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## Integrated Math I
### Spring 2018 Item Release
#### Content Summary and Answer Key

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<tr>
<th>Question No.*</th>
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<th>Content Cluster</th>
<th>Content Standard</th>
<th>Answer Key</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equation Item</td>
<td>Analyze functions using different representations.</td>
<td>Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. <em>(F.IF.7b)</em>&lt;br&gt;b. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>2</td>
<td>Hot Text</td>
<td>Understand congruence in terms of rigid motions.</td>
<td>Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. <em>(G.CO.7)</em></td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>7</td>
<td>Multiple Choice</td>
<td>Understand the concept of a function and use function notation.</td>
<td>Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by <em>f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)</em> for <em>n ≥ 1</em>. <em>(F.IF.3)</em></td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>9</td>
<td>Multiple Select</td>
<td>Experiment with transformations in the plane.</td>
<td>Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. <em>(G.CO.5)</em></td>
<td>A, C</td>
<td>1 point</td>
</tr>
</tbody>
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Content Summary and Answer Key

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<tbody>
<tr>
<td>11</td>
<td>Equation Item, Hot Text</td>
<td>Understand solving equations as a process of reasoning and explain the reasoning.</td>
<td>Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. (A.REI.1)</td>
<td>2 points</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Equation Item</td>
<td>Create equations that describe numbers or relationships.</td>
<td>Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. (A.CED.1)</td>
<td>1 point</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Graphic Response</td>
<td>Summarize, represent, and interpret data on a single count or measurement variable.</td>
<td>Represent data with plots on the real number line (dot plots, histograms, and box plots). (S.ID.1)</td>
<td>1 point</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Equation Item</td>
<td>Summarize, represent, and interpret data on two categorical and quantitative variables.</td>
<td>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. (S.ID.5)</td>
<td>1 point</td>
<td></td>
</tr>
</tbody>
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<tbody>
<tr>
<td>20</td>
<td>Multiple Choice</td>
<td>Summarize, represent, and interpret data on a single count or measurement variable.</td>
<td>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (S.ID.3)</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>24</td>
<td>Multiple Choice</td>
<td>Interpret expressions for functions in terms of the situation they model.</td>
<td>Interpret the parameters in a linear or exponential function in terms of a context. (F.LE.5)</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>27</td>
<td>Table Match</td>
<td>Reason quantitatively and use units to solve problems.</td>
<td>Define appropriate quantities for the purpose of descriptive modeling. (N.Q.2)</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>31</td>
<td>Multiple Choice</td>
<td>Summarize, represent, and interpret data on two categorical and quantitative variables.</td>
<td>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. b. Informally assess the fit of a function by plotting and analyzing residuals (S.ID.6b)</td>
<td>C</td>
<td>1 point</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td>36</td>
<td>Equation Item</td>
<td>Solve systems of equations.</td>
<td>Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. <em>(A.REI.6)</em></td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>37</td>
<td>Multiple Choice</td>
<td>Experiment with transformations in the plane.</td>
<td>Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. <em>(G.CO.1)</em></td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>38</td>
<td>Equation Item</td>
<td>Use coordinates to prove simple geometric theorems algebraically.</td>
<td>Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). <em>(G.GPE.5)</em></td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>42</td>
<td>Equation Item</td>
<td>Represent and solve equations and inequalities graphically.</td>
<td>Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. <em>(A.REI.12)</em></td>
<td>---</td>
<td>2 points</td>
</tr>
<tr>
<td>43</td>
<td>Multiple Select</td>
<td>Understand congruence in terms of rigid motions.</td>
<td>Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. <em>(G.CO.6)</em></td>
<td>C, D, E</td>
<td>1 point</td>
</tr>
</tbody>
</table>

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<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>Multiple Choice</td>
<td>Interpret functions that arise in applications in terms of the context.</td>
<td>Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function ( h(n) ) gives the number of person-hours it takes to assemble ( n ) engines in a factory, then the positive integers would be an appropriate domain for the function. (F.IF.5)</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>46</td>
<td>Multiple Choice</td>
<td>Interpret the structure of expressions.</td>
<td>Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. (A.SSE.1a)</td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>47</td>
<td>Equation Item</td>
<td>Construct and compare linear, quadratic, and exponential models and solve problems.</td>
<td>Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). (F.LE.2)</td>
<td>---</td>
<td>1 point</td>
</tr>
</tbody>
</table>

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Question 1

Question and Scoring Guidelines
Question 1

A nature center tracks the deer population in a small section of a forest preserve. The number of deer over the years is modeled by the graph shown.

How many deer were in this section of the forest preserve when the nature center began tracking the population?

Points Possible: 1

**Content Cluster:** Analyze functions using different representations.

**Content Standard:** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. *(F.IF.7b)*

b. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
**Scoring Guidelines**

**Exemplar Response**

- 14

**Other Correct Responses**

- 13
- 15
- Any equivalent value

For this item, a full-credit response includes:

- A correct value (1 point).
Integrated Math I
Spring 2018 Item Release

Question 1

Sample Responses
Sample Response: 1 point

A nature center tracks the deer population in a small section of a forest preserve. The number of deer over the years is modeled by the graph shown.

How many deer were in this section of the forest preserve when the nature center began tracking the population?

14
Notes on Scoring

This response earns full credit (1 point) because it shows a correct approximation of the number of deer when the nature center began tracking. Since the nature center starts tracking the deer population at year zero, the y-intercept (the y-coordinate of the point where x = 0) represents the deer population when the tracking began. The labels on the y-axis show 8 deer for every two grid units which means that each vertical grid unit represents 4 deer. Since the y-intercept point is almost in the middle of the fourth vertical unit, its y-coordinate, that is approximately 14, is the number of deer at the beginning of the tracking.

Since the number of deer is to be found from the graph, the coordinates of points are approximations, so the y-intercept could also be 13 or 15.
Sample Response: 1 point

A nature center tracks the deer population in a small section of a forest preserve. The number of deer over the years is modeled by the graph shown.

How many deer were in this section of the forest preserve when the nature center began tracking the population?

13

Notes on Scoring

This response earns full credit (1 point) because it shows an approximate number of deer from the acceptable range of answers. Since the number of deer is to be found from the graph, the coordinate pairs representing points are approximations, and 14 or 15 for the y-value of the y-intercept are also accepted for full credit.
A nature center tracks the deer population in a small section of a forest preserve. The number of deer over the years is modeled by the graph shown.

How many deer were in this section of the forest preserve when the nature center began tracking the population?

16

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect number of deer when the nature center began tracking. The student may use the nearest labeled grid line along the y-axis.
Sample Response: 0 points

A nature center tracks the deer population in a small section of a forest preserve. The number of deer over the years is modeled by the graph shown.

How many deer were in this section of the forest preserve when the nature center began tracking the population?

12

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect number of deer when the nature center began tracking. The student may round down to the nearest grid line along the y-axis.
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Question 2

Question and Scoring Guidelines
Question 2

\[\triangle JKL \text{ is rotated about point (5, 5) to create a triangle that is congruent to itself.}\]

Complete the statements in the table by placing the correct parts of the triangles in the blanks.

| \(\angle JNM\) | JK corresponds to |
| \(J\) | |
| \(\angle JMN\) | JL corresponds to |
| \(\angle MJN\) | \(\angle JKL\) corresponds to |
| \(JM\) | JN |
| \(\angle MN\) | |
| \(\angle LN\) | |

Points Possible: 1

Content Cluster: Understand congruence in terms of rigid motions.

Content Standard: Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. (G.CO.7)
Scoring Guidelines

Exemplar Response

<table>
<thead>
<tr>
<th>JK</th>
<th>JN</th>
</tr>
</thead>
<tbody>
<tr>
<td>KL</td>
<td>NM</td>
</tr>
<tr>
<td>JL</td>
<td>JM</td>
</tr>
<tr>
<td>∠JKL</td>
<td>∠JNM</td>
</tr>
<tr>
<td>∠JLK</td>
<td>∠JMN</td>
</tr>
<tr>
<td>∠LJK</td>
<td>∠MJN</td>
</tr>
</tbody>
</table>

Other Correct Responses

- N/A

For this item, a full-credit response includes:

- The correct table (1 point).
Sample Response: 1 point

\( \triangle JKL \) is rotated about point \((5, 5)\) to create a triangle that is congruent to itself.

Complete the statements in the table by placing the correct parts of the triangles in the blanks.

| JK corresponds to | JN |
| KL corresponds to | NM |
| JL corresponds to | JM |
| \( \angle JKL \) corresponds to | \( \angle JNM \) |
| \( \angle JLK \) corresponds to | \( \angle JMN \) |
| \( \angle LJK \) corresponds to | \( \angle MJN \) |
Notes on Scoring

This response earns full credit (1 point) because it shows all correct pairs of corresponding sides and corresponding angles.

