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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>Build new functions from existing functions</td>
<td>Identify the effect on the graph of replacing ( f(x) ) by ( f(x) + k ), ( k ) ( f(x) ), ( f(kx) ), and ( f(x + k) ) for specific values of ( k ) (both positive and negative); find the value of ( k ) given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. (F.BF.3)</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>2</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.SSE.1) a. Interpret parts of an expression, such as terms, factors, and coefficients.</td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>3</td>
<td>Table Item</td>
<td>Understand the concept of a function and use function notation</td>
<td>Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. (F.IF.2)</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>4</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. (S.ID.6) a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.</td>
<td>C</td>
<td>1 point</td>
</tr>
</tbody>
</table>

*An asterisk appears next to any standard or group of standards linked with Modeling as a conceptual category.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>5</td>
<td>Multiple Choice</td>
<td>Create equations that describe numbers or relationships</td>
<td>Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (A.CED.4)</td>
<td>D</td>
<td>1 point</td>
</tr>
<tr>
<td>6</td>
<td>Multiple Choice</td>
<td>Interpret linear models</td>
<td>Distinguish between correlation and causation. (S.ID.9)</td>
<td>D</td>
<td>1 point</td>
</tr>
<tr>
<td>7</td>
<td>Equation Item</td>
<td>Solve equations and inequalities in one variable</td>
<td>Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. (A.REI.3)</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>8</td>
<td>Multiple Choice</td>
<td>Construct and compare linear, quadratic, and exponential models and solve problems</td>
<td>Distinguish between situations that can be modeled with linear functions and with exponential functions. (F.LE.1) b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>9</td>
<td>Multi-Select Item</td>
<td>Extend the properties of exponents to rational exponents</td>
<td>Rewrite expressions involving radicals and rational exponents using the properties of exponents. (N.RN.2)</td>
<td>A, C, E</td>
<td>1 point</td>
</tr>
<tr>
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<td>Item Type</td>
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<td>Answer Key</td>
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<td>-------------</td>
<td>------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>10</td>
<td>Multiple Choice</td>
<td>Interpret linear models</td>
<td>Compute (using technology) and interpret the correlation coefficient of a linear fit. (S.ID.8)</td>
<td>A</td>
<td>1 point</td>
</tr>
<tr>
<td>11</td>
<td>Multiple Choice</td>
<td>Summarize, represent, and interpret data on a single count or measurement variable</td>
<td>Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (S.ID.2)</td>
<td>B</td>
<td>1 point</td>
</tr>
<tr>
<td>12</td>
<td>Multiple Choice</td>
<td>Write expressions in equivalent forms to solve problems</td>
<td>Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (A.SSE.3) a. Factor a quadratic expression to reveal the zeros of the function it defines.</td>
<td>C</td>
<td>1 point</td>
</tr>
<tr>
<td>13</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. (A.REI.6)</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
<td>14</td>
<td>Equation Item</td>
<td>Create equations that describe numbers or relationships</td>
<td>Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (A.CED.2)</td>
<td>---</td>
<td>1 point</td>
</tr>
<tr>
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<td>Points</td>
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<td>-----------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>15</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>
<tr>
<td>16</td>
<td>Short Response</td>
<td>Interpret functions that arise in applications in terms of the context</td>
<td>For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* (F.IF.4)</td>
<td>---</td>
<td>2 points</td>
</tr>
<tr>
<td>17</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>C</td>
<td>1 point</td>
</tr>
</tbody>
</table>

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<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Multi-Select Item</td>
<td>Represent and solve equations and inequalities graphically</td>
<td>Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). (A.REI.10)</td>
<td>A, D</td>
<td>1 point</td>
</tr>
<tr>
<td>19</td>
<td>Multiple Choice</td>
<td>Perform arithmetic operations on polynomials</td>
<td>Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract and multiply polynomials. (A.APR.1)</td>
<td>D</td>
<td>1 point</td>
</tr>
<tr>
<td>20</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>---</td>
<td>2 points</td>
</tr>
</tbody>
</table>
Algebra I
Spring 2017 Item Release

Question 1

Question and Scoring Guidelines
Question 1

The graphs of two functions, \( f(x) \) and \( g(x) \), where \( g(x) = f(x) + h \), are shown.

Based on the graph, what is the value of \( h \)?

\[ h = \]

**Points Possible:** 1

**Content Cluster:** Build new functions from existing functions

**Content Standard:** Identify the effect on the graph of replacing \( f(x) \) by \( f(x) + k \), \( kf(x) \), \( f(kx) \), and \( f(x + k) \) for specific values of \( k \) (both positive and negative); find the value of \( k \) given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. (F.BF.3)
Scoring Guidelines

Exemplar Response

• \( h = 5 \)

Other Correct Responses

• Any equivalent value

For this item, a full-credit response includes:

• The correct value for \( h \) (1 point)
Sample Response: 1 point

The graphs of two functions, $f(x)$ and $g(x)$, where $g(x) = f(x) + h$, are shown.

Based on the graph, what is the value of $h$?

$h = 5$

Notes on Scoring

This response earns full credit (1 point) because it correctly identifies the effect of replacing the graph of $f(x)$ by the graph of $f(x) + h$.

A function that replaces $f(x)$ by $f(x) + h$ will perform a vertical translation $h$ units up. According to the graph, $f(x)$ has a $y$-intercept of 0, and $g(x)$ has a $y$-intercept of 5. This means that $g(x)$ was translated 5 units up from $f(x)$ since $5 - 0 = 5$. Therefore, $h = 5$. 
Sample Response: 1 point

A function that replaces \( f(x) \) by \( f(x) + h \) will perform a vertical translation \( h \) units up. According to the graph, \( f(x) \) has a y-intercept of 0, and \( g(x) \) has a y-intercept of 5. This means that \( g(x) \) was translated 5 units up from \( f(x) \) since \( 5 - 0 = 5 \). Therefore, \( h = 5 \) or 5.0.

Notes on Scoring

This response earns full credit (1 point) because it correctly identifies the effect of replacing the graph of \( f(x) \) by the graph of \( f(x) + h \).
Sample Response: 0 points

Based on the graph, what is the value of $h$?

$$h = -5$$

Notes on Scoring

This response earns no credit (0 points) because it incorrectly identifies the effect of replacing the graph of $f(x)$ by the graph of $f(x) + h$.

The student may have confused $g(x)$ with $f(x)$ and noticed that $f(x)$ was translated 5 units below $g(x)$, since $0 - 5 = -5$, and made the conclusion that $h = -5$. 
Notes on Scoring

This response earns no credit (0 points) because it incorrectly identifies the transformation of $f(x) + h$ on a graph.

The student may have found the $y$-coordinate at $x = 1$ for $g(x)$, which is $(1, 8)$, and $f(x)$, which is $(1, 3)$, and then found the ratio of $\frac{g(x)}{f(x)}$ as $\frac{8}{3}$ without realizing that the $y$-coordinates need to be subtracted in order to find the vertical translation.
Algebra I
Spring 2017 Item Release

Question 2

Question and Scoring Guidelines
Question 2

Henry places \(x\) marbles into an empty bucket. Each marble has the same weight. The weight, in ounces, of the bucket and marbles can be calculated using the expression shown.

\[3x + 8\]

What does the term 8 represent in this expression?

A. the weight of each marble
B. the weight of the empty bucket
C. the number of marbles in the bucket
D. the total weight of the bucket and marbles

Points Possible: 1

Content Cluster: Interpret the structure of expressions

Content Standard: Interpret expressions that represent a quantity in terms of its context.* (A.SSE.1)

a. Interpret parts of an expression, such as terms, factors, and coefficients.

*An asterisk appears next to any standard or group of standards linked with Modeling as a conceptual category.

Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have confused the meaning of the constant with the meaning of the coefficient.

Rationale for Option B: Key – The student noted that the variable term represented the marbles’ weight, while the constant was the bucket’s weight.

Rationale for Option C: This is incorrect. The student may have confused the meaning of the constant with the meaning of the variable.

