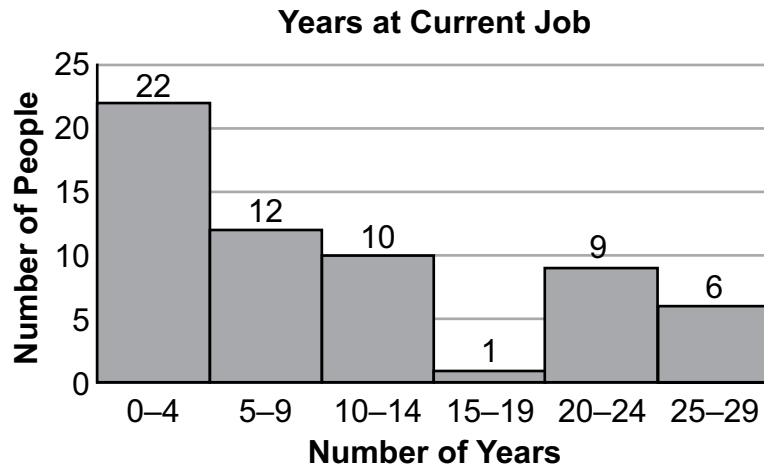
Part C: The student provided the correct answer (7). While support is not required, the student may have recognized that the first quartile of 3.5 means that $\frac{1}{4}$ of the 60 adults had worked less than 3.5 years at their current job and therefore 15 adults ($\frac{1}{4} \cdot 60 = 15$) had worked 0–3 years. This would leave 7 adults in the 0–4 interval ($22 - 15 = 7$), all of whom must have worked 4 years since that is the only whole number of years in this interval greater than 3.5 years. [1 point]

Part D: The student provided a correct answer (84). While support is not required, the student may have found the number of adults who had worked less than 10 years at their current job by adding the totals for the 0–4 and 5–9 intervals ($22 + 12 = 34$), divided this sum by the total number of adults surveyed to find the percentage ($34 \div 60 = 0.5\overline{6} = 56.\overline{6}\%$), truncated the percentage to the nearest whole (56%), and then found 56% of 150 adults by multiplying 150 by 0.56, resulting in a product of 84 adults. [1 point]

STUDENT RESPONSE

Response Score: 3 points

14. Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.



- A. How many of the 60 adults have been at their current job for 15 years or more?

number of adults: 16

- B. In which of the given intervals does the median of Terry's data lie?

interval: 10-14

Go to the next page to finish question 14.



Part A: The student provided the correct answer (16). While support is not required, the student may have found the number of adults who had worked 15 years or more at their current job by adding the totals for the 15–19, 20–24, and 25–29 intervals ($1 + 9 + 6 = 16$). [1 point]

Part B: The student provided an incorrect interval (10–14). No support (work or explanation) is required, so it is unclear where an error was made. The student may have recognized that the median represents the middle value of the data set but then considered the middle value to be the two middle intervals (10–14 and 15–19) and selected the middle interval with the greater frequency (10–14) since that interval contains 10 data points and the interval 15–19 contains only 1 data point. [0 points]

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

The first quartile of Terry's data is 3.5.

- C. How many of the 60 adults Terry surveyed gave a response of 4 years?

number of adults: 7

Terry used his data to make a prediction about the next 150 adults he will survey at the mall.

- D. What is the best estimate of the number of adults in the next 150 surveyed who will have been at their current job for less than 10 years?

$$\frac{34}{60} = \frac{17}{30}$$

$$\frac{68}{120} = \frac{85}{150}$$

number of adults: 85

**AFTER YOU HAVE FINISHED YOUR WORK, CLOSE THIS BOOKLET
SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.**



Part C: The student provided the correct answer (7). While support is not required, the student may have recognized that the first quartile of 3.5 means that 25% of the 60 adults worked less than 3.5 years at their current job, resulting in 15 adults ($25\% \text{ of } 60 = 0.25 \cdot 60 = 15$) having worked 0–3 years. This would leave 7 adults in the 0–4 interval ($22 - 15 = 7$), all of whom must have worked 4 years at their current job since that is the only whole number of years in this interval greater than 3.5 years. [1 point]