The right triangle J NM is a result of a rotation (a rigid motion that preserves distances between any two points of the figure) of the right triangle J KL. Therefore, the pairs of corresponding sides are congruent, i.e. equal in length, and the center of rotation J (5, 5) remains at the same location. Point N is the image of point K, and point M is the image of point L. Therefore, JK corresponds to JN, KL corresponds to NM, and JL corresponds to JM.

A rotation also takes the original triangle to a congruent triangle, keeping correspondent angles congruent. In the two triangles shown, corresponding angles are located at the intersection of corresponding sides. Therefore, ∠JKL corresponds to ∠JNM, ∠JLK corresponds to ∠JMN, and ∠LJK corresponds to ∠MJN.
Sample Response: 0 points

\( \triangle JKL \) is rotated about point \((5, 5)\) to create a triangle that is congruent to itself.

Complete the statements in the table by placing the correct parts of the triangles in the blanks.

<table>
<thead>
<tr>
<th>JK corresponds to</th>
<th>JN</th>
</tr>
</thead>
<tbody>
<tr>
<td>KL corresponds to</td>
<td>JM</td>
</tr>
<tr>
<td>JL corresponds to</td>
<td>NM</td>
</tr>
<tr>
<td>( \angle JKL ) corresponds to</td>
<td>( \angle JNM )</td>
</tr>
<tr>
<td>( \angle JLK ) corresponds to</td>
<td>( \angle JMN )</td>
</tr>
<tr>
<td>( \angle LJK ) corresponds to</td>
<td>( \angle MJN )</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) because out of three statements asking for corresponding sides, it shows two incorrect placements (Line 2 and Line 3). The student may identify congruent, but not corresponding, sides. The corresponding angles are placed correctly.
Sample Response: 0 points

△JKL is rotated about point (5, 5) to create a triangle that is congruent to itself.

Complete the statements in the table by placing the correct parts of the triangles in the blanks:

<table>
<thead>
<tr>
<th>JK corresponds to</th>
<th>JN</th>
</tr>
</thead>
<tbody>
<tr>
<td>KL corresponds to</td>
<td>NM</td>
</tr>
<tr>
<td>JL corresponds to</td>
<td>JM</td>
</tr>
<tr>
<td>△JKL corresponds to △MjN</td>
<td></td>
</tr>
<tr>
<td>△JLK corresponds to △JMN</td>
<td></td>
</tr>
<tr>
<td>△LJK corresponds to △JNM</td>
<td></td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) because out of three statements asking for corresponding angles, it shows two incorrect placements (Line 4 and Line 6). The student may identify congruent, but not corresponding, angles. The corresponding sides are placed correctly.
Question 7

A sequence is shown.

3, 6, 12, 24, 48, ...

Which function, \( f(n) \), represents the \( n \)th term of the sequence, where \( f(1) = 3 \)?

A  \( f(n) = 2 \cdot 3^{n-1} \)

B  \( f(n) = 3 \cdot 2^{n-1} \)

C  \( f(n) = 3 \cdot 2^n \)

D  \( f(n) = 6^n \)

Points Possible: 1

Content Cluster: Understand the concept of a function and use function notation.

Content Standard: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by \( f(0) = f(1) = 1 \), \( f(n+1) = f(n) + f(n-1) \) for \( n \geq 1 \). (F.IF.3)
Scoring Guidelines

Rationale for Option A: The student may correctly notice that the first term of the sequence is 3 and each term after the first is 2 times the previous term but incorrectly switches the base of the exponential expression with the y-intercept when writing the function. Then, the student may verify this answer choice by incorrectly calculating \( f(1) = 2^{1-1} \cdot 3 = 2^0 \cdot 3 = 1 \cdot 3 = 3 \) and comparing this with the first term of the sequence, 3.

Rationale for Option B: Key – The student correctly realizes that the value of \( f(1) \) for this answer choice would be \( f(1) = 3 \cdot 2^{n-1} = 3 \cdot 2^{1-1} = 3 \cdot 2^0 = 3 \cdot 1 = 3 \), which matches the given sequence. Additionally, the value of \( f(2) \) is 6 because \( f(2) = 3 \cdot 2^{2-1} = 3 \cdot 2^1 = 3 \cdot 2 = 6 \), which matches the second term, 6, and so on.

Rationale for Option C: The student may notice the first term of the sequence is 3 and each term after the first is 2 times the previous term but does not realize that if \( f(n) = 3 \cdot 2^n \), then \( f(1) = 3 \cdot 2^1 = 3 \cdot 2 = 6 \), which does not match the given value of \( f(1) \).

Rationale for Option D: The student may notice that 6 is a common factor for a few terms of the sequence and select a function with base 6.

Sample Response: 1 point

A sequence is shown.
3, 6, 12, 24, 48, ...

Which function, \( f(n) \), represents the \( n \)th term of the sequence, where \( f(1) = 3 \)?

- A \( f(n) = 2 \cdot 3^{n-1} \)
- \( f(n) = 3 \cdot 2^{n-1} \)
- C \( f(n) = 3 \cdot 2^n \)
- D \( f(n) = 6^n \)
Question 9

Triangle ABC and triangle ADE are shown.

Select all of the transformations that could be performed to carry triangle ABC onto triangle ADE.

☐ a reflection across the line $y = -x$

☐ a reflection across the $x$-axis, and then a reflection across the $y$-axis

☐ a rotation of 90 degrees clockwise about the origin, and then a reflection across the $y$-axis

☐ a rotation of 90 degrees clockwise about the origin, and then a reflection across the $x$-axis

☐ a rotation of 180 degrees clockwise about the origin, and then a reflection across the line $y = -x$

**Points Possible:** 1

**Content Cluster:** Experiment with transformations in the plane.

**Content Standard:** Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. (*G.CO.5*)
**Scoring Guidelines**

**Rationale for First Option:** **Key** - The student recognizes that each pair of corresponding vertices are equidistant from the line $y = -x$. A reflection of triangle ABC across $y = -x$ carries the triangle onto triangle ADE.

**Rationale for Second Option:** The student may identify that triangle ADE is congruent to triangle ABC but does not realize that reflecting triangle ABC over each axis will not carry triangle ABC onto triangle ADE. When triangle ABC is reflected over the x-axis, the corresponding vertices do not have the same y-coordinate, so when this image is reflected again over the y-axis, the resulting image has a different orientation than triangle ADE.

**Rationale for Third Option:** **Key** - The student recognizes that a rotation of triangle ABC 90 degrees clockwise about the origin results in an image where each corresponding vertex of the rotated image and triangle ADE have the same y-coordinates, so a reflection of the image across the line equidistant from each vertex in each corresponding pair of vertices (in this case the y-axis) carries triangle ABC onto triangle ADE.

**Rationale for Fourth Option:** The student may recognize that a rotation 90 degrees clockwise would be a part of the correct response but then confuses the axis of reflection in the next step.

**Rationale for Fifth Option:** The student may notice that a 180-degree rotation would result in sides of triangles ABC and ADE being collinear and thinks that reflecting over the line $y = -x$ would result in triangles ABC and ADE having orientations shown.
Sample Response: 1 point

Triangle ABC and triangle ADE are shown.

Select all of the transformations that could be performed to carry triangle ABC onto triangle ADE.

- [x] a reflection across the line $y = -x$
- [ ] a reflection across the $x$-axis, and then a reflection across the $y$-axis
- [x] a rotation of 90 degrees clockwise about the origin, and then a reflection across the $y$-axis
- [ ] a rotation of 90 degrees clockwise about the origin, and then a reflection across the $x$-axis
- [ ] a rotation of 180 degrees clockwise about the origin, and then a reflection across the line $y = -x$
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Question 11

Question and Scoring Guidelines
Question 11

This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x \).

