Item #	Rationale	
1	Option A is correct	To determine the measurement that is closest to the volume of the marble in cubic millimeters, the student should have substituted the length of the radius (distance from the center of the circle to a point on the circle) into the formula for the volume of a sphere ($V = \frac{4}{3}\pi r^3$, where *r* represents the radius of the sphere). To calculate the length of the radius, the student should have divided the length of the diameter (straight line that goes through the center of a sphere and connects two points on the sphere), 13 mm, by 2, resulting in *r* = 6.5 mm. Replacing *r* with 6.5, the student should have determined that $V = \frac{4}{3}\pi(6.5)^3 \approx 1{,}150$ mm^3.
	Option B is incorrect	The student likely forgot to multiply by $\frac{4}{3}$ in the formula for the volume of a sphere, resulting in $V = \pi(6.5)^3 \approx 863$ mm^3. The student needs to focus on understanding the formula for the volume of a sphere.
	Option C is incorrect	The student likely forgot to multiply by $\frac{4}{3}$ in the formula for the volume of a sphere and used the diameter, 13 mm, as the radius, resulting in $V = \pi(13)^3 \approx 6{,}902$ mm^3. The student needs to focus on understanding the formula for the volume of a sphere.
	Option D is incorrect	The student likely substituted the diameter, *d* = 13 mm, instead of the radius, *r* = 6.5 mm, into the formula for the volume of a sphere, resulting in $\frac{4}{3}\pi(13)^3 \approx 9{,}202$ mm^3. The student needs to focus on understanding the formula for the volume of a sphere.

Item #	Rationale	
2	Option B is correct	To determine the order of the values in the list from greatest to least, the student could have converted each value to a decimal representation so that a comparison could be made. The decimal representations are $\frac{39}{8} \approx 4.875$, $\sqrt{24} \approx 4.899$, and 4.84. Therefore, from greatest to least, the values are $\sqrt{24}, \frac{39}{8}, 4.84$. This an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely compared only the first two values. The student needs to focus on comparing the values of any types of numbers (negative, positive, fraction, square root, etc.) and ordering the numbers by the value.
	Option C is incorrect	The student likely ordered $\frac{39}{8}$ as greater than $\sqrt{24}$. The student needs to focus on determining the values of any types of numbers (negative, positive, fraction, square root, etc.) and ordering the numbers by value.
	Option D is incorrect	The student likely reversed the order and chose the list ordered from least to greatest. The student needs to focus on attending to the details of the question in the problem.

Item #	Rationale	
3	Option A is correct	To determine which graph does not represent *y* as a function of *x* (a relationship in which each input [*x*-value] has a single output [*y*-value]), the student could have chosen the graph where one *x*-value, $x = 1$, corresponds to two *y*-values, $y = 0$ and $y = 2$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely selected a graph with a negative slope (steepness of a straight line when graphed on a coordinate grid), believing that a decreasing set of ordered pairs is not a function. The student needs to focus on understanding the definition of a function and being able to identify one on a graph.
	Option C is incorrect	The student likely selected a graph with ordered pairs that form a horizontal line, believing that a function cannot have more than one *x*-value for each *y*-value. The student needs to focus on understanding the definition of a function and being able to identify one on a graph.
	Option D is incorrect	The student likely selected a graph with ordered pairs that form a curve, believing that a curve does not represent a function. The student needs to focus on understanding the definition of a function and being able to identify one on a graph.

Item #	Rationale	
4	Option C is correct	To determine the best prediction from the scatterplot (a graph of plotted points that shows the relationship between two sets of data) of the time in minutes to read a 90-page report, the student could have drawn a line of best fit (using the Graph/Draw feature in ITS) that closely follows the pattern formed by the points on the graph, by keeping about half the points above the line and the other half below the line. A good line of best fit for this scatterplot would pass through the points (38, 50) and (54, 72). The student could have calculated the slope of that line as $m = \frac{72-50}{54-38} = \frac{11}{8}$. To determine the time it will take to read a 90-page report, the student could have set up a proportion, $\frac{11}{8} = \frac{y}{90}$, and solved for *y*, resulting in *y* = 123.75, which is approximately 125 minutes. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely estimated that the next point on the scatterplot would have a *y*-value of 95 but did not understand that the corresponding number of pages in the report would be 70. The student needs to focus on drawing a line as close as possible to all points, with a similar number of points above and below the line, and using the correct value for *x*.
	Option B is incorrect	The student likely underestimated the slope of the line of best fit, drawing a trendline through (20, 22) and (42, 48), and predicted that it would take 105 minutes to read the 90-page report. The student needs to focus on drawing a line as close as possible to all points, with a similar number of points above and below the line, and using the correct value for *x*.
	Option D is incorrect	The student likely overestimated the slope of the line of best fit, drawing a trendline through (28, 41) and (42, 66), and predicted that it would take 155 minutes to read the 90-page report. The student needs to focus on drawing a line as close as possible to all the points, with a similar number of points above and below the line, and using the correct value for *x*.

Item #		Rationale
5	3/4; 2	To determine an equation in slope-intercept form ($y = mx + b$, where m represents the slope [steepness of a straight line when graphed on a coordinate grid] of the line and b represents the value of the y-intercept [value where a line crosses the y-axis]), the student could have first used the points (–4, –1) and (4, 5) and the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, to determine the slope of the line, resulting in $m = \frac{5-(-1)}{4-(-4)} = \frac{6}{8} = \frac{3}{4}$. Then the student could have found the y-intercept by substituting the slope and one of the points into $y = mx + b$ and solving the equation for b, resulting in $1 = \frac{3}{4}(-4) + b$, or $b = 2$. The student then could have substituted $m = \frac{3}{4}$ and $b = 2$ into the slope-intercept equation, resulting in $y = \frac{3}{4}x + 2$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
6	Option D is correct	To determine which proportion (comparison of two ratios) is true for the similar figures (two figures with corresponding angles that are equal and corresponding sides that are proportional), the student should have determined that the corresponding (paired) angles in quadrilateral *PQRT* and quadrilateral *KLMN* are equal, which means that the lengths of the corresponding sides of the figures forming those equal angles are proportional. The student then should have determined that the ratio relating the corresponding sides *KN* and *PT,* $\frac{9}{3}$, is equivalent to the ratio relating the corresponding sides *MN* and *RT,* $\frac{y}{4.12}$.
	Option A is incorrect	The student constructed a proportion by choosing corresponding sides based on the orientation of the shapes (left sides of figures and top sides of figures), disregarding that the shapes are oriented differently. The student needs to focus on paying attention to details when identifying the correspondence between the sides of similar figures.
	Option B is incorrect	The student believed that sides *RT* and *KN* were corresponding sides because they are both oriented vertically, disregarding that the shapes are oriented differently. The student needs to focus on paying attention to details when identifying the correspondence between the sides of similar figures.
	Option C is incorrect	The student believed that sides *QR* and *MN* were corresponding sides because both are shown as the left side of the labeled angle of their corresponding quadrilaterals, disregarding that the shapes are oriented differently. The student needs to focus on paying attention to details when identifying the correspondence between the sides of similar figures.