Rationale for Option D: This is incorrect. The student may have seen that the 8 was added on and assumed it meant total weight.
Sample Response: 1 point

Henry places $x$ marbles into an empty bucket. Each marble has the same weight. The weight, in ounces, of the bucket and marbles can be calculated using the expression shown.

$$3x + 8$$

What does the term 8 represent in this expression?

- [ ] the weight of each marble
- [ ] the weight of the empty bucket
- [ ] the number of marbles in the bucket
- [ ] the total weight of the bucket and marbles
Algebra I
Spring 2017 Item Release

Question 3

Question and Scoring Guidelines
Question 3

Ryan works for a delivery service. The function $f(n)$ is used to calculate his daily pay, in dollars, on a day when he makes $n$ deliveries.

$$f(n) = 7n + 96$$

Use the function to complete the table shown.

<table>
<thead>
<tr>
<th>Number of Deliveries</th>
<th>Daily Pay (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>145</td>
</tr>
</tbody>
</table>

Points Possible: 1

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

Content Standard: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. (F.IF.2)
Scoring Guidelines

Exemplar Response

<table>
<thead>
<tr>
<th>Number of Deliveries</th>
<th>Daily Pay (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>5</td>
<td>131</td>
</tr>
<tr>
<td>7</td>
<td>145</td>
</tr>
</tbody>
</table>

Other Correct Responses

- Any equivalent values

For this item, a full-credit response includes:

- Three correct values (1 point)
Algebra I
Spring 2017 Item Release

Question 3

Sample Responses
Sample Response: 1 point

Ryan works for a delivery service. The function \( f(n) \) is used to calculate his daily pay, in dollars, on a day when he makes \( n \) deliveries. \[ f(n) = 7n + 96 \]

Use the function to complete the table shown.

<table>
<thead>
<tr>
<th>Number of Deliveries</th>
<th>Daily Pay (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>5</td>
<td>131</td>
</tr>
<tr>
<td>7</td>
<td>145</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns full credit (1 point) because it shows three correct values of the inputs/outputs of a function inserted in the table.

The Number of Deliveries, \( n \), is the input of the function \( f(n) = 7n + 96 \). The Daily Pay, \( f(n) \), in dollars, is the output of the function. To find the Daily Pay for \( n = 0 \), or \( f(0) \), substitute 0 into the equation for \( n \) to get \( f(0) = 7(0) + 96 \), so \( f(0) = 96 \). To find the Daily Pay for \( n = 5 \), or \( f(5) \), substitute 5 into the equation for \( n \) to get \( f(5) = 7(5) + 96 \), so \( f(5) = 131 \). To find the Number of Deliveries when the Daily Pay equals 145, substitute 145 in for \( f(n) \) to get \( 145 = 7n + 96 \). Then solve the equation by subtracting 96 from both sides to get \( 49 = 7n \). Then divide both sides by 7, \( \frac{49}{7} = \frac{7n}{7} \), which results in \( n = 7 \).
Sample Response: 1 point

Ryan works for a delivery service. The function \( f(n) \) is used to calculate his daily pay, in dollars, on a day when he makes \( n \) deliveries.

\[
f(n) = 7n + 96
\]

Use the function to complete the table shown.

<table>
<thead>
<tr>
<th>Number of Deliveries</th>
<th>Daily Pay (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>96.00</td>
</tr>
<tr>
<td>5</td>
<td>131.00</td>
</tr>
<tr>
<td>7.00</td>
<td>145</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns full credit (1 point) because it shows three correct values of the inputs/outputs of a function inserted in the table.

The Number of Deliveries, \( n \), is the input of the function \( f(n) = 7n + 96 \). The Daily Pay, \( f(n) \), in dollars, is the output of the function. To find the Daily Pay for \( n = 0 \), or \( f(0) \), substitute 0 into the equation for \( n \) to get \( f(0) = 7(0) + 96 \), so \( f(0) = 96 \). To find the Daily Pay for \( n = 5 \), or \( f(5) \), substitute 5 into the equation for \( n \) to get \( f(5) = 7(5) + 96 \), so \( f(5) = 131 \). To find the Number of Deliveries when the Daily Pay equals 145, substitute 145 in for \( f(n) \) to get \( 145 = 7n + 96 \). Then solve the equation by subtracting 96 from both sides to get \( 49 = 7n \). Then divide both sides by 7, \( \frac{49}{7} = \frac{7n}{7} \), which results in \( n = 7 \). Equivalent values of 96.00, 131.00, and 7.00 also earn full credit.
Sample Response: 0 points

Ryan works for a delivery service. The function $f(n)$ is used to calculate his daily pay, in dollars, on a day when he makes $n$ deliveries.

$$f(n) = 7n + 96$$

Use the function to complete the table shown.

<table>
<thead>
<tr>
<th>Number of Deliveries</th>
<th>Daily Pay (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>7</td>
<td>145</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) because out of three required values, it shows two incorrect values of the inputs/outputs of a function inserted in the table.

The student is correct that when the Number of Deliveries is 7, the correct Daily Pay is $145. However, the student incorrectly calculated the Daily Pay at $0, when the Number of Deliveries is 0. For $f(0)$ the Daily Pay should be $96, not $0. The student also incorrectly calculated the Daily Pay at $35, when the Number of Deliveries is 5. For $f(5)$ the Daily Pay should be $131, not $35. The student may have ignored that a constant of $96 is added to $7n$ when substituting 0 and 5 in for $n$.

Students need to get all three values correct in order to get full credit for this item.
Sample Response: 0 points

Ryan works for a delivery service. The function \( f(n) \) is used to calculate his daily pay, in dollars, on a day when he makes \( n \) deliveries.

\[
f(n) = 7n + 96
\]

Use the function to complete the table shown.

<table>
<thead>
<tr>
<th>Number of Deliveries</th>
<th>Daily Pay (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>5</td>
<td>131</td>
</tr>
<tr>
<td>49</td>
<td>145</td>
</tr>
</tbody>
</table>

Notes on Scoring

This response earns no credit (0 points) because out of three required values, it shows one incorrect value of the inputs/outputs of a function inserted in the table.

The Daily Pay of $96 for 0 deliveries is correct. The Daily Pay of $131 for 5 deliveries is correct. However, the number of deliveries for $145 is incorrect. The student may have forgotten to divide by 7 when solving \( f(n) = 7n + 96 \) for \( n \).

Students need to get all three values correct in order to get full credit for this item.
Algebra I
Spring 2017 Item Release

Question 4

Question and Scoring Guidelines
Question 4

Which scatterplot represents the data that would be best modeled by a quadratic function?

A

C

B

D

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. (S.ID.6)

a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have confused a square root model with a quadratic model.

Rationale for Option B: This is incorrect. The student may have thought that since the data was not perfectly linear, a quadratic model would be best.

Rationale for Option C: Key – The student correctly identified that the data in the scatterplot represented half of a U-shape, which would be best modeled by a quadratic function.

Rationale for Option D: This is incorrect. The student may have confused a linear model with negative-slope with a model represented by quadratic function.

Sample Response: 1 point
Algebra I
Spring 2017 Item Release

Question 5

Question and Scoring Guidelines
**Question 5**

The equation shown is used to find the force of gravity, $F$, between two objects, where

- $G$ is the gravitational constant,
- $m_1$ and $m_2$ are the masses of the two objects, and
- $r$ is the distance between the two objects.

$$F = \frac{Gm_1m_2}{r^2}$$

Which equation correctly shows the distance between the two objects?

A) $r = \frac{\sqrt{F}}{Gm_1m_2}$

B) $r = \frac{\sqrt{Gm_1m_2}}{F}$

C) $r = \sqrt{\frac{F}{Gm_1m_2}}$

D) $r = \sqrt{\frac{Gm_1m_2}{F}}$

**Points Possible:** 1

**Content Cluster:** Create equations that describe numbers or relationships.

**Content Standard:** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (A.CED.4)
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have taken the square root of $F$ and $r^2$ but not the other terms, and he or she may have also confused multiplying with dividing when rearranging the equation to find $r$.

Rationale for Option B: This is incorrect. The student may only have taken the square root of the terms on the right side of the equation before rearranging to find $r$.