**Part A.** Select the first equation in which Eleanor makes an error.

<table>
<thead>
<tr>
<th>Step</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given</td>
<td>( \frac{1}{2}(x+18) = 4(2x - 6) - 9x )</td>
</tr>
<tr>
<td>1.</td>
<td>( x + 18 = 8(2x - 6) - 9x )</td>
</tr>
<tr>
<td>2.</td>
<td>( x + 18 = 16x - 48 - 9x )</td>
</tr>
<tr>
<td>3.</td>
<td>( x + 18 = 7x - 48 )</td>
</tr>
<tr>
<td>4.</td>
<td>( 66 = 6x )</td>
</tr>
<tr>
<td>5.</td>
<td>( x = 11 )</td>
</tr>
</tbody>
</table>

**Part B.** Create an equation to correct Eleanor’s error identified in Part A.
**Part C.** What is the correct solution to \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x \)?

\[ x = \]

Points Possible: 2

**Content Cluster:** Understand solving equations as a process of reasoning and explain the reasoning.

**Content Standard:** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. (A.REI.1)
# Scoring Guidelines

<table>
<thead>
<tr>
<th>Score Point</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 points</td>
<td>Both bullets are necessary for full credit of 2 points:</td>
</tr>
<tr>
<td></td>
<td>- The student identified the error in the work, providing evidence of the ability to identify a flaw related to the equality of numbers in a solution process AND the student created a correct equation, providing evidence of the ability to correct a flaw related to the equality of numbers in a solution process.</td>
</tr>
<tr>
<td></td>
<td>- The student calculated the correct solution, providing evidence of the ability to complete each step in a solution process.</td>
</tr>
<tr>
<td></td>
<td><strong>Exemplar:</strong></td>
</tr>
<tr>
<td></td>
<td>For example, the response may include:</td>
</tr>
<tr>
<td></td>
<td>Part 1: Step 1</td>
</tr>
<tr>
<td></td>
<td>Part 2: $x + 18 = 8(2x - 6) - 18x$</td>
</tr>
<tr>
<td></td>
<td>Part 3: -22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1 point</th>
<th>One of the following bullets is necessary for partial credit of 1 point:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- The student identified the error in the work, providing evidence of the ability to identify a flaw related to the equality of numbers in a solution process AND the student created a correct equation, providing evidence of the ability to correct a flaw related to the equality of numbers in a solution process.</td>
</tr>
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<td>- The student calculated the correct solution, providing evidence of the ability to complete each step in a solution process.</td>
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<td><strong>Exemplar:</strong></td>
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<td>For example, the response may include:</td>
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<tr>
<td></td>
<td>Part 1: Step 1</td>
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<tr>
<td></td>
<td>Part 2: $x + 18 = 8(2x - 6) - 18x$</td>
</tr>
<tr>
<td></td>
<td>Part 3: 22</td>
</tr>
</tbody>
</table>
Integrated Math I
Spring 2018 Item Release

Question 11

Sample Responses
Sample Response: 2 points

This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x \).

**Part A.** Select the first equation in which Eleanor makes an error.

<table>
<thead>
<tr>
<th>Step</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given</td>
<td>( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x )</td>
</tr>
<tr>
<td>1.</td>
<td>( x + 18 = 8(2x - 6) - 9x )</td>
</tr>
<tr>
<td>2.</td>
<td>( x + 18 = 16x - 48 - 9x )</td>
</tr>
<tr>
<td>3.</td>
<td>( x + 18 = 7x - 48 )</td>
</tr>
<tr>
<td>4.</td>
<td>( 66 = 6x )</td>
</tr>
<tr>
<td>5.</td>
<td>( x = 11 )</td>
</tr>
</tbody>
</table>

**Part B.** Create an equation to correct Eleanor’s error identified in Part A.

\( x + 18 = 8(2x - 6) - 18x \)
Part C. What is the correct solution to $\frac{1}{2}(x + 18) = 4(2x - 6) - 9x$?

$x = -22$
Notes on Scoring

This response earns full credit (2 points). For the first point, it correctly selects the first equation with an error (part A) and creates an equation to correct the error identified (part B). For the second point (part C), it finds a correct solution for the equation in part B.

Eleanor’s solution attempts to clear a fraction \( \frac{1}{2} \) using the Multiplication Property of Equality to multiply both sides of the equation by 2. She does it correctly on the left side of the equation, \( 2 \cdot \left[ \frac{1}{2}(x - 18) \right] \), to get \( x + 18 \) but makes an error on the right side of the equation. Eleanor multiplies only one term on the right side of the equation instead of both terms, \( 2 \cdot [4(2x - 6) - 9x] \). Based on the Distributive Property, the correct expression on the right side should be \( 8(2x - 6) - 18x \) instead of \( 8(2x - 6) - 9x \). Therefore, the correct response for part A is Step 1.

The correct equation for part B would be \( x + 18 = 8(2x - 6) - 18x \) or an equivalent equation such as \( \frac{1}{2}x + 9 = 4(2x - 6) - 9x \).

Part C shows a correct solution, \( x = -22 \), for the equation from part B.

\[
\begin{align*}
x + 18 &= 8(2x - 6) - 18x \\
x + 18 &= 16x - 48 - 18x & \text{Distributive Property} \\
x + 18 &= -2x - 48 & \text{Combining like terms} \\
x + 2x &= -18 - 48 & \text{Addition Property of Equality} \\
3x &= -66 & \text{Combining like terms} \\
x &= -22 & \text{Multiplication Property of Equality}
\end{align*}
\]
Sample Response: 2 points

This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x. \)

**Part A.** Select the first equation in which Eleanor makes an error.

<table>
<thead>
<tr>
<th>Step</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given</td>
<td>( \frac{1}{2}(x+18) = 4(2x-6) - 9x )</td>
</tr>
<tr>
<td>1.</td>
<td>( x + 18 = 8(2x - 6) - 9x )</td>
</tr>
<tr>
<td>2.</td>
<td>( x + 18 = 16x - 48 - 9x )</td>
</tr>
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<td>3.</td>
<td>( x + 18 = 7x - 48 )</td>
</tr>
<tr>
<td>4.</td>
<td>( 66 = 6x )</td>
</tr>
<tr>
<td>5.</td>
<td>( x = 11 )</td>
</tr>
</tbody>
</table>

**Part B.** Create an equation to correct Eleanor’s error identified in Part A.

\( \frac{1}{2}x + 9 = 4(2x - 6) - 9x \)
Part C. What is the correct solution to $\frac{1}{2}(x + 18) = 4(2x - 6) - 9x$?

$x = -22$

Notes on Scoring

This response earns full credit (2 points). For the first point, it correctly selects the first equation with an error (part A) and creates an equivalent equation to correct the error identified (part B). For the second point (part C), it finds a correct solution for the equation in part B.
Sample Response: 1 point

This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x \).

**Part A.** Select the first equation in which Eleanor makes an error.

<table>
<thead>
<tr>
<th>Step</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
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<td>( 66 = 6x )</td>
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<td>5.</td>
<td>( x = 11 )</td>
</tr>
</tbody>
</table>

**Part B.** Create an equation to correct Eleanor’s error identified in Part A.

\[
\frac{1}{2}x + 9 = 4(2x - 6) - 9x
\]
Notes on Scoring

This response earns partial credit (1 point). The student correctly selects the equation with an error (part A) and creates an equivalent equation to correct the error identified (part B). In part C, the student leaves off the negative sign to give an incorrect answer, (22), instead of (–22) for the equation in part B.
Sample Response: 1 point

This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x \).

Part A. Select the first equation in which Eleanor makes an error.

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>( x = 11 )</td>
</tr>
</tbody>
</table>

Part B. Create an equation to correct Eleanor’s error identified in Part A.

\( x = -22 \)
Part C. What is the correct solution to $\frac{1}{2}(x + 18) = 4(2x - 6) - 9x$?

$x = -22$

Notes on Scoring

This response earns partial credit (1 point). The student correctly selects the first equation with an error (part A) and states the correct solution in part C but provides an incorrect equation to correct the error in part B.
This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2} (x + 18) = 4(2x - 6) - 9x \).

**Part A.** Select the first equation in which Eleanor makes an error.

<table>
<thead>
<tr>
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<td>5.</td>
<td>( x = 11 )</td>
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</table>

**Part B.** Create an equation to correct Eleanor's error identified in Part A.

\( \frac{1}{2}x + 9 = 8(2x - 6) - 9x \)
Notes on Scoring

This response earns no credit (0 points). The student correctly selects the first equation with an error (part A) but fails to provide the correct equation in part B by misapplying the Multiplication Property of Equality. The student multiplies only 4(2x – 6) by 2 instead of the entire equation. In part C, the student provides an incorrect solution to the incorrect equation from part B. On the right side of the equation, the student may only multiply the first term inside the parentheses by 8 to get \( \frac{1}{2}x + 9 = 16x - 6 - 9x \). Then the student may solve this equation as shown.

\[
\frac{1}{2}x + 9 = 16x - 6 - 9x
\]

\[
\frac{1}{2}x + 9 = 7x - 6
\]

\[-6.5x = -15
\]

\[x \approx 2.3\]
Sample Response: 0 points

This item has three parts.

Eleanor incorrectly solves the equation \( \frac{1}{2}(x + 18) = 4(2x - 6) - 9x \).

**Part A.** Select the first equation in which Eleanor makes an error.

<table>
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<tr>
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<tr>
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<td>5.</td>
<td>( x = 11 )</td>
</tr>
</tbody>
</table>

**Part B.** Create an equation to correct Eleanor’s error identified in Part A.

\( x + 18 = 25x - 48 \)
Notes on Scoring

This response earns no credit (0 points). In part A, the student does not select the first equation with an error. In part B, the student creates a non-equivalent equation to correct the error identified in part A. In part C, the student provides an incorrect answer for the equation in part B.
Integrated Math I
Spring 2018 Item Release

Question 12

Question and Scoring Guidelines
Question 12

A factory has two assembly lines, M and N, that make the same toy. On Monday, only assembly line M was functioning, and it made 900 toys.

On Tuesday, both assembly lines were functioning for the same amount of time. Line M made 300 toys per hour and line N made 480 toys per hour. Line N made as many toys on Tuesday as line M did over both days.