Part D: The student provided a correct answer (85). The student provided work, although the work is not required or assessed. The student wrote $\frac{34}{60}$ to represent 34 adults who had worked less than 10 years at their current job out of 60 adults surveyed, simplified that fraction to $\frac{17}{30}$ by dividing the numerator and denominator by 2, then doubled the numerator and denominator of $\frac{34}{60}$ by multiplying the 34 and the 60 by 2, resulting in $\frac{68}{120}$, found a fraction equivalent to $\frac{17}{30}$ by multiplying the numerator and denominator by 5, resulting in $\frac{85}{150}$, and then interpreted the fraction as 85 adults who will have been at their current job for less than 10 years out of the next 150 adults surveyed. [1 point]

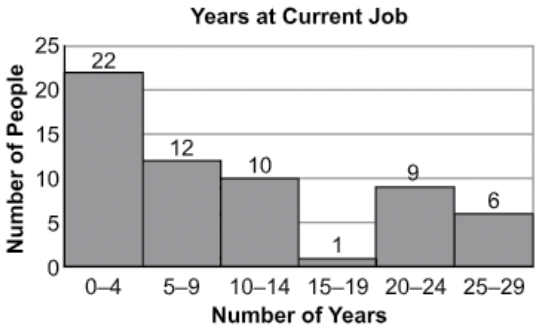
STUDENT RESPONSE

 Computer Response Score: 2 points

PARTS A and B

Question 14
Page 1 of 2

Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.



Number of Years	Number of People
0-4	22
5-9	12
10-14	10
15-19	1
20-24	9
25-29	6

A. How many of the 60 adults have been at their current job for 15 years or more?

number of adults:

B. In which of the given intervals does the median of Terry's data lie?

interval:

Review/End Test Pause Flag Options Next

Part A: The student provided the correct answer (16). While support is not required, the student may have found the number of adults who had worked 15 years or more at their current job by adding the totals for the 15–19, 20–24, and 25–29 intervals ($1 + 9 + 6 = 16$). [1 point]

Part B: The student provided the correct interval $[(5,9)]$, using a notation that clearly indicated the beginning and end of the intended interval. While support is not required, the student may have recognized that the median would be the average of the middle two values, which are the 30th and 31st values since there are 60 data points, and then identified that both values reside in the 5–9 interval, which contains the 23rd through 34th values. [1 point]

PARTS C and D

Question 14
Page 2 of 2

Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.

Years at Current Job

Number of Years	Number of People
0-4	22
5-9	12
10-14	10
15-19	1
20-24	9
25-29	6

The first quartile of Terry's data is 3.5.

C. How many of the 60 adults Terry surveyed gave a response of 4 years?

number of adults:

2 / 50

Terry used his data to make a prediction about the next 150 adults he will survey at the mall.

D. What is the best estimate of the number of adults in the next 150 surveyed who will have been at their current job for less than 10 years?

number of adults:

1 / 50

Review/End Test Pause Flag Options Back Next

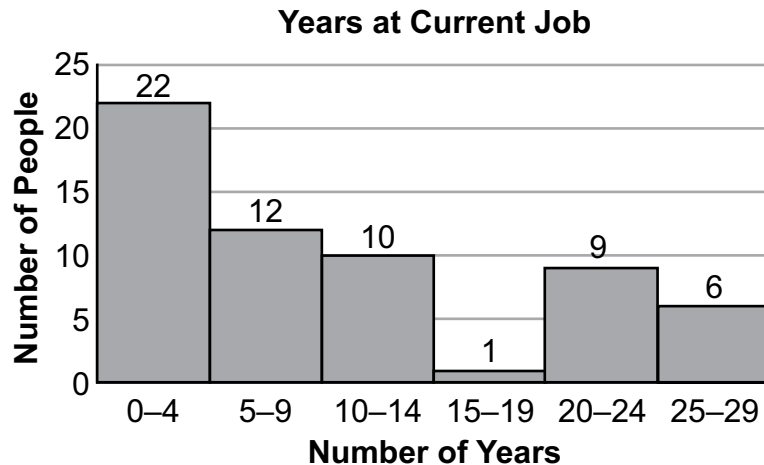
Part C: The student provided an incorrect answer (15). No support (work or explanation) is required, so it is unclear where an error was made. The student may have known that a quartile contains $\frac{1}{4}$ of the data points and multiplied $\frac{1}{4}$ by 60, which equals 15. However, this value represents the number of adults who had worked 0–3 years at their current job; to find the number of adults who had worked 4 years, the student needed to subtract the 15 from the number of people in the 0–4 interval ($22 - 15 = 7$ adults). [0 points]