Rationale for Option C: This is incorrect. The student may have taken the square root of all the terms but confused multiplication with division when rearranging to find $r$.

Rationale for Option D: Key – The student correctly rearranged the formula, $F = \frac{G(m_1)(m_2)}{r^2}$, to find $r$. The first step would be to multiply both sides by $r^2$ which would result in $(r^2)(F) = G(m_1)(m_2)$. Then the student would divide each side by $F$ resulting in $r^2 = \frac{G(m_1)(m_2)}{F}$. Finally, he or she would take the square root of both sides to get $r = \frac{\sqrt{G(m_1)(m_2)}}{F}$. 

Sample Response: 1 point

The equation shown is used to find the force of gravity, $F$, between two objects, where

- $G$ is the gravitational constant,
- $m_1$ and $m_2$ are the masses of the two objects, and
- $r$ is the distance between the two objects.

$$F = \frac{Gm_1 m_2}{r^2}$$

Which equation correctly shows the distance between the two objects?

(A) $r = \frac{\sqrt{F}}{Gm_1 m_2}$

(B) $r = \sqrt{\frac{Gm_1 m_2}{F}}$

(C) $r = \sqrt{\frac{F}{Gm_1 m_2}}$

(D) $r = \sqrt{\frac{Gm_1 m_2}{F}}$
Algebra I
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Question 6

Question and Scoring Guidelines
Question 6

![Sales Data](image)

A store manager records the total visitors and sales, in dollars, for 10 days. The data are shown in the scatter plot.

What conclusion can the store manager draw based on the data?

1. An increase in sales causes a decrease in visitors.
2. An increase in visitors causes an increase in sales.
3. An increase in sales is correlated with a decrease in visitors.
4. An increase in visitors is correlated with an increase in sales.

Points Possible: 1

Content Cluster: Interpret linear models

Content Standard: Distinguish between correlation and causation. (S.ID.9)

Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have confused an increase in visitors with a decrease in visitors and thought that a positive trend in the data was enough to show causation.

Rationale for Option B: This is incorrect. The student may have incorrectly thought that a positive trend in the data was enough to show causation.

Rationale for Option C: This is incorrect. The student may have correctly noticed that a trend in the data can imply correlation, but confused an increase in visitors with a decrease in visitors.

Rationale for Option D: Key – The student correctly noticed that a positive trend in the data implies a direct correlation.
A store manager records the total visitors and sales, in dollars, for 10 days. The data are shown in the scatter plot.

What conclusion can the store manager draw based on the data?

A. An increase in sales causes a decrease in visitors.
B. An increase in visitors causes an increase in sales.
C. An increase in sales is correlated with a decrease in visitors.
D. An increase in visitors is correlated with an increase in sales.
Algebra I
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Question 7

Question and Scoring Guidelines
Question 7

An equation is shown.

\[ 3x + \frac{4}{5} = 7 - 2x \]

What is the solution to the equation?

\[ x = \]

Points Possible: 1

Content Cluster: Solve equations and inequalities in one variable

Content Standard: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. (A.REI.3)
Scoring Guidelines

Exemplar Response

- $\frac{31}{25}$

Other Correct Responses

- Any equivalent values

For this item, a full-credit response includes:

- A correct value (1 point)
Sample Response: 1 point

An equation is shown.

3x + \( \frac{4}{5} \) = 7 − 2x

What is the solution to the equation?

\[ x = \frac{31}{25} \]

Notes on Scoring

This response earns full credit (1 point) because it shows the correct solution when solving linear equations in one variable.

To find a solution, the linear equation must be rearranged to isolate \( x \). It can be solved in many ways. One way to solve the equation \( 3x + \frac{4}{5} = 7 − 2x \) is to add 2x to both sides to get \( 3x + (2x) + \frac{4}{5} = 7 − 2x + (2x) \), which simplifies to \( 5x + \frac{4}{5} = 7 \). Then, \(- \frac{4}{5}\) could be added to both sides of the equation to get \( 5x + \frac{4}{5} + \left(- \frac{4}{5}\right) = 7 + \left(- \frac{4}{5}\right) \), which simplifies to \( 5x = 6 \frac{1}{5} \) or \( 5x = \frac{31}{5} \). The next step is to multiply both sides by \( \frac{1}{5} \) to get \( \frac{1}{5} \)(5x) = \( \left(\frac{31}{5}\right)\left(\frac{1}{5}\right) \), which simplifies to \( x = \frac{31}{25} \).
Sample Response: 1 point

An equation is shown.

\[ 3x + \frac{4}{5} = 7 - 2x \]

What is the solution to the equation?

\[ x = \frac{16}{25} \]

Notes on Scoring

This response earns full credit (1 point) because it shows the correct solution when solving linear equations in one variable.

To find a solution, the linear equation must be rearranged to isolate \( x \). It can be solved in many ways. One way to solve the equation \( 3x + \frac{4}{5} = 7 - 2x \) is to add \( 2x \) to both sides to get \( 3x + (2x) + \frac{4}{5} = 7 - 2x + (2x) \), which simplifies to \( 5x + \frac{4}{5} = 7 \). Then, \( -\frac{4}{5} \) could be added to both sides of the equation to get \( 5x + \frac{4}{5} + (-\frac{4}{5}) = 7 + (-\frac{4}{5}) \), which simplifies to \( 5x = 6\frac{1}{5} \) or \( 5x = \frac{31}{5} \). The next step is to multiply both sides by \( \frac{1}{5} \) to get \( \frac{1}{5}(5x) = \left(\frac{31}{5}\right)(\frac{1}{5}) \), which simplifies to \( x = \frac{31}{25} \), which is equivalent to \( 1\frac{6}{25} \).
Sample Response: 0 points

An equation is shown.
\[ 3x + \frac{4}{5} = 7 - 2x \]

What is the solution to the equation?

\[ x = \frac{31}{5} \]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect solution when solving linear equations in one variable.

To find a solution, the linear equation must be rearranged to isolate \( x \). It can be solved in many ways. One way to solve the equation \( 3x + \frac{4}{5} = 7 - 2x \) is to add \( 2x \) to both sides to get \( 3x + (2x) + \frac{4}{5} = 7 - 2x + (2x) \), which simplifies to \( 5x + \frac{4}{5} = 7 \). Then, \( -\frac{4}{5} \) could be added to both sides of the equation to get \( 5x + \frac{4}{5} + \left(-\frac{4}{5}\right) = 7 + \left(-\frac{4}{5}\right) \), which simplifies to \( 5x = 6\frac{1}{5} \) or \( 5x = \frac{31}{5} \). The student may have ended his or her solution without multiplying each side by \( \frac{1}{5} \).
Sample Response: 0 points

An equation is shown.

\[3x + \frac{4}{5} = 7 - 2x\]

What is the solution to the equation?

\[x = \frac{3}{17}\]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect solution when solving linear equations in one variable.
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Question 8

Question and Scoring Guidelines
Question 8

Some values for a function are shown in the table.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
</tr>
</tbody>
</table>

Which statement best describes the function?

A. It is linear because $f(x)$ increases by a constant amount compared to $x$.
B. It is linear because $f(x)$ increases by a constant percentage compared to $x$.
C. It is not linear because $f(x)$ does not increase by a constant amount compared to $x$.
D. It is not linear because $f(x)$ does not increase by a constant percentage compared to $x$.

Points Possible: 1

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

Content Standard: Distinguish between situations that can be modeled with linear functions and with exponential functions. (F.LE.1)
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have only looked at the change in $f(x)$, and not the change in $x$, that appears to be a constant amount ($25 - 0 = 25$ and $50 - 25 = 25$) instead of finding the ratio of differences of $f(x)$ and $x$, $\left(\frac{f(x)_{2} - f(x)_{1}}{x_{2} - x_{1}}\right)$ that is not a constant amount.

Rationale for Option B: This is incorrect. The student may have only considered the change in $f(x)$, and not the change in $x$, which appears to be a constant amount ($25 - 0 = 25$ and $50 - 25 = 25$). He or she may have thought that $f(x)$ is a linear function that increases by a constant percentage mistaking the definition of exponential function for the definition of linear function.