Write an equation that can be used to find the number of hours, \( t \), that the assembly lines were functioning on Tuesday.

Points Possible: 1

Content Cluster: Create equations that describe numbers or relationships.

Content Standard: Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. (A.CED.1)
Scoring Guidelines

Exemplar Response

- $300t + 900 = 480t$

Other Correct Responses

- Any equivalent equation except $t = 5$

For this item, a full-credit response includes:

- A correct equation (1 point).
Integrated Math I
Spring 2018 Item Release

Question 12

Sample Responses
A factory has two assembly lines, M and N, that make the same toy. On Monday, only assembly line M was functioning, and it made 900 toys.

On Tuesday, both assembly lines were functioning for the same amount of time. Line M made 300 toys per hour and line N made 480 toys per hour. Line N made as many toys on Tuesday as line M did over both days.

Write an equation that can be used to find the number of hours, \( t \), that the assembly lines were functioning on Tuesday.

\[
300t + 900 = 480t
\]

Notes on Scoring

This response earns full credit (1 point) because it shows a correct equation modeling the situation. The equation for finding the number of hours, \( t \), should compare the production of toys for Line N on Tuesday and the combined production for Line M on Tuesday and Monday.

On Tuesday, by making 480 toys per hour and working for \( t \) hours, assembly line N assembled 480\( \cdot t \) toys.

Assembly line M worked on Monday and Tuesday. On Monday, it assembled 900 toys. On Tuesday, by making 300 toys per hour and working for \( t \) hours, line M assembled 300\( \cdot t \) toys. A combined two-day production for assembly line M was \( 300t + 900 \).

Since line N assembled as many toys on Tuesday as line M did over two days, the equation modeling the situation is

\[
480t = 300t + 900.
\]
Sample Response: 1 point

A factory has two assembly lines, M and N, that make the same toy. On Monday, only assembly line M was functioning, and it made 900 toys.

On Tuesday, both assembly lines were functioning for the same amount of time. Line M made 300 toys per hour and line N made 480 toys per hour. Line N made as many toys on Tuesday as line M did over both days.

Write an equation that can be used to find the number of hours, \( t \), that the assembly lines were functioning on Tuesday.

\[ 900 = 180t \]

Notes on Scoring

This response earns full credit (1 point) because it shows a correct equation, \( 900 = 180t \), that is equivalent to the equation \( 480t = 300t + 900 \) after \((-300t)\) has been added to both sides, using the Addition Property of Equality.
Sample Response: 0 points

A factory has two assembly lines, M and N, that make the same toy. On Monday, only assembly line M was functioning, and it made 900 toys.

On Tuesday, both assembly lines were functioning for the same amount of time. Line M made 300 toys per hour and line N made 480 toys per hour. Line N made as many toys on Tuesday as line M did over both days.

Write an equation that can be used to find the number of hours, $t$, that the assembly lines were functioning on Tuesday.

$t = \frac{900}{300 + 480}$

Notes on Scoring

This response earns no credit (0 points) because it shows the solution to the equation instead of showing the equation modeling the situation.

This student solves the equation instead of just writing an equation that could be used to model the situation.
Sample Response: 0 points

A factory has two assembly lines, M and N, that make the same toy. On Monday, only assembly line M was functioning, and it made 900 toys.

On Tuesday, both assembly lines were functioning for the same amount of time. Line M made 300 toys per hour and line N made 480 toys per hour. Line N made as many toys on Tuesday as line M did over both days.

Write an equation that can be used to find the number of hours, $t$, that the assembly lines were functioning on Tuesday.

$$900 = 480t + 300t$$

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect equation modeling the situation.

Instead of comparing the production of toys for Line N on Tuesday and the combined production for Line M on Tuesday and Monday, the student compares the production for line M on Monday and the combined production for lines N and M on Tuesday.
Integrated Math I
Spring 2018 Item Release

Question 13

Question and Scoring Guidelines
Question 13

A landscaper records the heights, in feet, of 15 newly planted trees in a community garden, as shown.

3.2, 4.3, 3.5, 5.4, 3.7,
5.5, 6.2, 3.1, 6.8, 7.1,
4.8, 6.5, 4.9, 5.3, 5.9

Complete the histogram by selecting frequencies for the heights of the newly planted trees in the community garden.

Points Possible: 1

Content Cluster: Summarize, represent, and interpret data on a single count or measurement variable.

Content Standard: Represent data with plots on the real number line (dot plots, histograms, and box plots). (S.ID.1)
Scoring Guidelines

Exemplar Response

Other Correct Responses

- N/A

For this item, a full-credit response includes:

- The correct histogram (1 point).
Integrated Math I
Spring 2018 Item Release

Question 13

Sample Responses
A landscaper records the heights, in feet, of 15 newly planted trees in a community garden, as shown.

3.2, 4.3, 3.5, 5.4, 3.7, 5.5, 6.2, 3.1, 6.8, 7.1, 4.8, 6.5, 4.9, 5.3, 5.9

Complete the histogram by selecting frequencies for the heights of the newly planted trees in the community garden.
Notes on Scoring

This response earns full credit (1 point) because it shows a correct histogram representing the heights of the newly planted trees.

To make a histogram, the first step is to arrange the data set in order from lowest value to greatest value:
3.1, 3.2, 3.5, 3.7, 4.3, 4.8, 4.9, 5.3, 5.4, 5.5, 5.9, 6.2, 6.5, 6.8, 7.1
Students must then find the frequency distribution. The idea behind a frequency distribution is to break the data into groups so that patterns become clearer.

The second step is to figure out the number of groups. The number of data points in each group is the frequency. In this situation, since the given data set contains 15 data points and begins at 3.1, it is reasonable to start the first group at 3 and separate the data into 5 groups.

Group One, with values between 3 and 4 (not inclusive), contains 4 data points 3.1, 3.2, 3.5, and 3.7, so the frequency is 4.

Group Two, with values between 4 and 5 (not inclusive), contains 3 data points 4.3, 4.8, and 4.9, so the frequency is 3.

Group Three, with values between 5 and 6 (not inclusive), contains 4 data points 5.3, 5.4, 5.5, and 5.9, so the frequency is 4.

Group Four, with values between 6 and 7 (not inclusive), contains 3 data points between 6.2, 6.5, and 6.8, so the frequency is 3.

Group Five, with values between 7 and 8 (not inclusive), contains 1 data point, 7.1, so the frequency is 1.

The last step is to show the groups on the horizontal axis, and the frequency on the vertical axis. Then use bars to represent the frequency of each individual group.
Sample Response: 0 points

A landscaper records the heights, in feet, of 15 newly planted trees in a community garden, as shown.

3.2, 4.3, 3.5, 5.4, 3.7, 5.5, 6.2, 3.1, 6.8, 7.1, 4.8, 6.5, 4.9, 5.3, 5.9

Complete the histogram by selecting frequencies for the heights of the newly planted trees in the community garden.

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect histogram representing the heights of the newly planted trees. Even though the student breaks the data into five groups, the frequencies for some groups are incorrect. In Group One, with values between 3 and 4 (not inclusive), the frequency is 2 instead of 4. In Group Five, with values between 7 and 8 (not inclusive), the frequency is 3 instead of 1.
A landscaper records the heights, in feet, of 15 newly planted trees in a community garden, as shown.

3.2, 4.3, 3.5, 5.4, 3.7, 5.5, 6.2, 3.1, 6.8, 7.1, 4.8, 6.5, 4.9, 5.3, 5.9

Complete the histogram by selecting frequencies for the heights of the newly planted trees in the community garden.

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect histogram representing the heights of the newly planted trees. Per the histogram, Group One contains values between 1 and 2 (not inclusive) but the data set does not include any heights within this interval. The student may misread 3.1 as 1.3.
Integrated Math I
Spring 2018 Item Release

Question 16

Question and Scoring Guidelines
Question 16

Casey asks a random sample of students at his school about their natural hair and eye colors. The results of his survey are shown in the relative frequency table.

<table>
<thead>
<tr>
<th>Hair Color</th>
<th>Eye Color</th>
<th>Brown</th>
<th>Blue</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Brown</td>
<td>0.225</td>
<td>0.000</td>
<td>0.025</td>
<td>0.250</td>
</tr>
<tr>
<td>Brown</td>
<td>Brown</td>
<td>0.350</td>
<td>0.125</td>
<td>0.100</td>
<td>0.575</td>
</tr>
<tr>
<td>Red</td>
<td>Brown</td>
<td>0.025</td>
<td>0.000</td>
<td>0.025</td>
<td>0.050</td>
</tr>
<tr>
<td>Blonde</td>
<td>Brown</td>
<td>0.050</td>
<td>0.075</td>
<td>0.000</td>
<td>0.125</td>
</tr>
<tr>
<td>Total</td>
<td>Brown</td>
<td>0.650</td>
<td>0.200</td>
<td>0.150</td>
<td>1.000</td>
</tr>
</tbody>
</table>

In the sample, there are 4 more students with brown hair and blue eyes than blonde hair and blue eyes. How many total students have black hair?