Item #	Rationale	
7	Option D is correct	To determine which statement about the ending balance each year is true, the student should have recognized that the account earns 2% interest each year and that the account balance increases by $200.00 each year since a deposit is made. Therefore, the student should have concluded that the balance increases by 2% of the sum of the prior year's ending balance and $200.00.
	Option A is incorrect	The student likely verified only that the statement was true for the next row of the table, Year 2, believing that it holds true for all subsequent years. The student needs to focus on attending to the details of the question in the problem and looking at every row and column in the table.
	Option B is incorrect	The student likely concluded that the account earns interest only on the amount deposited, $200.00, each year. The student needs to focus on attending to the details of the question in the problem and looking at every row and column in the table.
	Option C is incorrect	The student likely concluded that the account earns interest only on the previous year's ending balance. The student needs to focus on attending to the details of the question in the problem and looking at every row and column in the table.

Item #	Rationale	
8	Option B is correct	To determine the total surface area (total area of the surfaces of a three-dimensional figure) of the triangular prism in square feet, the student could have used the formula for the total surface area of a prism ($S = Ph + 2B$, where S represents surface area, P represents the perimeter of the base of the prism, h represents the height of the prism [the distance between the two bases], and B represents the area of one base). For the triangular prism shown, the student should have identified the base of the prism as a triangle with side lengths of 10 ft, 10 ft, and 12 ft and a height of 8 ft. The student could have calculated the perimeter of the base as $P = 10 + 10 + 12 = 32$ ft, and the area of the base as $B = \frac{1}{2}(12)(8)$, or $B = 48$ ft^2. The student should have identified the height of the prism as 18 ft and calculated the total surface area as $S = 32(18) + 2(48) = 672$ ft^2. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely found the area of each face of the triangular prism but left off one of the rectangular faces when finding the total surface area, resulting in $S = 48 + 48 + 180 + 180 = 456$. The student needs to focus on understanding how to properly apply the formula for the total surface area of a figure.
	Option C is incorrect	The student likely did not multiply by $\frac{1}{2}$ when calculating the area of the triangular base, resulting in $B = 12(8) = 96$ ft^2. The student then likely applied the total surface area formula for a prism, resulting in $S = 32(18) + 2(96) = 768$ ft^2. The student needs to focus on understanding how to properly apply the formula for the total surface area of a figure.
	Option D is incorrect	The student likely calculated the lateral surface area (total amount of space covered by the surfaces, not including the bases) of the triangular prism, resulting in $S = Ph = (32)(18) = 576$ ft^2. The student needs to focus on understanding how to properly apply the formula for the total surface area of a figure.

Item #	Rationale	
9	Option C is correct	To determine which inequality represents all possible values of x, the student should have interpreted the verbal description of the amount of water in the tank, "containing 1,060 gallons of water, and 35 gallons of water leaks from the tank every hour," as the expression $1{,}060 - 35x$. The student should have interpreted the verbal description of the amount of water in the pool, "empty pool is filled with water at a rate of 480 gallons per hour," as $480x$. Then the student should have compared the two quantities by interpreting the verbal description "when the tank contains less water than the pool" as "<", which results in the inequality $1{,}060 - 35x < 480x$.
	Option A is incorrect	The student likely misinterpreted the rate of change of the water in the tank as positive 35 gallons instead of negative. The student then likely misinterpreted the phrase "the tank contains less water than the pool" and reversed the inequality sign. The student needs to focus on understanding how to write an inequality from a verbal description.
	Option B is incorrect	The student likely misinterpreted the phrase "the tank contains less water than the pool" and reversed the inequality sign. The student needs to focus on understanding how to write an inequality from a verbal description.
	Option D is incorrect	The student likely misinterpreted the rate of change of the water in the tank as positive 35 gallons instead of negative. The student needs to focus on understanding how to write an inequality from a verbal description.

Item #	Rationale	
10	$3x$, $3y$	To determine the transformation rule for a dilation, the student should have used the format $(x, y) \rightarrow (kx, ky)$, where *k* is the scale factor. The student could have used corresponding (paired) vertices to determine the scale factor of the dilation. The student could have recognized that *P* and *P*' correspond and that the ordered pairs are (1, 3) and (3, 9) respectively. Since the *x*- and *y*-coordinates increase by a factor of 3, the student could have concluded that the scale factor is $k = 3$. Therefore, the rule for the transformation is $(x, y) \rightarrow (3x, 3y)$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
11	Option B is correct	To determine which graph has a slope (steepness of a straight line when graphed on a coordinate grid) that best represents the average number of ounces of ink used per minute, the student should have first determined that the relationship between the number of ounces of ink and the time in minutes is proportional since it produces a unit rate where the ratios are equivalent for all ordered pairs on the graph. To determine the unit rate, the student could have divided the number of ounces of ink by the time in minutes, resulting in $\frac{24}{18}$, or $\frac{4}{3}$ ounces per minute. Since the relationship is proportional, the student should have recognized that the graph contains the point (0, 0), since all proportional graphs pass through the origin, and the point (3, 4), which indicates that in 3 minutes, 4 ounces of ink were used. The student then could have selected a graph that contains these two points, which has a slope of $\frac{4}{3}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely divided the time in minutes by the number of ounces of ink used when calculating the unit rate, resulting in $\frac{18}{24} = \frac{3}{4}$. The student needs to focus on understanding how unit rates are represented on graphs.
	Option C is incorrect	The student likely divided the time in minutes by the number of ounces of ink used when calculating the unit rate, resulting in $\frac{18}{24} = \frac{3}{4}$. Then the student likely counted gridlines on the *y*-axis (vertical axis) without noticing the scale on the graph. The student needs to focus on understanding how unit rates are represented on graphs.
	Option D is incorrect	The student likely divided the number of ounces of ink used by the time in minutes but counted gridlines on the *y*-axis without noticing the scale on the graph. The student needs to focus on understanding how unit rates are represented on graphs.