Rationale for Option C: Key – The student realized that since the rate of change between the two pairs of points is not a constant amount, $\frac{50 - 25}{3 - 2} = \frac{25}{1}$ and $\frac{25 - 0}{2 - 0} = \frac{25}{2}$, the function $f(x)$ is not linear.

Rationale for Option D: This is incorrect. The student may have realized that $f(x)$ is not linear, but used terminology related to exponential functions rather than terminology for linear functions.
Sample Response: 1 point

Some values for a function are shown in the table.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
</tr>
</tbody>
</table>

Which statement best describes the function?

(A) It is linear because $f(x)$ increases by a constant amount compared to $x$.

(B) It is linear because $f(x)$ increases by a constant percentage compared to $x$.

(C) It is not linear because $f(x)$ does not increase by a constant amount compared to $x$.

(D) It is not linear because $f(x)$ does not increase by a constant percentage compared to $x$. 

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Question 9

Question and Scoring Guidelines
Question 9

Select all of the expressions that are equivalent to $16^{\frac{5}{2}}$.

- $4^5$
- $8^5$
- $\sqrt[3]{16}$
- $\sqrt[5]{16^2}$
- $(16^2)(16^{\frac{1}{3}})$
- $(16^5)(16^{\frac{1}{3}})$

Points Possible: 1

Content Cluster: Extend the properties of exponents to rational exponents.

Content Standard: Rewrite expressions involving radicals and rational exponents using the properties of exponents. (N.RN.2)
Scoring Guidelines

Rationale for First Option: Key – The student correctly selected an equivalent expression. According to the property of exponents
\[16^{\frac{5}{2}} = 16^2 \cdot 16^{\frac{1}{2}}.\] Since \(16^2 = (4^2)^2 = 4^4\) and \(16^{\frac{1}{2}} = (4^{\frac{1}{2}})^2 = 4\), then
\[16^2 \cdot 16^{\frac{1}{2}} = 4^4 \cdot 4 = 4^5\] and \(16^{\frac{5}{2}} = 4^5\).

Rationale for Second Option: This is incorrect. The student may have divided the 16 by the 2 in the denominator of the exponent instead of taking the square root of 16.

Rationale for Third Option: Key – The student correctly selected an equivalent expression because expressions in the form \(x^{\frac{b}{a}}\) can be written as \(\sqrt[\frac{a}{b}]{x^b}\) so that \(16^{\frac{5}{2}} = \sqrt[\frac{2}{5}]{16^5}\).

Rationale for Fourth Option: This is incorrect. The student may have recognized that numbers with fraction exponents can be written with radicals, but reversed the meaning of the numerator and denominator and used the numerator as the radical's index instead of the denominator.

Rationale for Fifth Option: Key – The student correctly selected an equivalent expression because the product of two exponential expressions with the same bases is the exponential expression with the unchanged base and the sum of exponents. In this case, the sum of the exponents is 2.5 or \(\frac{5}{2}\) in the given expression, so
\[16^{\frac{5}{2}} = 16^{\frac{2}{2} + \frac{5}{2}} = 16^2 \cdot 16^{\frac{1}{2}}.\]

Rationale for Sixth Option: This is incorrect. The student may have incorrectly converted the improper fraction \(\frac{5}{2}\) to 5 and \(\frac{1}{2}\) instead of 2 and \(\frac{1}{2}\), and applied the product property of exponents \(16^{5.5} = 16^{5 + \frac{1}{2}} = 16^5 \cdot 16^{\frac{1}{2}}\).
Sample Response: 1 point

Select all of the expressions that are equivalent to $16^{\frac{5}{2}}$.

- $4^5$
- $8^5$
- $\sqrt[5]{16^5}$
- $\sqrt[5]{16^2}$
- $(16^2)(16^{\frac{1}{3}})$
- $(16^{\frac{5}{2}})(16^{\frac{1}{3}})$
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Question 10

Question and Scoring Guidelines
Bryson collects data on the depth of a river at various points and the velocity of the river at those points. His data have a correlation coefficient of -0.9182.

Which scatterplot could represent Bryson's data?

Points Possible: 1

Content Cluster: Interpret linear models

Content Standard: Compute (using technology) and interpret the correlation coefficient of a linear fit. (S.ID.8)
Scoring Guidelines

Rationale for Option A: **Key** – The student correctly identified that a correlation coefficient of \(-0.9382\) indicates a strong negative linear relationship because the scatterplot shows the set of points lying closely to the imaginary line of best fit with increasing variable \(x\) and decreasing variable \(y\).

Rationale for Option B: This is incorrect. The student may have thought that a correlation coefficient of \(-0.9382\) represents a weak negative linear relationship and chose the scatterplot that represented this data.

Rationale for Option C: This is incorrect. The student may have thought that because the absolute value of a correlation coefficient of \(-0.9382\) is close to 1, it represents a strong positive linear relationship and chose the scatterplot that represented this data.

Rationale for Option D: This is incorrect. The student may have thought that a correlation coefficient of \(-0.9382\) represents a weak positive linear relationship and chose the scatterplot that represented this data.
Sample Response: 1 point

Bryson collects data on the depth of a river at various points and the velocity of the river at those points. His data have a correlation coefficient of \(-0.9382\).

Which scatterplot could represent Bryson’s data?
Algebra I
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Question 11

Question and Scoring Guidelines
Question 11

Which statistical measure changes when every number in a data set is increased by 10?

A) range  
B) mean  
C) standard deviation  
D) interquartile range

Points Possible: 1

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

Content Standard: Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (S.ID.2)
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have thought that since each value was increased by 10, the range would also increase, but neglected to consider that the increases of 10 would cancel each other when subtracting the minimum from the maximum to calculate the range.

Rationale for Option B: Key – The student correctly determined that the mean of the data set would increase because if every data point increases by 10 and the number of data points remains the same, the average increases.

Rationale for Option C: This is incorrect. The student may have thought that since each value increased by 10, the standard deviation would also increase, but because the mean would increase by 10 and each data point increases by 10, the increases cancel each other when finding the difference between each data point and the mean to calculate the deviation.

Rationale for Option D: This is incorrect. The student may have thought that since all data points increased by 10, the interquartile range would also increase but neglected to consider that the increases of 10 to the first and third quartiles would cancel each other when finding their difference to calculate the interquartile range.

Sample Response: 1 point

Which statistical measure changes when every number in a data set is increased by 10?

A  range
B  mean
C  standard deviation
D  interquartile range
Algebra I
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Question 12

Question and Scoring Guidelines
Question 12

Which correctly factored form of the function $f(x) = 36x^2 + 15x - 6$ can be used to identify the zeros?

A. $f(x) = (4x - 1)(3x + 2)$  
B. $f(x) = (12x - 2)(3x + 3)$  
C. $f(x) = 3(4x - 1)(3x + 2)$  
D. $f(x) = 3(12x - 2)(3x + 3)$

**Points Possible:** 1

**Content Cluster:** Write expressions in equivalent forms to solve problems.

**Content Standard:** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (A.SSE.3)  
a. Factor a quadratic expression to reveal the zeros of the function it defines.
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have factored the greatest common factor from the expression and then left it out from the final answer since it is not a binomial. The student may have also failed to use multiplication to verify that it is not equivalent to the quadratic expression in the given $f(x)$.

Rationale for Option B: This is incorrect. The student may have factored only the squared term, $36x^2$, and constant term, $-6$, when selecting option B. The student may have also failed to use multiplication to verify that it is not equivalent to the quadratic expression in the given $f(x)$.

Rationale for Option C: **Key** – The student chose the completely factored form of the given expression by stating that $36x^2 + 15x - 6 = 3(12x^2 + 5x - 2) = 3(4x - 1)(3x + 2)$. Next, the student may have first used the distributive property and then multiplication to verify if the expression in option C is equivalent to the quadratic expression in the given $f(x)$.

Rationale for Option D: This is incorrect. The student may have recognized that the expression has a greatest common factor of 3, but then may have factored just the squared term, $36x^2$, and constant term, $-6$, of the given quadratic expression $f(x)$. The student may have also failed to use first the distributive property and then multiplication to verify that it is not equivalent to the quadratic expression in the given $f(x)$.