Points Possible: 1

Content Cluster: Summarize, represent, and interpret data on two categorical and quantitative variables.

Content Standard: Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. (S.ID.5)
**Scoring Guidelines**

**Exemplar Response**

- 20

**Other Correct Responses**

- Any equivalent value

For this item, a full-credit response includes:

- The correct value (1 point).
Integrated Math I
Spring 2018 Item Release

Question 16

Sample Responses
Sample Response: 1 point

Casey asks a random sample of students at his school about their natural hair and eye colors. The results of his survey are shown in the relative frequency table.

<table>
<thead>
<tr>
<th>Hair Color</th>
<th>Brown</th>
<th>Blue</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>0.225</td>
<td>0.000</td>
<td>0.025</td>
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<td>0.100</td>
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<td>0.025</td>
<td>0.000</td>
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<tr>
<td>Blonde</td>
<td>0.050</td>
<td>0.075</td>
<td>0.000</td>
<td>0.125</td>
</tr>
<tr>
<td>Total</td>
<td>0.650</td>
<td>0.200</td>
<td>0.150</td>
<td>1.000</td>
</tr>
</tbody>
</table>

In the sample, there are 4 more students with brown hair and blue eyes than blonde hair and blue eyes.

How many total students have black hair?

20
Notes on Scoring

This response earns full credit (1 point) because it shows a correct number of students with black hair. One way to find the number of students with black hair is first to determine the total number of students at the school, and then use information in the frequency table showing that the number of students with black hair (row 1, column 4) is 0.25 of the total number of students.

Let \( x \) represent the total number of students. The relative frequency of students with brown hair and blue eyes (row 2, column 2) is 0.125, so the number of students with brown hair and blue eyes is 0.125\( x \).

The relative frequency of students with blonde hair and blue eyes (row 4, column 2) is 0.075, so the number of students with blond hair and blue eyes is 0.075\( x \).

Since in the sample there are 4 more students with brown hair and blue eyes than students with blonde hair and blue eyes, the situation can be modeled by the equation:

\[
0.125x = 0.075x + 4 \\
0.125x - 0.075x = 4 \\
0.05x = 4 \\
0.05x = \frac{4}{0.05} \\
x = 80
\]

Since the relative frequency of students with black hair is 0.25 and the total number of students is 80, the number of students with black hair is 0.25 \( \times \) 80, or 20.
Sample Response: 0 points

Casey asks a random sample of students at his school about their natural hair and eye colors. The results of his survey are shown in the relative frequency table.

<table>
<thead>
<tr>
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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>0.225</td>
<td>0.000</td>
<td>0.025</td>
<td>0.250</td>
</tr>
<tr>
<td>Brown</td>
<td>0.350</td>
<td>0.125</td>
<td>0.100</td>
<td>0.575</td>
</tr>
<tr>
<td>Red</td>
<td>0.025</td>
<td>0.000</td>
<td>0.025</td>
<td>0.050</td>
</tr>
<tr>
<td>Blonde</td>
<td>0.050</td>
<td>0.075</td>
<td>0.000</td>
<td>0.125</td>
</tr>
<tr>
<td>Total</td>
<td>0.650</td>
<td>0.200</td>
<td>0.150</td>
<td>1.000</td>
</tr>
</tbody>
</table>

In the sample, there are 4 more students with brown hair and blue eyes than blonde hair and blue eyes.

How many total students have black hair?

40

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect number of students with black hair. The student may determine that there are 80 students, but then incorrectly calculate $0.25 \times 80$ to be 40 rather than 25.
Sample Response: 0 points

Casey asks a random sample of students at his school about their natural hair and eye colors. The results of his survey are shown in the relative frequency table.

<table>
<thead>
<tr>
<th>Hair Color</th>
<th>Eye Color</th>
<th>Brown</th>
<th>Blue</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>0.225</td>
<td>0.000</td>
<td>0.025</td>
<td>0.250</td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>0.350</td>
<td>0.125</td>
<td>0.100</td>
<td>0.575</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>0.025</td>
<td>0.000</td>
<td>0.025</td>
<td>0.050</td>
<td></td>
</tr>
<tr>
<td>Blonde</td>
<td>0.050</td>
<td>0.075</td>
<td>0.000</td>
<td>0.125</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.650</td>
<td>0.200</td>
<td>0.150</td>
<td>1.000</td>
<td></td>
</tr>
</tbody>
</table>

In the sample, there are 4 more students with brown hair and blue eyes than blonde hair and blue eyes.

How many total students have black hair?

\[
\frac{0.250}{0.05}
\]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect number of students with black hair. The student may think that the number of students with black hair can be found by dividing the total relative frequency of students with black hair, 0.250, by the difference between 0.125 and 0.075, or the relative frequency of students with brown hair/blue eyes and the relative frequency of students with blond hair/blue eyes. The student may not take into consideration that the difference of those two samples should be 4 and the number of students must be represented by a whole number, not a complex fraction like \(\frac{0.250}{0.05}\).
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Question 20

Question and Scoring Guidelines
Question 20

The histograms shown display the number of cans of food donated by students in the freshman class and the sophomore class at a school.

Which statement is true?

A. The freshman class has a lesser mean number of cans donated than the sophomore class.

B. The freshman class has the same median number of cans donated as the sophomore class.

C. The freshman class has a greater mean number of cans donated than the sophomore class.

D. The freshman class has a greater median number of cans donated than the sophomore class.

Points Possible: 1

Content Cluster: Summarize, represent, and interpret data on a single count or measurement variable.

Content Standard: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (S.ID.3)
**Rationale for Option A: Key** - The student correctly compares the means of the classes based on the skew of the histograms. For the freshman class, the mean can be approximated using the middle values of each histogram’s group. For example, the middle value of the first group is 57.5 and the corresponding frequency is 22. The number of cans represented by the first histogram’s bar is $57.5 \cdot 22 = 1265$. Repeating the same procedure for each group, the mean of cans donated by the freshman class is

\[
\frac{57.5 \cdot 22 + 62.5 \cdot 22 + 67.5 \cdot 25 + 72.5 \cdot 27 + 77.5 \cdot 24 + 82.5 \cdot 22 + 87.5 \cdot 21}{22 + 22 + 25 + 27 + 24 + 22 + 21} \approx 72.38
\]

Similarly, the mean of cans donated by the sophomore class is

\[
\frac{62.5 \cdot 21 + 67.5 \cdot 22 + 72.5 \cdot 23 + 77.5 \cdot 26 + 82.5 \cdot 26 + 87.5 \cdot 22 + 92.5 \cdot 21 + 97.5 \cdot 21}{21 + 22 + 23 + 26 + 26 + 22 + 21 + 21} \approx 79.89
\]

The freshman class has a lesser mean number of cans than the sophomore class.

**Rationale for Option B:** The student may incorrectly compare the median numbers of students who donated cans by either incorrectly calculating the medians or confusing the data sets. The median can be calculated by finding the total number of students in each class and then determining the number of cans donated by the middle student. In the freshman class, the number of students is $22 + 22 + 25 + 27 + 24 + 22 + 21 = 163$. The middle student is then between the $81^{st}$ and $82^{nd}$ data points, which is in the highest bar of histogram which corresponds to a median between 70 and 75 cans. In the sophomore class, the number of students is $21 + 22 + 23 + 26 + 26 + 22 + 21 + 21 = 182$. The middle student is the $91^{st}$ data point, which is in the histogram bar for 75 – 80 cans. Thus, the median for the sophomore class is higher than the median for the freshman class.

**Rationale for Option C:** The student may incorrectly compare the means of students who donated cans by either incorrectly calculating the means or confusing the data sets.

**Rationale for Option D:** The student may confuse the median of the sophomore class with the median of the freshman class. The median for the freshman class is between 70 and 75 cans while the median for the sophomore class is between 75 and 80 cans.
The histograms shown display the number of cans of food donated by students in the freshman class and the sophomore class at a school.

Which statement is true?

- The freshman class has a lesser mean number of cans donated than the sophomore class.
- The freshman class has the same median number of cans donated as the sophomore class.
- The freshman class has a greater mean number of cans donated than the sophomore class.
- The freshman class has a greater median number of cans donated than the sophomore class.
Question 24

A health club charges new members a one-time start-up fee in addition to a monthly fee. The cost, in dollars, of the membership for $x$ months is modeled by the function $f(x) = 80 + 30x$.

What does the 80 represent in the function?

- the start-up fee
- the monthly fee
- the rate of change in the monthly fee
- the total amount charged each month

**Points Possible: 1**

**Content Cluster:** Interpret expressions for functions in terms of the situation they model.

**Content Standard:** Interpret the parameters in a linear or exponential function in terms of a context. *(F.LE.5)*
Scoring Guidelines

Rationale for Option A: **Key** - The student correctly identifies that since \( f(0) = 80 + 30 \cdot 0 = 80 \), 80 represents the amount of money paid after 0 months, it can be referred to as a start-up fee.