Item #	Rationale	
12	Option C is correct	To determine the volume (amount of three-dimensional space taken up) of the swimming pool in cubic feet, the student should have used the formula for the volume of a cylinder ($V = Bh$, where V represents the volume, B represents the area of the base of the cylinder, and h represents the height of the cylinder). Since the base of a cylinder is circular, the student should have used the formula for the area of a circle ($A = \pi r^2$, where A represents the area and r is the radius [distance from the center of the circle to a point on the circle]). Substituting $r = 9$ into $A = \pi r^2$, the student could have determined that the area of the circular base is $A = \pi(9)^2$ ft^2. Substituting $B = \pi(9)^2$ and $h = 4$ into $V = Bh$, the student could have determined that the volume of the cylinder is given by the equation $V = \pi(9)^2(4)$ ft^3.
	Option A is incorrect	The student likely multiplied the diameter (length of a line segment that goes through the center of a circle and connects two points on the circle) by the height of the cylinder, resulting in $V = 2(9)(4)$. The student needs to focus on understanding the formula for the volume of a cylinder.
	Option B is incorrect	The student likely omitted π from the formula for volume of a cylinder. The student needs to focus on understanding the formula for the volume of a cylinder.
	Option D is incorrect	The student likely calculated the circumference ($C = 2\pi r$, where C represents the circumference [distance around the circle] and r represents the radius of the circle) instead of the area of the base, resulting in $V = 2\pi(9)(4)$. The student needs to focus on understanding the formula for the volume of a cylinder.

Item #	Rationale	
13	Option B is correct	To determine the representation that best describes a proportional relationship, the student should have first recognized that this graph goes through the origin, (0, 0). The student then could have recognized that the graph increases at a constant rate; in this case, the graph has a slope (steepness of a straight line when graphed on a coordinate grid) of 3.5. Since the graph goes through the origin and increases at a constant rate, the student could have concluded that this graph best represents a proportional relationship. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely chose a linear relationship because the slope, $\frac{3}{4}$, is written as a ratio. The student needs to focus on understanding the definition of a proportional relationship.
	Option C is incorrect	The student likely confused an additive relationship with a proportional relationship. The student needs to focus on understanding the definition of a proportional relationship.
	Option D is incorrect	The student likely misunderstood a vertical line as showing a proportional relationship. The student needs to focus on understanding the definition of a proportional relationship.

Item #	Rationale	
14	120°, 60°, 60°	To determine the angle measures x, y, and z in degrees, the student should have first observed from the figures that the three interior angles of a triangle have a sum of 180°. Since y is the measure of an interior angle, the student could have used the observation that the three interior angles of a triangle have a sum of 180° to find the value of y, resulting in $y + 30° + 90° = 180°$, $y + 120° = 180°$, and $y = 60°$. Next, the student could have observed that the alternate interior angles (angles between the parallel lines, on opposite sides of the transversal [the diagonal line that intersects the parallel lines]) in the figures are congruent (have the same measure). Since y and z are the measures of alternate interior angles, the student could have concluded that they are congruent, resulting in $z = y$, or $z = 60°$. Last, the student could have observed that the angles with measures x and y form a linear pair (two adjacent angles whose measures have a sum of 180°). Since the sum of x and y is 180°, the student could have substituted $y = 60°$ into the equation $x + y = 180°$ to obtain $x + 60° = 180°$ and solved to determine that $x = 120°$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
15	Option C is correct	To determine how many bottles the artist had at the start, the student should have recognized the need to find the value of the *y*-intercept (value where a line crosses the *y*-axis [vertical number line]) since it represents the initial number of bottles the artist had. In order to find the *y*-intercept, the student could have first found the slope (steepness of a straight line when graphed on a coordinate grid) of the linear relationship using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $m = \frac{34-25}{7-4} = \frac{9}{3} = 3$. Next, the student could have written an equation in slope-intercept form ($y = mx + b$, where m represents the slope and b represents the *y*-intercept) to represent the linear relationship. Substituting $m = 3$ and (4, 25) into $y = mx + b$, the student could have obtained $25 = 3(4) + b$, $25 = 12 + b$, and $13 = b$. Since b represents the *y*-intercept or starting value, the student could have concluded that the artist started with 13 bottles of paint. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely calculated the slope instead of the *y*-intercept. The student needs to focus on identifying and interpreting the *y*-intercept and slope in real-world situations.
	Option B is incorrect	The student likely calculated the change in the *y*-values of the first two rows of the table, 34 – 25 = 9. The student needs to focus on identifying and interpreting the *y*-intercept and slope in real-world situations.
	Option D is incorrect	The student likely calculated the change in the *y*-values in the second and third rows of the table, 49 – 34 = 15. The student needs to focus on identifying and interpreting the *y*-intercept and slope in real-world situations.

Item #	Rationale	
16	Option A is correct	To determine the difference between the balances of the two accounts, the student could have first calculated the balance of each account after 4 years. For Account I, the student could have used the formula for simple interest ($I = Prt$, where I represents the earned interest in dollars, P represents the principal [initial amount] in dollars, r represents the interest rate as a decimal, and t represents the time in years) to determine the interest earned. Substituting $P = 1{,}200$, $r = 0.015$, and $t = 4$ into $I = prt$, the student could have obtained $I = 1{,}200(0.015)(4) = 72$. The student then could have added the amount of interest earned to the principal amount to determine the account balance, resulting in $72 + 1{,}200 = 1{,}272$. For Account II, the student could have used the formula for compound interest ($A = P(1 + r)^t$, where A represents the account balance in dollars, P represents the principal in dollars, r represents the interest rate as a decimal, and t represents the time in years) to determine the account balance. Substituting $P = 1{,}200$, $r = 0.015$, and $t = 4$ into $A = P(1 + r)^t$, the student could have obtained $A = 1{,}200(1 + 0.015)^4 \approx 1{,}273.64$. To determine the difference, the student could have subtracted the two balances, resulting in $1{,}273.64 – 1{,}272 = 1.64$. Therefore, the student could have concluded that the difference between the balances of the two accounts at the end of 4 years is $1.64. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely chose the interest earned in Account I. The student needs to focus on attending to the details of the question in the problem.
	Option C is incorrect	The student likely chose the interest earned in Account II, which could be found using $I = 1{,}273.64 – 1{,}200 = 73.64$. The student needs to focus on attending to the details of the question in the problem.
	Option D is incorrect	The student likely calculated the simple interest earned in Account I for one year and misplaced the decimal point when converting the interest rate to a decimal, resulting in $I = 1{,}200(0.0015)(1) = 1.80$. The student needs to focus on attending to the details of the question in the problem.