Sample Response: 1 point

Which correctly factored form of the function $f(x) = 36x^2 + 15x - 6$ can be used to identify the zeros?

- **A** $f(x) = (4x - 1)(3x + 2)$
- **B** $f(x) = (12x - 2)(3x + 3)$
- **C** $f(x) = 3(4x - 1)(3x + 2)$
- **D** $f(x) = 3(12x - 2)(3x + 3)$
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Question 13

Question and Scoring Guidelines
Question 13

What two numbers have a sum of 217 and a difference of 85?

**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

- 151
- 66

Other Correct Responses

- Any equivalent value

For this item, a full-credit response includes:

- The correct values (1 point)
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Question 13

Sample Responses
Sample Response: 1 point
Notes on Scoring

This response earns full credit (1 point) because it shows two correct numbers representing a solution of a system of two linear equations in two variables that can be used to solve this problem.

The sum of two numbers that have a sum of 217 can be written by the linear equation \( x + y = 217 \), where \( x \) represents the first number and \( y \) represents the second number. Two numbers that have a difference of 85 can be written by the linear equation \( x - y = 85 \). There are many ways to solve systems of equations. One method is to use the elimination method to add the equations and eliminate one variable:

\[
\begin{align*}
  x + y &= 217 \\
+ x - y &= 85 \\
\hline
2x + 0 &= 302
\end{align*}
\]

This simplifies to \( 2x = 302 \). By dividing each side by 2, \( \frac{2x}{2} = \frac{302}{2} \), the result is \( x = 151 \). Then, substitute 151 in for \( x \) in the first equation to get \( 151 + y = 217 \). After subtracting 151 from both sides to get \( 151 - 151 + y = 217 - 151 \), \( y \) is found to equal 66. Therefore, the two numbers are 151 and 66.
Sample Response: 1 point

What two numbers have a sum of 217 and a difference of 85?

66

151
Notes on Scoring

This response earns full credit (1 point) because it shows two correct numbers representing a solution of a system of two linear equations in two variables that can be used to solve this problem.

The sum of two numbers that have a sum of 217 can be written by the linear equation \( x + y = 217 \), where \( x \) represents the first number and \( y \) represents the second number. Two numbers that have a difference of 85 can be written by the linear equation \( x - y = 85 \).

There are many ways to solve systems of equations. One method is to use the elimination method to add the equations and eliminate one variable:

\[
\begin{align*}
 x + y &= 217 \\
 x - y &= 85 \\
 \hline
 2x &= 302 \\
 x &= 151
\end{align*}
\]

This simplifies to \( 2x = 302 \). By dividing each side by 2, \( \frac{2x}{2} = \frac{302}{2} \), the result is \( x = 151 \). Then, substitute 151 in for \( x \) in the first equation to get \( 151 + y = 217 \). After subtracting 151 from both sides to get \( 151 - 151 + y = 217 - 151 \), \( y \) is found to equal 66. Therefore, the two numbers are 66 and 151, or 151 and 66. It does not matter which number goes into which box.
Sample Response: 0 points

What two numbers have a sum of 217 and a difference of 85?

302

132

Notes on Scoring

This response earns no credit (0 points) because it shows two incorrect numbers representing a solution of a system of two linear equations in two variables that can be used to solve this problem.

The student may not have understood that he or she needed to write two equations to represent the problem and instead added 217 and 85 to get 302. Then, he or she may have subtracted 85 from 217 to get 132.
Sample Response: 0 points

What two numbers have a sum of 217 and a difference of 85?

146
61

Notes on Scoring

This response earns no credit (0 points) because it shows two incorrect numbers representing a solution of a system of two linear equations in two variables that can be used to solve this problem.

The student may have misread the problem and found two numbers whose sum is 207, instead of 217, and whose difference is 85.
Question 14

Stephanie adds pennies, nickels and quarters to a scale until the mass of the combined coins is 75 grams. Each penny has a mass of 2.5 grams, each nickel has a mass of 5 grams and each quarter has a mass of 5.7 grams.

Create an equation to model this situation, where \(x\) is the number of pennies, \(y\) is the number of nickels and \(z\) is the number of quarters that Stephanie can put on the scale so that the mass of the combined coins is exactly 75 grams.

Points Possible: 1

Content Cluster: Create equations that describe numbers or relationships

Content Standard: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (A.CED.2)

Scoring Guidelines

Exemplar Response

- \(2.5x + 5y + 5.7z = 75\)

Other Correct Responses

- Any equivalent equation

For this item, a full-credit response includes:

- The correct equation (1 point)
Sample Response: 1 point

Stephane adds pennies, nickels and quarters to a scale until the mass of the combined coins is 75 grams. Each penny has a mass of 2.5 grams, each nickel has a mass of 5 grams and each quarter has a mass of 5.7 grams.

Create an equation to model this situation, where $x$ is the number of pennies, $y$ is the number of nickels and $z$ is the number of quarters that Stephanie can put on the scale so that the mass of the combined coins is exactly 75 grams.

$$2.5x + 5y + 5.7z = 75$$

Notes on Scoring

This response earns full credit (1 point) because it shows a correct equation to represent the relationships between quantities.

The mass of each coin type is equal to the mass of the coin times the number of coins. Since $x$ is the number of pennies, the mass of all the pennies is represented by $2.5x$. Since $y$ is the number of nickels, the mass of all the nickels is represented by $5y$. Since $z$ is the number of quarters, the mass of all the quarters is represented by $5.7z$. The mass of all the pennies plus the mass of all the nickels plus the mass of all the quarters equals the total mass of all the coins, which is 75, so $2.5x + 5y + 5.7z = 75$ is an equation that models the situation.
Sample Response: 1 point

Stephanie adds pennies, nickels and quarters to a scale until the mass of the combined coins is 75 grams. Each penny has a mass of 2.5 grams, each nickel has a mass of 5 grams and each quarter has a mass of 5.7 grams.

Create an equation to model this situation, where $x$ is the number of pennies, $y$ is the number of nickels and $z$ is the number of quarters that Stephanie can put on the scale so that the mass of the combined coins is exactly 75 grams.

\[ 75 = 5.7z + 5y + 2.5x \]

Notes on Scoring

This response earns full credit (1 point) because it shows a correct equation to represent the relationships between quantities.

The mass of each coin type is equal to the mass of the coin times the number of coins. Since $x$ is the number of pennies, the mass of all the pennies is represented by $2.5x$. Since $y$ is the number of nickels, the mass of all the nickels is represented by $5y$. Since $z$ is the number of quarters, the mass of all the quarters is represented by $5.7z$. The mass of all the pennies plus the mass of all the nickels plus the mass of all the quarters equals the total mass of all the coins, which is 75, so $2.5x + 5y + 5.7z = 75$ is an equation that models the situation. The equation can also be written as $75 = 2.5x + 5y + 5.7z$. 

83
Sample Response: 0 points

Stephanie adds pennies, nickels and quarters to a scale until the mass of the combined coins is 75 grams. Each penny has a mass of 2.5 grams, each nickel has a mass of 5 grams and each quarter has a mass of 5.7 grams.

Create an equation to model this situation, where \( x \) is the number of pennies, \( y \) is the number of nickels and \( z \) is the number of quarters that Stephanie can put on the scale so that the mass of the combined coins is exactly 75 grams.

\[ x + y + z = 75 \]

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect equation to represent the relationships between quantities.

The student knew that he or she needed to add the three types of coins to get the combined mass of all the coins but did not take into account the mass of each coin.
Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect equation to represent the relationships between quantities.