Part D: The student provided an incorrect answer (3). No support (work or explanation) is required, so it is unclear where an error was made. The student may have divided the number of intervals (6) by the number of intervals representing less than 10 years (2), resulting in a quotient of 3. [0 points]

STUDENT RESPONSE

Response Score: 1 point

14. Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.



- A. How many of the 60 adults have been at their current job for 15 years or more?

number of adults: 1

- B. In which of the given intervals does the median of Terry's data lie?

1, 6, 9, 10, 12, 22

interval: 10–14 years

Go to the next page to finish question 14.

GO ON 

Part A: The student provided an incorrect answer (1). No support (work or explanation) is required, so it is unclear where an error was made. The student may have considered “15 years” rather than “15 years or more” and used the total for the 15–19 interval. [0 points]

Part B: The student provided an incorrect interval (10–14 years). The student provided work, although the work is not required or assessed. Based on the work provided, the student may have been trying to locate the median of the interval totals rather than the median of the total number of adults; the student wrote the totals of the intervals in numerical order, identified the middle two values (9, 10) by crossing off the outer values, and then used this information to select the 10–14 interval. [0 points]

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

The first quartile of Terry's data is 3.5.

- C. How many of the 60 adults Terry surveyed gave a response of 4 years?

number of adults: 22

Terry used his data to make a prediction about the next 150 adults he will survey at the mall.

- D. What is the best estimate of the number of adults in the next 150 surveyed who will have been at their current job for less than 10 years?

$$\begin{array}{r} 60 \\ 34 \end{array} \quad 56\%$$

$$150 \times .56 = 84$$

number of adults: 84

**AFTER YOU HAVE FINISHED YOUR WORK, CLOSE THIS BOOKLET
SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.**



Part C: The student provided an incorrect answer (22). No support (work or explanation) is required, so it is unclear where an error was made. The student may have seen that the first quartile (3.5) is located in the 0–4 interval and identified the number of adults for that interval rather than determining the number of adults in that interval who had worked more than 3.5 years at their current job (i.e., 4 years) by calculating the number of adults surveyed who had worked less than 3.5 years ($0.25 \cdot 60 = 15$) and then subtracting that amount from 22 ($22 - 15 = 7$). [0 points]

Part D: The student provided a correct answer (84). The student provided some work, although the work is not required or assessed. The student wrote the total number of adults from the original survey (60), the total number of adults who had worked less than 10 years at their current job (34), and the percentage of the adults surveyed who had worked less than 10 years (56%), which can be found by dividing 34 by 60. The student then multiplied 150 by 0.56, resulting in a product of 84 ($150 \times .56 = 84$). [1 point]

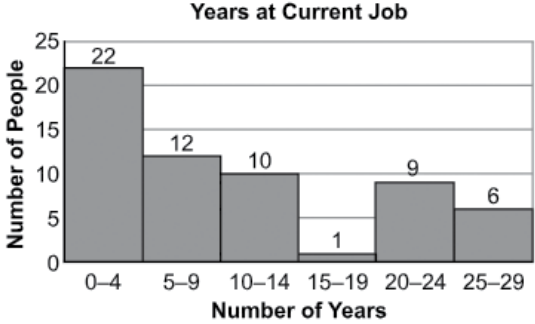
STUDENT RESPONSE

 Computer Response Score: 0 points

PARTS A and B

Question 14
Page 1 of 2

Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.