Item #	Rationale	
17	Preserves Congruence, Preserves Congruence, Does Not Preserve Congruence	To determine whether a transformation preserves or does not preserve congruence, the student should have recalled the that a transformation preserves congruence if the image is the same size and shape as the pre-image. A reflection (flip) across the *y*-axis produces an image with the same size and shape but a different orientation, so the student should have concluded that this transformation preserves congruence. A rotation (circular movement) of 180° counterclockwise with the origin as the center of rotation produces an image with the same size and shape but a different orientation, so the student should have concluded that this transformation preserves congruence. A dilation (resize) by a scale factor of 0.5 with the origin as the center of dilation produces an image that is the same shape but is reduced in size, so the student should have concluded that this transformation does not preserve congruence.

Item #	Rationale	
18	Option A is correct	To determine the value of *x* in the equation modeled by the tiles, the student should have first identified the equation being modeled as $2x + 5 = -3x + 8$. The student should have added $3x$ to both sides of the equation, resulting in $2x + 3x + 5 = -3x + 3x + 8$, or $5x + 5 = 8$. Next, the student should have subtracted 5 from both sides of the equation, resulting in $5x + 5 - 5 = 8 - 5$, or $5x = 3$. Last, the student should have divided both sides of the equation by 5, resulting in $\frac{5}{5}x = \frac{3}{5}$, or $x = \frac{3}{5}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely obtained the correct equation from the model but subtracted 8 from 5 instead of 5 from 8 when solving for *x*, resulting in $5x + 5 - 5 = 5 - 8$ or $5x = -3$. The student then likely made a division error when dividing both sides of the equation by 5, resulting in $\frac{5}{5}x = \frac{5}{-3}$, or $x = -\frac{5}{3}$. The student needs to focus on understanding the arithmetic of solving equations.
	Option C is incorrect	The student likely obtained the correct equation from the model but subtracted 8 from 5 instead of 5 from 8 when solving for *x*, resulting in $5x + 5 - 5 = 5 - 8$, or $5x = -3$. The student then likely divided both sides of the equation by 5, resulting in $\frac{5}{5}x = \frac{-3}{5}$, or $x = -\frac{3}{5}$. The student needs to focus on understanding the arithmetic of solving equations.
	Option D is incorrect	The student likely obtained the correct equation from the model but made a division error when dividing both sides of the equation by 5, resulting in $\frac{5}{5}x = \frac{5}{3}$ or $x = \frac{5}{3}$. The student needs to focus on understanding the arithmetic of solving equations.

Item #	Rationale	
19	Option D is correct	To determine which measurement is closest to the length of the roof in feet, the student should have first recognized that the line segment representing the roof is the hypotenuse (the longest side, opposite the 90° angle in a right triangle) of the triangle. The student then should have applied the Pythagorean theorem ($a^2 + b^2 = c^2$, where the variables a and b represent the lengths of the legs of the right triangle and c represents the length of the hypotenuse) to determine the length of the roof. Substituting $a = 18$ and $b = 8$, the lengths of the two legs, into the formula, the student could have obtained $18^2 + 8^2 = c^2$, $388 = c^2$, $c = \sqrt{388}$, and $c \approx 19.7$.
	Option A is incorrect	The student likely added the lengths of the two legs and then took the square root, resulting in $\sqrt{18 + 8} \approx 5.1$. The student needs to focus on how to apply the Pythagorean theorem with the given information.
	Option B is incorrect	The student likely used 18 as the value of c, resulting in $a^2 + 8^2 = 18^2$, $a^2 = 18^2 - 8^2$, $a^2 = 260$, $a = \sqrt{260}$, and $a \approx 16.1$. The student needs to focus on how to apply the Pythagorean theorem with the given information.
	Option C is incorrect	The student likely added the lengths of the two legs, resulting in $18 + 8 = 26$. The student needs to focus on how to apply the Pythagorean theorem with the given information.

Item #	Rationale	
20	Option C is correct	To determine the rule that describes the translation (slide), the student should have recognized that the square is being translated 3 units to the right and is not being translated vertically. Therefore, the x-coordinate is increasing by 3, represented by $x + 3$, and the y-coordinate is not changing. The student then should have concluded that the rule $(x, y) \rightarrow (x + 3, y)$ describes this translation.
	Option A is incorrect	The student likely switched the coordinates in the translation and made a sign error when writing the translation, resulting in $y - 3$. The student needs to focus on understanding the rules for translations.
	Option B is incorrect	The student likely switched the coordinates in the translation and increased the y-value by 3 instead of the x-value, resulting in $y + 3$. The student needs to focus on understanding the rules for translations.
	Option D is incorrect	The student likely made a sign error when writing the change in the x-coordinate in the translation, resulting in $x - 3$. The student needs to focus on understanding the rules for translations.

Item #	Rationale	
21	Option A is correct	To determine which ordered pair can be added to the grid to show *y* as a function of *x* (relationship in which each input [*x*-value] has a single output [*y*-value]), the student could have recognized that the graph does not contain at point at $x = 3$, so the ordered pair $(3, -6)$ can belong to the function. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option E is correct	To determine which ordered pair can be added to the grid to show *y* as a function of *x,* the student could have recognized that the graph does not contain at point at $x = -2$, so the ordered pair $(-2, 4)$ can belong to the function. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely did not recognize that the graph has the same *x*-value, $x = -1$, paired with a different *y*-value, $y = 2$. The student needs to focus on the definition of a function and on applying it to determine whether a set of ordered pairs represents a function.
	Option C is incorrect	The student likely did not recognize that the graph has the same *x*-value, $x = 1$, paired with a different *y*-value, $y = -2$. The student needs to focus on the definition of a function and on applying it to determine whether a set of ordered pairs represents a function.
	Option D is incorrect	The student likely did not recognize that the graph has the same *x*-value, $x = 0$, paired with a different *y*-value, $y = 0$. The student needs to focus on the definition of a function and on applying it to determine whether a set of ordered pairs represents a function.