The student knew that he or she needed to add the mass of each of the three types of coins to get the combined mass of all the coins. However, the student assigned the wrong masses to the pennies and quarters.
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Question 15

Question and Scoring Guidelines
Question 15

The population of snails in a tank at the aquarium is found to triple every year. Mark visits the aquarium and counts 80 snails in the tank. Write a function \( f(n) \) to model the number of snails in the tank \( n \) years after Mark’s visit.

\[
f(n) = \frac{80 \cdot 3^n}{10}
\]

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

- \( f(n) = 80 \cdot 3^n \)

Other Correct Responses

- Any equivalent function

For this item, a full-credit response includes:

- A correct function (1 point)
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Question 15

Sample Responses
Sample Response: 1 point

The population of snails in a tank at the aquarium is found to triple every year. Mark visits the aquarium and counts 80 snails in the tank. Write a function $f(n)$ to model the number of snails in the tank $n$ years after Mark’s visit.

\[ f(n) = 80 \cdot 3^n \]

Notes on Scoring

This response earns full credit (1 point) because it shows a correct exponential equation modeling the situation.

Since the population of snails triples every year, the growth factor remains the same and the situation is represented by the exponential function $f(n) = ab^n$, where $a$ stands for the initial number and $b$ stands for the growth factor. Since the initial number of snails is 80, it is used in place of $a$. The growth factor is 3 and is used in place of $b$, which gives the equation $f(n) = 80 \cdot 3^n$. 
Sample Response: 1 point

The population of snails in a tank at the aquarium is found to triple every year. Mark visits the aquarium and counts 80 snails in the tank. Write a function \( f(n) \) to model the number of snails in the tank \( n \) years after Mark’s visit.

\[ f(n) = 3^n \cdot 80 \]

Notes on Scoring

This response earns full credit (1 point) because it shows a correct exponential equation modeling the situation.

Since the population of snails triples every year, the growth factor remains the same and the situation is represented by the exponential function \( f(n) = a b^n \), where \( a \) stands for the initial number and \( b \) stands for the growth factor. Since the initial number of snails is 80, it is used in place of \( a \). The growth factor is 3 and is used in place of \( b \), which gives the equation \( f(n) = 80 \cdot 3^n \). The equivalent equation of \( f(n) = 3^n \cdot 80 \) is also a correct answer because of the Commutative Property of Multiplication.
Sample Response: 0 points

The population of snails in a tank at the aquarium is found to triple every year. Mark visits the aquarium and counts 80 snails in the tank. Write a function $f(n)$ to model the number of snails in the tank $n$ years after Mark’s visit.

$$f(n) = 3^n \cdot 80$$

Notes on Scoring

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

The student may have confused the form of an exponential equation, $f(n) = ab^n$, where $a$ stands for the initial number and $b$ standards for the growth factor, with a form of a linear equation.
Sample Response: 0 points

The population of snails in a tank at the aquarium is found to triple every year. Mark visits the aquarium and counts 80 snails in the tank. Write a function \( f(n) \) to model the number of snails in the tank \( n \) years after Mark’s visit.

\[
f(n) = 3n + 80
\]

Notes on Scoring

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

The student may have thought that the situation was represented by a linear model, \( (n) = mn + b \), instead of the exponential model \( f(n) = ab^n \).
Algebra I
Spring 2017 Item Release

Question 16

Question and Scoring Guidelines
Question 16

Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

Points Possible: 2

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

Content Standard: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* (F.IF.4)

*An asterisk appears next to any standard or group of standards linked with Modeling as a conceptual category.
Scoring Guidelines

Score Point | Description
-------------|-----------------------------------------------------------
2 points      | Response includes the following correct Initial Position with a correct Maximum Speed.

**Initial Position:**

a) Train B is closer to Columbus than Train A at 6:00 a.m.

**Maximum Speed:**

b) Since the speed of an object is measured by dividing the distance the object travels by the time it takes the object to travel that distance, the speed of each train is the slope of each train’s graph. Tom is correct since the graph of each train has the same slope when both trains are moving.

1 point | Response includes the correct Initial Position listed above with an incorrect or missing Maximum Speed or vice versa.

0 points | The response does not meet the criteria required to earn one point. The response indicates inadequate or no understanding of the task and/or the idea or concept needed to answer the item. It may only repeat information given in the test item. The response may provide an incorrect solution/response and the provided supportive information may be irrelevant to the item, or possibly, no other information is shown. The student may have written on a different topic or written, “I don’t know.”
Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

A. Train A started the trip 1,800 miles away from Columbus, while train B started 600 miles closer to the city.
B. Tom’s claim is correct. The lines on the graph are parallel, which means the two trains were traveling at the same speed. Train B must have started later than Train A since the line on the graph shows that the train did not move for 7 hours.
Notes on Scoring

This response earns full credit (2 points) because it shows a correct interpretation of the graphs of two functions in terms of the context.

A. The graph shows that Train A begins its trip at 1,800 miles and Train B begins its trip at 1,200 miles from Columbus. Therefore, Train B is closer to Columbus than Train A by 600 miles (1800 − 1200 = 600).

B. The y-value of each point on the line on the grid represents the train’s remaining distance to Columbus. The slope (the rate of change) of each line represents the speed of the corresponding train. Because lines are parallel over the certain interval of time, their slopes are equal and the trains travel with equal speeds over that interval of time.

There is an interval on the graph between 1:00 p.m. and 6:00 p.m. where both lines are parallel, so the trains have the same speed over that interval. Therefore, Tom is correct that both trains traveled the same speed over a certain interval of time. Sara is incorrect. She may have thought that since Train A arrives to Columbus first, it went faster than Train B.
Sample Response: 2 points

Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

Two Trains Traveling to Columbus, Ohio

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

Train A is farther away from Columbus than Train B. Tom is right, both trains are moving at the same speed over a certain interval. Train A is moving 150 miles an hour from 10 a.m. to 2 p.m. Train B is moving 150 miles an hour from 1 to 5 p.m. These are both 4 hour windows and they are both moving 150 miles per hour.
Notes on Scoring

This response earns full credit (2 points) because it shows a correct interpretation of the graphs of two functions in terms of the context.

A. The graph shows that Train A begins its trip at 1,800 miles from Columbus and Train B begins its trip at 1,200 miles from Columbus. Therefore, Train A is farther from Columbus than Train B by 600 miles ($1800 - 1200 = 600$).

B. On the graph, the speeds of the trains are represented by the slopes of the lines. The line representing the remaining distance of Train A has a constant slope, which can be calculated by $\frac{(1200-1800)}{(10:00 \text{ a.m.} - 6:00 \text{ a.m.)}}$ and is equivalent to $\left| \frac{-600}{4} \right|$, which simplifies to 150 miles per hour. Since the graph representing Train B is a horizontal line from 6:00 a.m. to 1:00 p.m., Train B does not start moving until 1:00 p.m. After 1:00 p.m., Train B has a constant speed (rate of change), which can be calculated by $\left| \frac{(1200-600)}{(1:00 \text{ p.m.} - 5:00 \text{ p.m.})} \right|$ or $\left| \frac{600}{-4} \right|$ and which simplifies to 150 miles per hour. Therefore, Tom is correct that both trains have the same speed of 150 miles per hour between 1:00 p.m. and 6:00 p.m.
Sample Response: 1 point

Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

Two Trains Traveling to Columbus, Ohio

<table>
<thead>
<tr>
<th>Time</th>
<th>Distance from Columbus, Ohio (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 a.m.</td>
<td>2000</td>
</tr>
<tr>
<td>7:00 a.m.</td>
<td>1800</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>1600</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>1400</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>1200</td>
</tr>
<tr>
<td>11:00 a.m.</td>
<td>1000</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>800</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td>600</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>400</td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>200</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>0</td>
</tr>
</tbody>
</table>

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

Tom is correct. They do not travel the same speed the whole time but from 1:00 pm to 6:00 pm the travel at the same speed. I know this because the lines are parallel in that time period.
Notes on Scoring

This response earns partial credit (1 point) because it shows only one correct interpretation of the graphs of two functions in terms of the context.

A. The student did not answer the first question.

B. The height (y-value) of each line on the grid denotes the train's remaining distance to Columbus. The slope (the rate of change) of each line represents the speed of the corresponding train. Because lines are parallel over the certain interval of time, their slopes are equal and the trains travel with equal speeds over that interval of time.