Rationale for Option B: The student may confuse the monthly fee, $30, with the one-time start-up fee. A monthly fee is the amount that a health club charges every month and therefore is the coefficient of \( x \)-term, or slope, in a linear expression.

Rationale for Option C: The student may think that the constant amount 80 is added on to the monthly fee and therefore represents a change in the monthly fee.

Rationale for Option D: The student may think that the club charged a total of $80 each month instead of $30 each month in addition to the one-time start-up fee.

**Sample Response: 1 point**

A health club charges new members a one-time start-up fee in addition to a monthly fee. The cost, in dollars, of the membership for \( x \) months is modeled by the function \( f(x) = 80 + 30x \).

What does the 80 represent in the function?

- the start-up fee
- the monthly fee
- the rate of change in the monthly fee
- the total amount charged each month
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Question 27

Question and Scoring Guidelines
Question 27

Select the most appropriate unit for each situation.

<table>
<thead>
<tr>
<th>Rate of walking to school</th>
<th>feet minute</th>
<th>square feet minute</th>
<th>cubic feet minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of painting a bedroom wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of filling a bucket with water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of mopping the kitchen floor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Points Possible: 1

Content Cluster: Reason quantitatively and use units to solve problems.

Content Standard: Define appropriate quantities for the purpose of descriptive modeling. (N.Q.2)
Scoring Guidelines

Exemplar Response

Select the most appropriate unit for each situation.

<table>
<thead>
<tr>
<th>Rate of walking to school</th>
<th>feet/minute</th>
<th>square feet/minute</th>
<th>cubic feet/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Rate of painting a bedroom wall | | | |
|---------------------------------| | | |
| Rate of filling a bucket with water | | | |
| Rate of mopping the kitchen floor | | | |
|                                | ✓ | | |

Other Correct Responses

- N/A

For this item, a full-credit response includes:

- A correct table (1 point).
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Question 27

Sample Responses
### Notes on Scoring

This response earns full credit (1 point) because it shows four correctly selected units for each situation.

The rate of walking to school is a distance to school divided by the time spent on walking to school. Since in this case the distance is measured in linear units, feet, the correct selection is the first box in the top row.

The rate of painting a bedroom wall is the area of the wall divided by the time spent on painting the wall. Since in this case the area is measured in square feet, the correct selection is the second box in the second row from the top.

The rate of filling a bucket with water is measured by the volume of water divided by the time spent on filling the bucket. Since volume is measured in cubic units, or in this case in cubic feet, the correct selection is the third box in the third row from the top.

The rate of mopping the kitchen floor is the area of the floor divided by the time spent on mopping the floor. Since area is measured in square units, or in this case in square feet, the correct selection is the middle box of the bottom row.
Sample Response: 0 points

Select the most appropriate unit for each situation.

<table>
<thead>
<tr>
<th></th>
<th>feet minute</th>
<th>square feet minute</th>
<th>cubic feet minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of walking to school</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of painting a bedroom wall</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Rate of filling a bucket with water</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Rate of mopping the kitchen floor</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) because out of four responses it shows one incorrectly selected unit for Rate of mopping the kitchen floor. The student may think that because mopping is done with water, and the amount of water is measured in units of volume, the correct response is $\text{cubic feet per minute}$ instead of $\text{square feet per minute}$. 
Sample Response: 0 points

Select the most appropriate unit for each situation.

<table>
<thead>
<tr>
<th></th>
<th>feet minute</th>
<th>square feet minute</th>
<th>cubic feet minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of walking to school</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of painting a bedroom wall</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Rate of filling a bucket with water</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Rate of mopping the kitchen floor</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) because it shows one incorrectly selected unit for Rate of painting a bedroom wall. The student may think about the volume of the entire bedroom and use the units of volume, \( \frac{\text{cubic feet}}{\text{minute}} \), instead of \( \frac{\text{square feet}}{\text{minute}} \).
A new car wash business records the number of cars it washes each day for the first 7 days the business is open. The data are shown in the table.

<table>
<thead>
<tr>
<th>Day</th>
<th>Number of Cars Washed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
</tr>
<tr>
<td>6</td>
<td>56</td>
</tr>
<tr>
<td>7</td>
<td>57</td>
</tr>
</tbody>
</table>

The car wash owner uses the equation \( y = x + 44 \) to model the data, where \( x \) represents the number of days the business has been open and \( y \) represents the number of cars washed.

Which explanation best describes whether the equation is a good fit for the data?

A. The equation is a good fit because the residual points are approximately linear.

B. The equation is a good fit because the residual points have a positive association.

C. The equation is not a good fit because a residual plot with the pattern from this data set indicates a bad fit.

D. The equation is not a good fit because there should be an equal number of points below and above the \( x \)-axis in the residual plot.

Points Possible: 1

Content Cluster: Summarize, represent, and interpret data on two categorical and quantitative variables.

Content Standard: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 
\( b. \) Informally assess the fit of a function by plotting and analyzing residuals. (S.ID.6)
Scoring Guidelines

**Rationale for Option A:** The student may correctly note that the residual plot for this data set is approximately linear but may not realize that a presence of a linear pattern in the residual plot is an indication of bad fit of the equation for the data set.

**Rationale for Option B:** The student may correctly note that the residual plot for this data set has a positive association but may not realize that a positive pattern of the residual plot indicates a bad fit of the equation for the data set.

**Rationale for Option C:** Key – The student correctly determines that the equation is not a good fit for the data set because a residual plot that either has an approximate linear pattern or that does not have an approximately symmetric distribution of points above and below the x-axis indicates a bad fit.

**Rationale for Option D:** The student may correctly note only one criteria for why the equation is not a good fit for the data set and may miss that the unequal number of points above and below the x-axis is not the only indication of a bad fit of the equation for the data set.
A new car wash business records the number of cars it washes each day for the first 7 days the business is open. The data are shown in the table.

<table>
<thead>
<tr>
<th>Day</th>
<th>Number of Cars Washed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>48</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
</tr>
<tr>
<td>6</td>
<td>56</td>
</tr>
<tr>
<td>7</td>
<td>57</td>
</tr>
</tbody>
</table>

The car wash owner uses the equation $y = x + 44$ to model the data, where $x$ represents the number of days the business has been open and $y$ represents the number of cars washed.

Which explanation **best** describes whether the equation is a good fit for the data?

A. The equation is a good fit because the residual points are approximately linear.

B. The equation is a good fit because the residual points have a positive association.

C. The equation is not a good fit because a residual plot with the pattern from this data set indicates a bad fit.

D. The equation is not a good fit because there should be an equal number of points below and above the x-axis in the residual plot.
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Question 36

Question and Scoring Guidelines
Question 36

A total of 330 children and adults attended a school play. There were 21 times as many children in attendance as there were adults.

This situation is modeled by the given system of equations, where \( a \) represents the number of adults and \( c \) represents the number of children.

\[
c = 21a \\
a + c = 330
\]

How many children attended the play?

Points Possible: 1

Content Cluster: Solve systems of equations.

Content Standard: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (A.REI.6)
Scoring Guidelines

Exemplar Response

• 315

Other Correct Responses

• Any equivalent value

For this item, a full-credit response includes:

• A correct value (1 point).
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Question 36

Sample Responses
Sample Response: 1 point

A total of 330 children and adults attended a school play. There were 21 times as many children in attendance as there were adults.

This situation is modeled by the given system of equations, where \( a \) represents the number of adults and \( c \) represents the number of children.

\[
\begin{align*}
c &= 21a \\
a + c &= 330
\end{align*}
\]

How many children attended the play?

315
Notes on Scoring

This response earns full credit (1 point) because it shows a correct number of children who attended the play. This item requires the student to find a solution of a system with two linear equations in two variables.

There are many methods to solve a system of linear equations, including substitution. To solve by substitution, first substitute $21\alpha$ for $c$ in the equation $\alpha + c = 330$. The equation becomes $\alpha + 21\alpha = 330$. Then, combine like terms to get $22\alpha = 330$. Next, apply the Multiplication Property of Equality to multiply both sides of the equation by $\frac{1}{22}$, or divide both sides by 22, to find $\alpha = 15$. Since the variable $\alpha$ represents the number of adults who attended the play, 15 needs to be substituted into one of the original equations for $\alpha$ to find the number of children, $c$, or $15 + c = 330$. Then using the Addition Property of Equality, add $(-15)$ to both sides of the equation to get $c = 315$. So, there are 315 children who attended the play.
Notes on Scoring

This response earns full credit (1 point) because it shows an equivalent correct number of children (315.00 = 315) who attended the play.
Sample Response: 0 points

A total of 330 children and adults attended a school play. There were 21 times as many children in attendance as there were adults.