Item #	Rationale	
22	Option A is correct	To determine the distance between points *K* and *L*, the student could have first determined that line segment *KL* can be seen as the hypotenuse of right triangle *JKL*, where point *J* is located at (2, 2), and line segments *JK* and *JL* are the legs of the triangle. By counting the units between the endpoints of the legs of the triangle, the student could have determined that the distance between points *J* and *K* is 5 units, and the distance between points *J* and *L* is 5 units. The student then could have substituted $a = 5$ and $b = 5$, to represent the lengths of *JK* and *JL* respectively, into the Pythagorean theorem ($a^2 + b^2 = c^2$, where the variables *a* and *b* represent the lengths of the legs of a right triangle and *c* represents the length of the hypotenuse [the longest side, opposite the 90° angle]), and solved for *c* to determine the length *KL*, resulting in $5^2 + 5^2 = c^2$, $50 = c^2$, $c = \sqrt{50}$, and $c \approx 7$. Therefore, the student could have concluded that distance between points *K* and *L* is approximately 7 units. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely found the distance between the endpoints of one leg of triangle *JKL*, where point *J* is located at (2, 2), rather than the distance between the endpoints of the hypotenuse, *K* and *L*. The student needs to focus on how to apply the Pythagorean theorem to determine the distance between two points.
	Option C is incorrect	The student likely counted the distance between the *x*-axis and point *K*, which is 7 units, and the distance between the *y*-axis and point *L,* which is also *7* units. The student then likely substituted these values into the Pythagorean theorem to get $7^2 + 7^2 = c^2$, $98 = c^2$, $c = \sqrt{98}$, and $c \approx 10$. The student needs to focus on the relationship between coordinates of points and segment lengths.
	Option D is incorrect	The student likely multiplied the lengths of the legs by 2 in the Pythagorean theorem instead of squaring them and did not square the length of the hypotenuse, resulting in $5(2) + 5(2) = c$ or $c = 20$. The student needs to focus on how to apply the Pythagorean theorem to determine the distance between two points.

Item #	Rationale	
23	Option B is correct	To determine the value of *y* when $x = \frac{1}{2}$, the student could have used the direct variation formula ($y = kx$, where k represents the constant of proportionality) to find the missing value. The student first could have substituted $x = \frac{3}{4}$ and $y = 56\frac{1}{4}$ into the direct variation formula and solved for k to determine the constant of proportionality, resulting in $56\frac{1}{4} = \frac{3}{4}k$, or $k = 75$. The student then could have concluded that the equation representing this relationship is $y = 75x$. Next, the student could have substituted $x = \frac{1}{2}$ into $y = 75x$ to determine the value of *y*, resulting in $y = 75\left(\frac{1}{2}\right) = 37\frac{1}{2}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely found the constant of proportionality and did not solve for the value of *y* when $x = \frac{1}{2}$. The student needs to focus on understanding the application of direct variation.
	Option C is incorrect	The student likely used the additive relationship $y = x + k$ to find the missing value. Substituting $x = \frac{3}{4}$ and $y = 56\frac{1}{4}$ into $y = x + k$, the student likely obtained $56\frac{1}{4} = \frac{3}{4} + k$, or $k = 55\frac{1}{2}$. The student then likely concluded that the equation representing this relationship is $y = x + 55\frac{1}{2}$. Substituting $x = \frac{1}{2}$ into $y = x + 55\frac{1}{2}$, the student likely obtained $y = \frac{1}{2} + 55\frac{1}{2} = 56$. The student needs to focus on understanding the application of direct variation.
	Option D is incorrect	The student likely set up a proportion but made an error placing the values in the proportion, resulting in $\frac{y}{56.25} = \frac{0.75}{0.5}$. The student needs to focus on understanding the application of direct variation.

Item #	Rationale	
24	Option C is correct	To determine the amount closest to the balance in the account at the end of 2 years, the student could have first used the formula for simple interest ($I = Prt$, where I represents the earned interest in dollars, P represents the principal [initial amount] in dollars, r represents the interest rate as a decimal, and t represents the time in years) to determine the interest earned. Substituting $P = 7{,}912$, $r = 0.0575$, and $t = 2$ into $I = Prt$, the student could have obtained $I = 7{,}912(0.0575)(2) = 909.88$. The student then could have added the amount of interest earned to the principal amount to determine the account balance, resulting in $909.88 + 7{,}912 = 8{,}821.88$. The student could have then concluded that \$8,822 is closest to the balance in the account. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely multiplied the interest rate by 2, resulting in $r = 2(0.0575) = 0.115$. The student then likely calculated the interest earned, resulting in $I = 7{,}912(0.115)(2) = 1{,}819.76$. The student then likely added the amount of interest earned to the principal amount, resulting in $1{,}819.76 + 7{,}912 = 9{,}731.76 \approx 9{,}732$. The student needs to focus on how to calculate simple interest.
	Option B is incorrect	The student likely multiplied the interest rate by 2, resulting in $r = 2(5.75) = 11.50$. The student then likely added that amount to the principal amount, resulting in $11.50 + 7{,}912 = 7{,}923.50 \approx 7{,}924$. The student needs to focus on how to calculate simple interest.
	Option D is incorrect	The student likely calculated the balance of the account using the compound interest formula, ($A = P(1 + r)^t$, where A represents the account balance in dollars, P represents the principal in dollars, r represents the interest rate as a decimal, and t represents the time in years). Substituting $P = 7{,}912$, $r = 0.0575$, and $t = 2$ into the compound interest formula, the student likely obtained $A = 7{,}912(1 + 0.0575)^2 \approx 8{,}848$. The student needs to focus on how to calculate simple interest.

Item #	Rationale	
25	7,160 and any equivalent values are correct	To determine the total surface area (total area of the surfaces of a three-dimensional figure) of the toy box in square inches, the student could have applied the formula for the total surface area of a prism ($S = Ph + 2B$, where S represents surface area, P represents the perimeter of the base of the prism, h represents the height of the prism [the distance between the two bases], and B represents the area of one base). The student could have identified the rectangle with dimensions 40 inches by 34 inches as the base of the prism. The student then could have found the perimeter, $P = 2(40) + 2(34) = 148$ in., and the area, $A = 34(40) = 1{,}360$ in.^{2}, of the base. Next, the student could have substituted $P = 148$, $B = 1{,}360$, and $h = 30$ into $S = Ph + 2B$ to find the total surface area, resulting in $S = 148(30) + 2(1{,}360) = 7{,}160$ square inches. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
26	Option B is correct	To determine which equation describes a proportional relationship, the student could have determined which equation increases or decreases at a constant rate and has a graph that goes through the origin, (0, 0). The student could have determined that the equation $y = \frac{x}{2}$ is a proportional relationship because the graph of the line has a slope (steepness of a straight line when graphed on a coordinate grid) of $\frac{1}{2}$, meaning that it increases at a constant rate, and goes through the point (0, 0). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely confused a proportional relationship with an additive relationship. The student needs to focus on understanding the definition of a proportional relationship.
	Option C is incorrect	The student likely identified an equation whose graph has a slope of 2, which is a constant rate, but did not recognize that the graph of the relationship would not go through the origin. The student needs to focus on understanding the definition of a proportional relationship.
	Option D is incorrect	The student likely confused a vertical line with the graph of a proportional relationship. The student needs to focus on understanding the definition of a proportional relationship.