There is an interval on the graph between 1:00 p.m. and 6:00 p.m. where both lines are parallel, so the trains have the same speed over that interval. Therefore, Tom is correct that both trains traveled the same speed over a certain interval of time. Sara may have thought that since Train A arrives to Columbus first, it went faster than Train B.
Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

### Two Trains Traveling to Columbus, Ohio

<table>
<thead>
<tr>
<th>Time</th>
<th>Distance from Columbus, Ohio (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 a.m.</td>
<td>2000</td>
</tr>
<tr>
<td>7:00 a.m.</td>
<td>1800</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>1600</td>
</tr>
<tr>
<td>9:00 a.m.</td>
<td>1400</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>1200</td>
</tr>
<tr>
<td>11:00 a.m.</td>
<td>1000</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>800</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td>600</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>400</td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>200</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>0</td>
</tr>
<tr>
<td>5:00 p.m.</td>
<td>0</td>
</tr>
<tr>
<td>6:00 p.m.</td>
<td>0</td>
</tr>
</tbody>
</table>

**Key**
- Blue line: Train A
- Red line: Train B

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

Train A distance is going to be longer than train B. Sara is correct because they took different paths and they got there at different times.
Notes on Scoring

This response earns partial credit (1 point) because it shows a partially correct interpretation of the graphs of two functions in terms of the context.

A. The student is correct that Train A is at a farther distance from Columbus than Train B. The graph shows that Train A begins its trip at 1,800 miles and Train B begins its trip at 1,200 miles from Columbus. Therefore, Train B is closer to Columbus than Train A by 600 miles (1800 − 1200 = 600).

B. The student is incorrect because he or she confused arrival time with the speed (slope of a line).
Sample Response: 1 point

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

A. Train A was farther away from Columbus than train B.

B. Sara's claim is correct because train B was traveling at a slower speed than train A but then started going the same speed at 1:00 p.m.
Notes on Scoring

This response earns partial credit (1 point) because it shows a partially correct interpretation of the graphs of two functions in terms of the context.

A. The student is correct that Train A is at a farther distance from Columbus than Train B. The graph shows that Train A begins its trip at 1,800 miles and Train B begins its trip at 1,200 miles from Columbus. Therefore, Train A was farther from Columbus than Train B by 600 miles (1800 – 1200 = 600).

B. The student is incorrect; Train B was not traveling at a slower speed initially. Instead, Train B was stopped until 1:00 p.m. From 1:00 p.m. until 6:00 p.m., the graphs are parallel, so the trains were going at the same speeds. Therefore, Tom is correct.
Sample Response: 0 points

Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

Two Trains Traveling to Columbus, Ohio

![Graph showing distance from Columbus over time for two trains.]

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

Train A is good.
Train B is bad.

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect interpretation of the graphs of two functions in terms of the context.
Sample Response: 0 points

Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

Two Trains Traveling to Columbus, Ohio

A. Compare the distances relative to Columbus from which the trains begin their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

If the trains were to travel different speeds the entire time the lines would be parallel on the graph and wouldn't intercept there for tom is correct.

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect interpretation of the graphs of two functions in terms of the context.
Two freight trains are traveling to Columbus, Ohio. A graph is shown representing each train’s remaining distance to Columbus over time.

Two Trains Traveling to Columbus, Ohio

A. Compare the distances relative to Columbus from which the trains began their trip.

B. Tom claims both trains traveled at the same speed over a certain interval. Sara claims that both trains traveled at different speeds the entire time. Justify which claim is correct.

Type your answer in the space provided.

Notes on Scoring

This response earns no credit (0 points) because it shows an incorrect interpretation of the graphs of two functions in terms of the context.
Question 17

Which graph represents a function whose domain is the set of non-negative real numbers?

A. [Graph A]
B. [Graph B]
C. [Graph C]
D. [Graph D]
E. [Graph E]
F. [Graph F]
G. [Graph G]
H. [Graph H]

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)*

*An asterisk appears next to any standard or group of standards linked with Modeling as a conceptual category.*
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have understood that this graph represents a function, but confused the domain, the set of x-coordinates, of all real numbers, with the range, the set of y-coordinates, of all non-negative real numbers.

Rationale for Option B: This is incorrect. The student may have understood that the domain is the set of non-negative x-values, but overlooked the fact that this is not the graph of a function.

Rationale for Option C: **Key** – The student correctly understood that the graph satisfies the requirements of a function where each x-coordinate corresponds to only one y-coordinate and that the domain is represented by the set of non-negative x-coordinates.

Rationale for Option D: This is incorrect. The student may have understood that this graph represents a function, but overlooked the fact that the domain, the set of x-coordinates, is all non-positive real numbers and the range is all non-negative real numbers.

Sample Response: 1 point
Question 18

The points (0, 1) and (1, 4) are contained in the graph of an equation with only two variables, $x$ and $y$. Select all of the true statements.

- There is exactly one equation in the form $y = mx + b$ that contains these points.
- There are two equations in the form $y = mx + b$ that contain these points.
- There are no equations in the form $y = a \cdot b^x$ that contain these points.
- There is exactly one equation in the form $y = a \cdot b^x$ that contains these points.
- There is more than one equation in the form $y = a \cdot b^x$ that contains these points.

Points Possible: 1

Content Cluster: Represent and solve equations and inequalities graphically

Content Standard: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). (A.REI.10)
Scoring Guidelines

Rationale for First Option: **Key** – The student correctly understood that two points determine a unique line that has a unique equation for a line, \( y = 3x + 1 \), in slope-intercept form.

Rationale for Second Option: This is incorrect. The student may have thought that you could find a different equation for each point, but two points form a unique line which can only have a unique equation.

Rationale for Third Option: This is incorrect. The student may have thought that the two points determine a line, so the two points could not be part of a curve.

Rationale for Fourth Option: **Key** – The student correctly understood that there is a unique exponential equation of the form \( y = a \cdot b^x \) that passes through the given points, \( y = 4^x \).

Rationale for Fifth Option: This is incorrect. The student may have imagined different curves pass through the two points, believing that more than one could be exponential, without attempting to find the values of \( a \) and \( b \).

Sample Response: 1 point

The points \((0, 1)\) and \((1, 4)\) are contained in the graph of an equation with only two variables, \(x\) and \(y\). Select all of the true statements.

- [ ] There is exactly one equation in the form \( y = mx + b \) that contains these points.
- [x] There are two equations in the form \( y = mx + b \) that contain these points.
- [x] There are no equations in the form \( y = a \cdot b^x \) that contain these points.
- [x] There is exactly one equation in the form \( y = a \cdot b^x \) that contains these points.
- [x] There is more than one equation in the form \( y = a \cdot b^x \) that contains these points.
Question 19

An expression is shown.

\[(2x - 3) + [4x(3x + 2)]\]

Which expression is equivalent to the given expression?

A. 9x - 1
B. 14x + 5
C. 12x^2 + 2x - 1
D. 12x^2 + 10x - 3

Points Possible: 1

Content Cluster: Perform arithmetic operations on polynomials.

Content Standard: Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. (A.APR.1)
Scoring Guidelines

Rationale for Option A: This is incorrect. The student may have added all the linear terms, 2x, 4x and 3x together, without applying the distributive property, and then added all the constant terms, −3 and 2, together.

Rationale for Option B: This is incorrect. The student may have distributed the 4 instead of 4x which resulted incorrectly in 2x − 3 + 12x + 8 and then combined like terms.

Rationale for Option C: This is incorrect. The student may have distributed the 4x term only to the 3x term, not the 2, thereby getting (2x − 3) + (12x^2 + 2). Then after combining like terms, the result would be 12x^2 + 2x − 1.

Rationale for Option D: Key – The student correctly performed operations with polynomials as (2x − 3) + [4x(3x + 2)] = (2x − 3) + [12x^2 + 8x] = 12x^2 + 10x − 3.

Sample Response: 1 point
Question 20

Trent plants a sunflower that is 6 inches tall. The sunflower is expected to grow at an average rate of 1.5 inches per day during the next month.

A. Create an equation that Trent can use to find the number of days, \( x \), it will take the sunflower to grow to a height of 45 inches.