This situation is modeled by the given system of equations, where \( a \) represents the number of adults and \( c \) represents the number of children.

\[ c = 21a \]
\[ a + c = 330 \]

How many children attended the play?

15

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect number of children who attended the play. The student may provide the number of adults, 15, instead of the number of children, 315.
Sample Response: 0 points

A total of 330 children and adults attended a school play. There were 21 times as many children in attendance as there were adults.

This situation is modeled by the given system of equations, where $a$ represents the number of adults and $c$ represents the number of children.

\[ c = 21a \]
\[ a + c = 330 \]

How many children attended the play?

\[
\begin{array}{c}
330 \\
\hline
22
\end{array}
\]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect number of children who attended the play. The student may solve the first equation for $a$: $a = \frac{c}{21}$ to substitute it into the second equation, resulting in $\frac{c}{21} + c = 330$. Next, to solve for $c$, instead of multiplying both sides of the equation by 21, the student may incorrectly multiply only the left side by 21 to get $c + 21c = 330$. Then, the student may combine like terms to get $22c = 330$ and solve to get $c = \frac{330}{22}$. 
Question 37

Points A and B are on a line. What is the best definition of line segment AB?

(A) Points A and B, and points in between them
(B) Points A and B, and all points on one side of A
(C) Points A and B, and all points on the line in between them
(D) Points A and B, and the line containing them

Points Possible: 1

Content Cluster: Experiment with transformations in the plane.

Content Standard: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. (G.CO.1)
Scoring Guidelines

Rationale for Option A: The student may select an imprecise definition because it mentions points A and B and a few of the points in between them. This definition could include a collection of 4 points, for example, instead of all points of the line between A and B.

Rationale for Option B: The student may confuse the definition of line segment with the definition of ray. A ray is defined as all points of a line on one side of a given endpoint, including the endpoint itself.

Rationale for Option C: Key – The student correctly identifies that the definition of line segment AB is points A and B and all points on the line that are in between them. It is essential that the definition include all points rather than just some of the points between the two endpoints.

Rationale for Option D: The student may confuse a definition of line segment with the definition of line since there is no stipulation that only the points between the endpoints are included.

Sample Response: 1 point

Points A and B are on a line. What is the best definition of line segment AB?

A. Points A and B, and points in between them
B. Points A and B, and all points on one side of A
C. Points A and B, and all points on the line in between them
D. Points A and B, and the line containing them
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Question 38

Question and Scoring Guidelines
The equation of a line is given.

\[ 5x + 2y = 6 \]

Allen graphs a line perpendicular to the given line.

What is the slope of Allen’s line?

Points Possible: 1

Content Cluster: Use coordinates to prove simple geometric theorems algebraically.

Content Standard: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). \((G.GPE.5)\)
**Scoring Guidelines**

**Exemplar Response**

- \( \frac{2}{5} \)

**Other Correct Responses**

- Any equivalent value

For this item, a full-credit response includes:

- A correct slope (1 point).
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Question 38

Sample Responses
Sample Response: 1 point

The equation of a line is given.

\[ 5x + 2y = 6 \]

Allen graphs a line perpendicular to the given line.

What is the slope of Allen’s line?

\[
\frac{2}{5}
\]
Notes on Scoring

This response earns full credit (1 point) because it shows the correct slope for a line perpendicular to the line represented by the equation $5x + 2y = 6$.

Because the slope of the given line and the slope of the line perpendicular to it are opposite reciprocals, the slope of the given line can be used to determine the slope of a line perpendicular to it.

First, convert the given equation to the slope-intercept form to highlight the slope:

$$5x + 2y = 6$$

$$2y = 6 - 5x$$

$$y = 3 - \frac{5}{2}x$$

$$y = -\frac{5}{2}x + 3$$

From here, since the slope of the given line is $-\frac{5}{2}$, the slope of the line perpendicular to it is $\frac{2}{5}$. 
Sample Response: 1 point

The equation of a line is given.

\[5x + 2y = 6\]

Allen graphs a line perpendicular to the given line.

What is the slope of Allen’s line?

0.4

Notes on Scoring

This response earns full credit (1 point) because it shows a correct equivalent number representing the slope of a line perpendicular to the line with the equation \(5x + 2y = 6\).
Sample Response: 0 points

The equation of a line is given.

\[ 5x + 2y = 6 \]

Allen graphs a line perpendicular to the given line.

What is the slope of Allen’s line?

\[ \frac{5}{2} \]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect slope for a line perpendicular to the line represented by the equation \( 5x + 2y = 6 \). The student may determine the slope of a line parallel to the given line instead of a perpendicular line.
Sample Response: 0 points

The equation of a line is given.

5x + 2y = 6

Allen graphs a line perpendicular to the given line.

What is the slope of Allen’s line?

\[-\frac{2}{5}\]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect slope for a line perpendicular to the line represented by the equation 5x + 2y = 6. The student may incorrectly think that the slope of the given line and the slope of the line perpendicular to it are reciprocals instead of opposite reciprocals.
Question 42

The graph of a system of inequalities is shown.

Create the system of inequalities that is represented by the graph.
Points Possible: 2

Content Cluster: Represent and solve equations and inequalities graphically.

Content Standard: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. (A.REI.12)

Scoring Guidelines

Exemplar Response

- $y < -3$
- $y \geq \frac{2}{3}x - 5$

Other Correct Responses

- Any equivalent system of inequalities

For this item, a full-credit response includes:

- A correct inequality (1 point) AND
- Another correct inequality (1 point).
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Question 42

Sample Responses
Sample Response: 2 points

The graph of a system of inequalities is shown.

Create the system of inequalities that is represented by the graph.

\[ y < -3 \]

\[ y \geq \frac{2}{3}x - 5 \]
Notes on Scoring

This response earns full credit (2 points) because it shows a correct system of two linear inequalities in two variables representing the graph.

In this situation, the shaded region denotes the solution for the system of the two linear inequalities. The shaded region is the overlap of the two individual solutions of linear inequalities given in the system.

The solution for the inequality $y < -3$ is the region below the horizontal dotted line because any point from this region makes the inequality true. For example, the point (-2, -6) makes $y < -3$ true because $-6 < -3$.

The solution for the inequality $y \geq \frac{2}{3}x - 5$ is the region above the solid line because any point from this region makes the inequality true. For example, the point (-4, 0) makes the inequality true because of the following comparison.

\[
0 \geq \frac{2}{3}(-4) - 5
\]

\[
0 \geq -\frac{21}{3}
\]

\[
0 > -7
\]
Sample Response: 2 points

The graph of a system of inequalities is shown.

Create the system of inequalities that is represented by the graph.

\[-3 > y\]

\[3y \geq 2x - 15\]
Notes on Scoring

This response earns full credit (2 points) because it shows a correct system of two equivalent linear inequalities in two variables representing the graph. The inequality \(-3 > y\) is equivalent to inequality \(y < -3\) and, using the Multiplication Property of Inequality to multiply both sides by \(\frac{1}{3}\), the inequality \(3y \geq 2x - 15\) becomes \(y \geq \frac{2}{3}x - 5\).
Sample Response: 1 point

The graph of a system of inequalities is shown.

Create the system of inequalities that is represented by the graph.

\[ y \geq \frac{2}{3}x - 5 \]

\[ y \leq -3 \]
Notes on Scoring

This response earns partial credit (1 point) because it shows one correct and one incorrect linear inequality in two variables representing the graph.

The student may not recognize that the region below the horizontal dotted line should be represented by inequality \( y < -3 \) instead of \( y \leq -3 \) because the points on the dotted line should not be included in the solution set.
Sample Response: 1 point

The graph of a system of inequalities is shown.

Create the system of inequalities that is represented by the graph.

\[
\begin{align*}
    y & \geq \frac{2}{3}x - 5 \\
    y & < -3
\end{align*}
\]
Notes on Scoring

This response earns partial credit (1 point) because it shows one correct and one incorrect linear inequality in two variables representing the graph.

The student may not recognize that the region above the solid line should be represented by inequality \( y \geq \frac{2}{3}x - 5 \) instead of \( y > \frac{2}{3}x - 5 \) because the points on the solid line should be included in the solution set.
Sample Response: 0 points

The graph of a system of inequalities is shown.

Create the system of inequalities that is represented by the graph.

\[ y > -3 \]

\[ 3y \leq 2x - 15 \]
**Notes on Scoring**

This response earns no credit (0 points) because it shows a system of two incorrect linear inequalities in two variables representing the graph.

The student may not realize that the region below the horizontal dotted line should be represented by inequality $y < -3$ instead of $y > -3$ because $y > -3$ would indicate a region above the dotted line.

Likewise, the region above the solid line would be represented by the inequality $y \geq \frac{2}{3}x - 5$ instead of $y \leq \frac{2}{3}x - 5$ or $3y \leq 2x - 15$. On the graph, the solution to the inequality $3y \leq 2x - 15$ would be the region below the solid line.
Create the system of inequalities that is represented by the graph.

\[ y > \frac{2}{3}x - 5 \]

\[ y \leq -3 \]
Notes on Scoring

This response earns no credit (0 points) because it shows a system of two incorrect linear inequalities in two variables representing the graph.