Item #	Rationale	
27	Option C is correct	To determine how to write the number in scientific notation, the student should have moved the decimal point 4 places to the left to create a number between 1 and 10, 1.53, and used the number of places the decimal point was moved to the left as the power of 10, resulting in 1.53×10^4.
	Option A is incorrect	The student moved the decimal point 5 places to the left to create a number between 0 and 1 instead of creating a number between 1 and 10, resulting in 0.153×10^5. The student needs to focus on understanding how to write numbers in scientific notation.
	Option B is incorrect	The student moved the decimal point 5 places to the left to create a number between 0 and 1 instead of creating a number between 1 and 10. Then the student likely wrote the exponent as a negative value since the decimal was moved to the left, resulting in 0.153×10^{-5}. The student needs to focus on understanding how to write numbers in scientific notation.
	Option D is incorrect	The student wrote the exponent as a negative value since the decimal was moved to the left, resulting in 1.53×10^{-4}. The student needs to focus on understanding how to write numbers in scientific notation.

Item #	Rationale	
28	Option D is correct	To determine the rule that best describes the dilation, the student should have understood that when a figure is dilated (enlarged or reduced in size), its measurements increase or decrease based on the scale factor (ratio of the length of a side of the dilated figure to the length of the corresponding [paired] side of the original figure). A dilation by a scale factor with the origin (the point represented by (0, 0), where the *x*-axis [horizontal number line] and *y*-axis [vertical number line] on a coordinate grid intersect [cross]) as the center of dilation means that each point on the dilated figure will be a certain number of times as far from the origin as it was on the original figure. Since the location of point *R* on the original pentagon is represented by (9, 3), and the location of the corresponding point *R*' of the dilated pentagon is represented by (6, 2), the scale factor of the dilation can be determined by dividing the value of each coordinate of the dilated pentagon by the value of the corresponding coordinate of the original pentagon, resulting in $k = \frac{6}{9} = \frac{2}{3}$. The student should have concluded that the rule $(x, y) \rightarrow \left(\frac{2}{3}x, \frac{2}{3}y\right)$ best describes the dilation.
	Option A is incorrect	The student likely determined that that scale factor of the dilation is $\frac{2}{3}$ but subtracted it from 1, resulting in $k = 1 - \frac{2}{3} = \frac{1}{3}$. The student then likely concluded that the rule $(x, y) \rightarrow \left(\frac{1}{3}x, \frac{1}{3}y\right)$ best describes the dilation. The student needs to focus on understanding the effect a dilation by a given scale factor has on a figure and how to determine the rule to explain the effect.
	Option B is incorrect	The student likely used 6 and 2 from *R*'(6, 2) to calculate the scale factor, resulting in $k = \frac{6}{2} = 3$. The student then likely concluded that the rule (x, y) → (3x, 3y) best describes the dilation. The student needs to focus on understanding the effect a dilation by a given scale factor has on a figure and how to determine the rule to explain the effect.
	Option C is incorrect	The student likely used the reciprocal of the scale factor, resulting in $k = \frac{3}{2}$. The student then likely concluded that the rule $(x, y) \rightarrow \left(\frac{3}{2}x, \frac{3}{2}y\right)$ best describes the dilation. The student needs to focus on understanding the effect a dilation by a given scale factor has on a figure and how to determine the rule to explain the effect.

Item #	Rationale	
29	2.5, 4	To determine the slope (steepness of a straight line when graphed on a coordinate grid) and *y*-intercept (value where a line crosses the *y*-axis [vertical number line]) of the linear relationship, the student could have substituted the first two ordered pairs from the table, (5, 16.5) and (7, 21.5), into the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, to determine the slope of the linear relationship, resulting in $m = \frac{21.5 - 16.5}{7 - 5} = \frac{5}{2} = 2.5$. The student then could have found the *y*-intercept by substituting $m = 2.5$ and the first point, (5, 16.5), from the table into slope-intercept form of a linear equation ($y = mx + b$, where m represents the slope and b represents the *y*-intercept), and solved for b, resulting in $16.5 = 2.5(5) + b$, or $b = 4$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
30	Option C is correct	To determine the volume of the cone in cubic centimeters, the student should have used the formula for the volume of a cone ($V = \frac{1}{3}\pi r^2 h$, where *r* is the radius [distance from the center of a circle to a point on the circle] of the circular base and *h* is the height of the cone). The student should have recognized that *r* = 12 and *h* = 18. The student then should have substituted *r* = 12 and *h* = 18 into the formula for the volume of a cone, resulting in $V = \frac{1}{3}\pi(12^2)18 = 864\pi$ cm³.
	Option A is incorrect	The student likely used the formula for the volume of a cylinder ($V = \pi r^2 h$, where *r* is the radius of the circular base and *h* is the height of the cylinder), resulting in $V = \pi(12^2)(18) = 2{,}592\pi$. The student needs to focus on understanding how to properly apply the formula for the volume of a cone.
	Option B is incorrect	The student likely used the formula for the area of a circle ($A = \pi r^2$, where *r* is the radius of the circle), resulting in $A = \pi(12^2) = 144\pi$. The student needs to focus on understanding and properly applying the formula for the volume of a cone.
	Option D is incorrect	The student likely squared the height instead of the radius in the formula for the volume of a cone, resulting in $V = \frac{1}{3}\pi(18^2)(12) = 1{,}296\pi$. The student needs to focus on understanding how to properly apply the formula for the volume of a cone.