B. How many days will it take the sunflower to grow to a height of 45 inches?

\[
\begin{align*}
A. & \\
B. & \text{days}
\end{align*}
\]

Points Possible: 2

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

- A. \(1.5x + 6 = 45\)
  
  B. 26

Other Correct Responses

- Any equivalent equation for part A except \(x = 26\)
  
  \(x = 26\) is also accepted for part B

For this item, a full-credit response includes:

- A correct equation (1 point);
  
  AND
  
  - The correct value (1 point).
Algebra I
Spring 2017 Item Release

Question 20

Sample Responses
Sample Response: 2 points

Trent plants a sunflower that is 6 inches tall. The sunflower is expected to grow at an average rate of 1.5 inches per day during the next month.

A. Create an equation that Trent can use to find the number of days, x, it will take the sunflower to grow to a height of 45 inches.

B. How many days will it take the sunflower to grow to a height of 45 inches?

A. $1.5x + 6 = 45$

B. 26 days

Notes on Scoring

This response earns full credit (2 points) because it shows a correct linear equation in one variable that describes a relationship and was used correctly to solve a problem.

A. The situation can be represented by a linear equation because it has a constant rate of change. One form of a linear equation is $y = mx + b$, where $b$ is the initial height of the plant, $m$ is the average growth rate, $x$ is the number of growing days, and $y$ is the total height of the plant. Since the sunflower is already 6 inches tall, 6 would be the initial height, or the $b$ term. The average growth rate of 1.5 would be the $m$ term. The total plant height of 45 would be the $y$ term, so the equation is $1.5x + 6 = 45$.

B. To find the number of days that it will take the sunflower to grow to 45 inches, the equation needs to be solved for $x$. The first step is to subtract 6 from each side to get $1.5x + 6 - 6 = 45 - 6$, which simplifies to $1.5x = 39$. The second step is to divide each side by 1.5, so $\frac{1.5x}{1.5} = \frac{39}{1.5}$, which results in 26 days.
Sample Response: 2 points

A. Create an equation that Trent can use to find the number of days, x, it will take the sunflower to grow to a height of 45 inches.

B. How many days will it take the sunflower to grow to a height of 45 inches?

A. \(1.5x + 6 = 45\)

B. \(x = 26\) days

Notes on Scoring

This response earns full credit (2 points) because it shows a correct linear equation in one variable that describes a relationship and was used correctly to solve a problem.

A. The situation can be represented by a linear equation because it has a constant rate of change. One form of a linear equation is \(y = mx + b\), where \(b\) is the initial height of the plant, \(m\) is the average growth rate, \(x\) is the number of growing days, and \(y\) is the total height of the plant. Since the sunflower is already 6 inches tall, 6 would be the initial height, or the \(b\) term. The average growth rate of 1.5 would be the \(m\) term. The total plant height of 45 would be the \(y\) term, so the equation is \(1.5x + 6 = 45\).

B. To find the number of days that it will take the sunflower to grow to 45 inches, the equation needs to be solved for \(x\). The first step is to subtract 6 from each side to get \(1.5x + 6 - 6 = 45 - 6\), which simplifies to \(1.5x = 39\). The second step is to divide each side by 1.5, so \(\frac{1.5x}{1.5} = \frac{39}{1.5}\), which results in 26 days, or \(x = 26\) days.
Sample Response: 1 point

Trent plants a sunflower that is 6 inches tall. The sunflower is expected to grow at an average rate of 1.5 inches per day during the next month.

A. Create an equation that Trent can use to find the number of days, \( x \), it will take the sunflower to grow to a height of 45 inches.

B. How many days will it take the sunflower to grow to a height of 45 inches?

A. \( 1.5x + 6 = 45 \)

B. 34 \( \text{days} \)

Notes on Scoring

This response earns partial credit (1 point) because it shows a correct linear equation in one variable that describes a relationship, but the equation was solved incorrectly.

A. The situation can be represented by a linear equation because it has a constant rate of change. One form of a linear equation is \( y = mx + b \), where \( b \) is the initial height of the plant, \( m \) is the average growth rate, \( x \) is the number of growing days, and \( y \) is the total height of the plant. Since the sunflower is already 6 inches tall, 6 would be the initial height, or the \( b \) term. The average growth rate of 1.5 would be the \( m \) term. The total plant height of 45 would be the \( y \) term, so the equation is \( 1.5x + 6 = 45 \).

B. The student solved the equation incorrectly. When solving the equation, the student may have added 6 to both sides, instead of subtracting 6, to get \( 1.5x + 6 + 6 = 45 + 6 \), which simplifies to \( 1.5x = 51 \). Then, the student may have divided each side by 1.5 to get \( \frac{1.5x}{1.5} = \frac{54}{1.5} \), which incorrectly resulted in 34 days.
Sample Response: 1 point

Trent plants a sunflower that is 6 inches tall. The sunflower is expected to grow at an average rate of 1.5 inches per day during the next month.

A. Create an equation that Trent can use to find the number of days, x, it will take the sunflower to grow to a height of 45 inches.

B. How many days will it take the sunflower to grow to a height of 45 inches?

A. 1.5x + 6 = 45

B. 58.5 days

Notes on Scoring

This response earns partial credit (1 point) because it shows a correct linear equation in one variable that describes a relationship, but the equation was solved incorrectly.

A. The situation can be represented by a linear equation because it has a constant rate of change. One form of a linear equation is \( y = mx + b \), where \( b \) is the initial height of the plant, \( m \) is the average growth rate, \( x \) is the number of growing days, and \( y \) is the total height of the plant. Since the sunflower is already 6 inches tall, 6 would be the initial height, or the \( b \) term. The average growth rate of 1.5 would be the \( m \) term. The total plant height of 45 would be the \( y \) term, so the equation is \( 1.5x + 6 = 45 \).

B. The student solved the equation incorrectly. To find the number of days that it will take the sunflower to grow to 45 inches, the equation needs to be solved for \( x \). The first step is to subtract 6 from each side to get \( 1.5x + 6 - 6 = 45 - 6 \), which simplifies to \( 1.5x = 39 \). However, then the student may have multiplied the right side by 1.5, instead of dividing the both sides by 1.5, to get an incorrect response of \( 39(1.5) = 58.5 \).
Sample Response: 1 point

Trent plants a sunflower that is 6 inches tall. The sunflower is expected to grow at an average rate of 1.5 inches per day during the next month.

A. Create an equation that Trent can use to find the number of days, x, it will take the sunflower to grow to a height of 45 inches.
B. How many days will it take the sunflower to grow to a height of 45 inches?

A. \(1.5x = 45\)

B. 30 \(\text{days}\)

Notes on Scoring

This response earns partial credit (1 point) because it shows an incorrect linear equation in one variable that describes a relationship, but it uses the equation correctly to solve a problem.

A. The student created an incorrect equation. He or she may have not realized that 6 inches represents the initial height in the equation. The equation should be \(1.5x + 6 = 45\).

B. The student correctly solved his or her equation for \(x\) by dividing 45 by 1.5 to get 30 days.
Sample Response: 1 point

Trent plants a sunflower that is 6 inches tall. The sunflower is expected to grow at an average rate of 1.5 inches per day during the next month.

A. Create an equation that Trent can use to find the number of days, x, it will take the sunflower to grow to a height of 45 inches.

\[1.5x - 6 = 45\]

B. How many days will it take the sunflower to grow to a height of 45 inches?

A. \[1.5x - 6 = 45\]

B. 34 days

Notes on Scoring

This response earns partial credit (1 point) because it shows an incorrect linear equation in one variable that describes a relationship, but it uses the equation correctly to solve a problem.

A. The student created an incorrect equation. He or she may have subtracted the initial height of the plant instead of adding it to the daily growth of the plant. The equation should be \(1.5x + 6 = 45\).

B. The student correctly solved his or her equation for \(x\) by adding 6 to both sides of the equation \(1.5x - 6 + 6 = 45 + 6\) to get \(1.5x = 51\). Then, he or she correctly divided each side by 1.5 to get \(\frac{1.5x}{1.5} = \frac{51}{1.5}\), which results in 34 days.