Number of Years	Number of People
0-4	22
5-9	12
10-14	10
15-19	1
20-24	9
25-29	6

A. How many of the 60 adults have been at their current job for 15 years or more?

number of adults:

B. In which of the given intervals does the median of Terry's data lie?

interval:

Review/End Test Pause Flag Options Next

Part A: The student provided an incorrect answer (6). No support (work or explanation) is required, so it is unclear where an error was made. The student may have considered the “or more” part of “15 years or more” and used the total for the interval representing the greatest number of years, which is the 25–29 interval. [0 points]

Part B: The student provided an incorrect interval (10 – 14). No support (work or explanation) is required, so it is unclear where an error was made. The student may have recognized that the median represents the middle value of the data set but then considered the middle value to be the two middle intervals (10–14 and 15–19) and selected the middle interval with the greater frequency (10–14) since that interval contains 10 data points and the interval 15–19 contains only 1 data point. [0 points]

PARTS C and D

Question 14
Page 2 of 2

Terry surveyed 60 adults at the mall about how many years they had worked at their current job. Each person gave a whole number as a response. He used the results to make the histogram shown below.

Years at Current Job

Number of Years	Number of People
0-4	22
5-9	12
10-14	10
15-19	1
20-24	9
25-29	6

The first quartile of Terry's data is 3.5.

C. How many of the 60 adults Terry surveyed gave a response of 4 years?

number of adults:

2 / 50

Terry used his data to make a prediction about the next 150 adults he will survey at the mall.

D. What is the best estimate of the number of adults in the next 150 surveyed who will have been at their current job for less than 10 years?

number of adults:

2 / 50

Review/End Test Pause Flag Options Back Next

Part C: The student provided an incorrect answer (22). No support (work or explanation) is required, so it is unclear where an error was made. The student may have considered that the first quartile (3.5) is located in the 0–4 interval and identified the number of adults for that interval rather than determining the number of adults in that interval who had worked more than 3.5 years at their current job (i.e., 4 years) by calculating the number of adults surveyed who had worked less than 3.5 years ($0.25 \cdot 60 = 15$) and then subtracting that amount from 22 ($22 - 15 = 7$). [0 points]

Part D: The student provided an incorrect answer (17). No support (work or explanation) is required, so it is unclear where an error was made. The student may have simplified the proportion $\frac{34}{60}$ by dividing the numerator and denominator by 2, resulting in $\frac{17}{30}$, and then interpreted the numerator as the number of adults who will have been at their current job for less than 10 years but did not consider that this would be divided by the 30 adults surveyed rather than divided by the 150 adults surveyed. [0 points]

Algebra I Module 2—Summary Data

Multiple-Choice

An asterisk (*) indicates the key.

Sample Number	Alignment	Answer Key	Depth of Knowledge	p-value A	p-value B	p-value C	p-value D
1	A1.2.1.1.1	C	2	5%	20%	51%*	24%
2	A1.2.1.1.2	C	1	31%	12%	43%*	14%
3	A1.2.1.2.1	B	2	14%	66%*	10%	10%
4	A1.2.1.2.2	D	1	13%	4%	8%	75%*
5	A1.2.2.1.1	A	2	41%*	16%	31%	12%
6	A1.2.2.1.2	B	2	5%	82%*	7%	6%
7	A1.2.2.1.4	D	1	21%	19%	9%	51%*
8	A1.2.2.2.1	D	1	15%	18%	26%	41%*
9	A1.2.3.1.1	D	2	3%	7%	22%	68%*
10	A1.2.3.2.1	A	2	50%*	21%	20%	9%
11	A1.2.3.2.2	B	2	26%	46%*	19%	9%
12	A1.2.3.3.1	B	2	15%	53%*	24%	8%

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	1.36

Keystone Exams Algebra I

Item and Scoring Sampler

Copyright © 2024 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.