Item #	Rationale	
31	Option A is correct	To determine which equation represents the total charge in dollars, *y*, for a delivery of *x* cookies, the student could have represented the situation with a linear equation in slope-intercept form, $y = mx + b$. The variable *m* represents the rate of change (also referred to as slope) and can be determined using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting the given values of *x* and *y* into the equation, $m = \frac{27.5 - 20}{18 - 12} = \frac{7.5}{6} = 1.25$, the student should have concluded that the bakery charges $1.25 per cookie. Next, the student could have recognized that the $5 delivery fee is a fixed amount, represented by *b* in the equation. Substituting these values of *m* and *b* into $y = mx + b$, the student could have found that the equation $y = 1.25x + 5$ represents *y*, the total charge in dollars for a delivery of *x* cookies. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely switched the values for the rate and the fixed amount, resulting in $y = 5x + 1.25$. The student needs to focus on understanding how to recognize a non-proportional relationship and apply the slope and *y*-intercept to find the equation of a line in slope-intercept form, which indicates the linear relationship between *x* and *y*.
	Option C is incorrect	The student likely used the correct value for the rate of change but used the change in *x* for the fixed amount, resulting in $b = 18 - 12 = 6$. The student then likely substituted $m = 1.25$ and $b = 6$ into $y = mx + b$, resulting in $y = 1.25x + 6$. The student needs to focus on understanding how to recognize a non-proportional relationship and apply the slope and *y*-intercept to find the equation of a line in slope-intercept form, which indicates the linear relationship between *x* and *y*.
	Option D is incorrect	The student likely used the delivery fee of $5 for the slope and used the difference in the total charges, 27.50 – 20.00 = 7.50, as the *y*-intercept, resulting $y = 5x + 7.50$. The student needs to focus on understanding how to recognize a non-proportional relationship and apply the slope and *y*-intercept to find the equation of a line in slope-intercept form, which indicates the linear relationship between *x* and *y*.

Item #	Rationale	
32	Option D is correct	To determine which scatterplot (graph of plotted points that shows the relationship between two sets of data) best represents a nonlinear relationship, the student should have understood that a linear relationship between *x* and *y* resembles a straight line. Therefore, a graph that represents a nonlinear relationship does not resemble a straight line. Using this understanding, the student should have identified the graph in which the data points form a curve.
	Option A is incorrect	The student likely misinterpreted a nonlinear relationship as one in which *y* decreases as *x* increases. The student needs to focus on understanding how to recognize linear and nonlinear relationships in a scatterplot.
	Option B is incorrect	The student likely misinterpreted a nonlinear relationship as one in which *y* increases as *x* increases. The student needs to focus on understanding how to recognize linear and nonlinear relationships in a scatterplot.
	Option C is incorrect	The student likely misinterpreted a nonlinear relationship as one in which *y* remains the same as *x* increases. The student needs to focus on understanding how to recognize linear and nonlinear relationships in a scatterplot.

Item #	Rationale	
33	Not a right triangle, Right triangle, Right triangle	To determine whether the triangle with each set of side lengths is a right triangle or not a right triangle, the student should have applied the Pythagorean theorem ($a^2 + b^2 = c^2$, where the variables a and b represent the lengths of the legs of a right triangle and c represents the length of the hypotenuse [the longest side, opposite the 90° angle]). For the side lengths 6, 8, and 9, the student should have substituted $a = 6$, $b = 8$, and $c = 9$ into $a^2 + b^2 = c^2$ and found that $6^2 + 8^2 = 100$ and $9^2 = 81$. Since $100 \neq 81$, the student should have concluded that the side lengths 6, 8, and 9 do not form a right triangle. For the side lengths 10, 24, and 26, the student should have substituted $a = 10$, $b = 24$, and $c = 26$ into $a^2 + b^2 = c^2$ and found that $10^2 + 24^2 = 676$ and $26^2 = 676$. Since $676 = 676$, the student should have concluded that the side lengths 10, 24, and 26 do form a right triangle. For the side lengths 24, 45, and 51, the student should have substituted $a = 24$, $b = 45$, and $c = 51$ into $a^2 + b^2 = c^2$ and found that $24^2 + 45^2 = 2{,}601$ and $51^2 = 2{,}601$. Since $2{,}601 = 2{,}601$, the student should have concluded that the side lengths 10, 24, and 26 do form a right triangle. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
34	Option B is correct	To determine which graph or table shows the proportional relationship described by the function $y = -2x$, the student could have first recognized that the graph of a proportional relationship goes through the origin, (0, 0). Next, the student could have substituted an x-value, such as $x = 2$, into the equation to determine another point on the graph of the function, resulting in $y = -2(2)$ or $y = -4$. The student then could have selected the graph of a line that goes through the points (0, 0) and (2, –4). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student selected a graph that represents a proportional relationship, since the graph goes through the origin, but likely did not recognize that the graph has a positive slope instead of a negative slope. The student needs to focus on representing the slopes of proportional relationships with tables and graphs.
	Option C is incorrect	The student selected a table that represents a proportional relationship but likely did not recognize that the relationship represented in the table is $y = -x$. The student needs to focus on representing the slopes of proportional relationships with tables and graphs.
	Option D is incorrect	The student selected a table that represents a proportional relationship but likely did not recognize that the relationship represented in the table is $y = -0.5x$. The student needs to focus on representing the slopes of proportional relationships with tables and graphs.

Item #	Rationale	
35	Option D is correct	To identify the rule that describes the transformation, the student should have recognized that the transformation is a rotation (circular movement) of 270° counterclockwise about the origin (the point where the *x*-axis [horizontal number line] and the *y*-axis [vertical number line] on a coordinate grid intersect [cross]). The student then should have recognized that the rule $(x, y) \rightarrow (y, -x)$ describes the transformation.
	Option A is incorrect	The student likely did not recognize the transformation rule $(x, y) \rightarrow (x, -y)$ represents a reflection across the *x*-axis. The student needs to focus on interpreting the rules for transformations.
	Option B is incorrect	The student likely did not recognize that the transformation rule $(x, y) \rightarrow -x, y)$ represents a reflection across the *y*-axis. The student needs to focus on interpreting the rules for transformations.
	Option C is incorrect	The student likely did not recognize that the transformation rule $(x, y) \rightarrow (-y, x)$ represents a 270° clockwise rotation about the origin. The student needs to focus on interpreting the rules for transformations.

Item #	Rationale	
36	Option D is correct	To determine which ordered pair could be the coordinates of vertex *V*, the student could have first found the slope (steepness of a straight line when graphed on a coordinate grid) of the line containing points *L* and *M*. The student could have substituted the ordered pairs for points *L* and *M*, (–3, –4) and (–6, –6) respectively, into the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $m = \frac{-6-(-4)}{-6-(-3)} = \frac{2}{3}$. Using the slope and point *W*(0, –2), the student could have gone up 2 units and right 3 units from point *W* to find another point on the line. Since (3, 0) is not an answer option, the student then could have gone up 2 units and right 3 units from (3, 0), resulting in (6, 2). The student then should have concluded that right triangle *UVW* with vertex *W* at (0, –2) could have vertex *V* at (6, 2). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student reflected vertex *K* over the *x*-axis. The student needs to focus on similar slopes and locations of vertices.
	Option B is incorrect	The student reflected vertex *L* over the *y*-axis. The student needs to focus on similar slopes and locations of vertices.
	Option C is incorrect	The student found vertex *U* instead of vertex *V*. The student needs to focus on similar slopes and locations of vertices.