The student may not recognize that the region below the horizontal dotted line would be represented by inequality \( y < -3 \) instead of \( y \leq -3 \) because the points on the dotted line are not included in the solution set. Likewise, the region above the solid line would be represented by inequality \( y \geq \frac{2}{3}x - 5 \) instead of \( y > \frac{2}{3}x - 5 \) because the points on the solid line would be included in the solution set.
Integrated Math I
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Question 43

Question and Scoring Guidelines
**Question 43**

Triangle MNO is transformed to produce triangle PQR.

Select all of the transformations that would guarantee triangles MNO and PQR are congruent.

- ☐ a dilation, then a translation
- ☐ a reflection, then a dilation
- ☐ a reflection, then a rotation
- ☐ a rotation, then a translation
- ☐ a translation, then a reflection

**Points Possible: 1**

**Content Cluster:** Understand congruence in terms of rigid motions.

**Content Standard:** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. (G.CO.6)
Scoring Guidelines

Rationale for First Option: The student may think that if one out of two transformations is a rigid motion, like the translation in this case, and another one is not rigid, then a combination of two transformations remains rigid and produces congruent triangles.

Rationale for Second Option: The student may think that if one out of two transformations is a rigid motion, like the reflection in this case, and another one is not rigid, then a combination of two transformations remains rigid and produces congruent triangles.

Rationale for Third Option: Key – The student recognizes that a combination of reflection and rotation produces congruent triangles because they are both rigid motions preserving distances between any two points of the triangle.

Rationale for Fourth Option: Key – The student recognizes that a combination of rotation and translation produces congruent triangles because they are both rigid motions preserving distances between any two points of the triangle.

Rationale for Fifth Option: Key – The student recognizes that a combination of translation and reflection produces congruent triangles because they are both rigid motions preserving distances between any two points of the triangle.

Sample Response: 1 point

Triangle MNO is transformed to produce triangle PQR.

Select all of the transformations that would guarantee triangles MNO and PQR are congruent.

☐ a dilation, then a translation
☐ a reflection, then a dilation
☒ a reflection, then a rotation
☒ a rotation, then a translation
☒ a translation, then a reflection
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Question 45

Question and Scoring Guidelines
Question 45

The graph of a function is shown.

What is the domain of the function?

- A. $x \geq -4$
- B. $x \geq -2$
- C. $x \geq 0$
- D. $x \geq 1$

Points Possible: 1

Content Cluster: Interpret functions that arise in applications in terms of the context.

Content Standard: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function $h(n)$ gives the number of person-hours it takes to assemble $n$ engines in a factory, then the positive integers would be an appropriate domain for the function. (F.IF.5)
Scoring Guidelines

Rationale for Option A: Key - The student correctly determines that the domain of the function is a set containing the x-coordinate of the leftmost point, (–4, –2), of the graph and x-coordinates of all points of the graph to the right of –4 that can be described by the inequality \( x \geq -4 \).

Rationale for Option B: The student may confuse domain, the set of x-coordinates of points on the graph starting from the leftmost point, (–4, –2), with range, the set of y-coordinates of points of the graph, and then describes the range by the inequality \( x \geq -2 \).

Rationale for Option C: The student may think that the lowest value of the domain must be represented by the x-coordinate of the y-intercept (0, 1) of the graph. Since the graph is continuous to the right, the student may incorrectly conclude that the domain is \( x \geq 0 \).

Rationale for Option D: The student may think that lowest value of the domain must be represented by the y-coordinate of the y-intercept (0, 1) of the graph. Since the graph is continuous to the right, the student may incorrectly conclude that the domain is \( x \geq 1 \).
The graph of a function is shown.

What is the domain of the function?

- $x \geq -4$
- $x \geq -2$
- $x \geq 0$
- $x \geq 1$
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Question 46

Question and Scoring Guidelines
Question 46

Samantha sells two types of wristbands, rope or beaded. She charges more for beaded wristbands than for rope wristbands. The amount of money, in dollars, that she collects from selling \( x \) wristbands of one type and \( y \) wristbands of the other type can be modeled by the expression \( 5x + 8y \).

What does the variable \( y \) represent in this situation?

- \( A \) the number of rope wristbands sold
- \( B \) the number of beaded wristbands sold
- \( C \) the selling price of one rope wristband
- \( D \) the selling price of one beaded wristband

**Points Possible:** 1

**Content Cluster:** Interpret the structure of expressions.

**Content Standard:** Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. (A.SSE.1a)
Scoring Guidelines

Rationale for Option A: The student may correctly determine that 5x and 8y represent money earned from selling each type of wristband but misses that Samantha charges more for a beaded wristband than she does for a rope wristband, so the 5x represents the money earned from selling x beaded wristbands and 8y from selling y rope wristbands.

Rationale for Option B: Key – The student correctly determines that 5x and 8y represent money earned from selling each type of wristband, 5 and 8 represent the selling price for each type of wristband, and x and y represent the number of wristbands sold of each type. Since Samantha charges more for beaded wristbands, then 8y represents amount of money earned from selling beaded wristbands and y is the number of beaded wristbands sold.

Rationale for Option C: The student may correctly determine that 5x and 8y represent money earned from selling each type of wristband but confuses the price and the quantity of wristbands. The student may think that 8 represents the number of rope wristbands and y represents the selling price of one rope wristband.

Rationale for Option D: The student may correctly determine that 5x and 8y represent money earned from selling each type of wristband but confuses the price and the quantity of wristbands. The student may think that 8 represents the number of beaded wristbands and y represents the selling price of one beaded wristband.

Sample Response: 1 point

Samantha sells two types of wristbands, rope or beaded. She charges more for beaded wristbands than for rope wristbands. The amount of money, in dollars, that she collects from selling x wristbands of one type and y wristbands of the other type can be modeled by the expression 5x + 8y.

What does the variable y represent in this situation?

a. the number of rope wristbands sold
b. the number of beaded wristbands sold
c. the selling price of one rope wristband
d. the selling price of one beaded wristband
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Question 47

Question and Scoring Guidelines
Emerson has $120. Each week, he saves an additional $15. Write a function $f(x)$ that models the total amount of money Emerson has after $x$ weeks.

$\displaystyle f(x) = \underline{\phantom{0000}}$

**Points Possible:** 1

**Content Cluster:** Construct and compare linear, quadratic, and exponential models and solve problems.

**Content Standard:** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). *(F.LE.2)*
Scoring Guidelines

Exemplar Response

- \( f(x) = 15x + 120 \)

Other Correct Responses

- Any equivalent function

For this item, a full-credit response includes:

- The correct function (1 point).
Sample Response: 1 point

Emerson has $120. Each week, he saves an additional $15.

Write a function $f(x)$ that models the total amount of money Emerson has after $x$ weeks.

$$f(x) = 15x + 120$$

Notes on Scoring

This response earns full credit (1 point) because it shows a correct function modeling the total amount of money after $x$ weeks.

Since Emerson saves the same amount each week, the situation is represented by the linear model $f(x) = mx + b$, where $m$ stands for the constant amount of money saved per week and $b$ stands for the initial amount of money. Since Emerson saves $15 each week, 15 is substituted in the equation for $m$. The initial amount of money is $120, so 120 is substituted in the function model for $b$. Therefore, the function modeling this situation is $f(x) = 15x + 120$. 
Sample Response: 1 point

Emerson has $120. Each week, he saves an additional $15.

Write a function \( f(x) \) that models the total amount of money Emerson has after \( x \) weeks.

\[
f(x) = 120 + 15x
\]

Notes on Scoring

This response earns full credit (1 point) because it shows a correct equivalent function modeling the total amount of money after \( x \) weeks. By the Commutative Property of Addition, the right side of the function written in the reverse order of terms represents an equivalent expression.
Sample Response: 0 points

Emerson has $120. Each week, he saves an additional $15.

Write a function $f(x)$ that models the total amount of money Emerson has after $x$ weeks.

$$f(x) = 135x$$

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect function modeling the total amount of money after $x$ weeks. The student may incorrectly combine unlike terms, 120 and $15x$, after writing an initially correct expression $120 + 15x$ to obtain an incorrect function $f(x) = 135x$. 
Sample Response: 0 points

Emerson has $120. Each week, he saves an additional $15.

Write a function f(x) that models the total amount of money Emerson has after x weeks.

\[ f(x) = x + 15 \]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect function modeling the total amount of money after x weeks. The student may not realize that the constant amount of money, 15 dollars, saved per week represents the slope \( m \) in the linear model \( y = mx + b \) and \( b \) stands for the initial amount of money. Instead, the student uses 15 for the initial amount, focusing on the word “additional” by placing the 15 behind the plus sign.