Item #	Rationale	
37	Option C is correct	To determine which numbers are greater than π, the student could have found the decimal approximation of each number and then compared the numbers to π. The decimal approximations are π ≈ 3.14, $\frac{8}{3} \approx 2.67$, $\frac{23}{7} \approx 3.29$, $\sqrt{9} = 3$, and $\sqrt{10} \approx 3.16$. Since 3.29 > 3.14, the student could have concluded that $\frac{23}{7}$ is greater than π. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option E is correct	To determine which numbers are greater than π, the student could have found the decimal approximation of each number and then compared the numbers to π. The decimal approximations are π ≈ 3.14, $\frac{8}{3} \approx 2.67$, $\frac{23}{7} \approx 3.29$, $\sqrt{9} = 3$, and $\sqrt{10} \approx 3.16$. Since 3.16 > 3.14, the student could have concluded that $\sqrt{10}$ is greater than π. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely calculated the equivalent form of $\frac{8}{3}$ as 8.3. The student then likely concluded that, since 8. 3 > 3.14, $\frac{8}{3}$ is greater than π. The student needs to focus on comparing numbers in different forms.
	Option B is incorrect	The student likely chose 3.14 because it is often used as a decimal equivalent for π. The student needs to focus on comparing numbers in different forms.
	Option D is incorrect	The student likely reversed the inequality and concluded that π is greater than $\sqrt{9}$. The student needs to focus on comparing numbers in different forms.

Item #	Rationale	
38	Option A is correct	To determine which value of x makes the equation $2x + 9 – 4x = x – 12$ true, the student could have first combined like terms (terms that contain the same variables raised to the same powers or constant terms) on each side of the equation, resulting in $9 – 2x = x – 12$. Next, the student could have added $2x$ to both sides of the equation, resulting in $9 – 2x + 2x = x + 2x – 12$, or $9 = 3x – 12$. The student then could have added 12 to both sides of the equation, resulting in $9 + 12 = 3x – 12 + 12$, or $21 = 3x$. Last, the student could have divided both sides of the equation by 3, resulting in $7 = x$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely added x to the left side of the equation, resulting in $2x – 4x + x = –12 – 9$, or $–x = –21$. The student then likely made a sign error when dividing both sides of the equation by –1, resulting in $x = –21$. The student needs to focus on understanding the arithmetic of solving equations.
	Option C is incorrect	The student likely subtracted 12 from the left side of the equation instead of adding 12, resulting in $9 – 12 = 3x$, or $–3 = 3x$. The student then likely divided both sides of the equation by 3, resulting in $–1 = x$. The student needs to focus on understanding the arithmetic of solving equations.
	Option D is incorrect	The student likely added $4x$ and $2x$ on the left side of the equation when combining like terms, resulting in $6x + 9 = x – 12$. The student then likely added x to the left side of the equation, resulting in $6x + x + 9 = – 12$, or $7x + 9 = –12$. Next, the student likely added 9 and 12 and placed the result on the right side of the equation, resulting in $7x = 21$. Last, the student likely divided both sides of the equation by 7, resulting in $x = 3$. The student needs to focus on understanding the arithmetic of solving equations.

Item #	Rationale	
39	Option C is correct	To determine the approximate number of cookies that would be eaten at an event with 45 guests, based on the scatterplot (a graph of plotted points that shows the relationship between two sets of data), the student could have drawn a line (using the Graph/Draw feature in ITS) that closely follows the pattern formed by the points on the graph by keeping about half the points above the line and half the points below. A good line would pass through the points (30, 32) and (38, 41). The student could have calculated the slope of that line as $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{41-32}{38-30} = \frac{9}{8}$. To determine approximately how many cookies would be eaten at an event with 45 guests, the student could have set up a proportion, $\frac{9}{8} = \frac{y}{45}$,and solved for *y*, resulting in *y* = 50.625, which is approximately 48 cookies. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely chose the point (38, 41) since it is the closest point to 45 guests and concluded that number of cookies that would be eaten is approximately 41. The student needs to focus on drawing a trendline as close as possible to all points, with a similar number of points above and below the line.
	Option B is incorrect	The student likely confused the *x*-axis and *y*-axis and identified the *x*-value that corresponds to a *y*-value of 45 when a trendline is drawn using the ordered pairs (30, 32) and (38, 41), and determined that the number of cookies that would be eaten is approximately 39. The student needs to focus on attending of the question in the problem.
	Option D is incorrect	The student likely used the greatest value labeled on the *y*-axis, 44, to estimate the number of cookies that would be eaten. The student needs to focus on drawing a trendline as close as possible to all points, with a similar number of points above and below the line, and on using the correct value for *x*.

Item #	Rationale	
40	Option D is correct	To determine which graph has a slope (steepness of a straight line when graphed on a coordinate grid) that best represents the number of cabinets the worker paints per hour, the student could have first recognized that the situation represents a proportional relationship since the worker can paint zero cabinets in zero hours. Therefore, the student could have concluded that the graph starts at the origin, (0, 0). Next, the student could have found the unit rate, or slope, by dividing the number of cabinets (*y*-value) painted by the number of hours (*x*-value), resulting in $m = \frac{4}{8} = \frac{1}{2}$. Using the slope, the student could have determined another point on the graph by going up 1 unit and right 2 units from the origin, resulting in the point (2, 1). The student then should have chosen the graph that contains those two points. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely chose the graph where the value of *y* is constantly 8, the given number of hours. The student needs to focus on recognizing a proportional relationship and how unit rates are represented on graphs.
	Option B is incorrect	The student likely found the reciprocal of the slope of the line, resulting in $m = 2$, and chose the graph that passes through the points (0, 0) and (1, 2). The student needs to focus on understanding how unit rates are represented on graphs.
	Option C is incorrect	The student likely chose the graph where the value of *y* is constantly 4, the given number of cabinets. The student needs to focus on recognizing a proportional relationship and how unit rates are represented on graphs.