

Item Position	Rationales	
1	Option B is correct	To determine the total mass in grams of the 5 pieces of clay, the student should have first read the scale to determine that the mass of one piece of clay is 500 grams. The student then could have multiplied the mass of one piece of clay by 5 to determine the total mass: $5 \times 500 = 2,500$ grams. 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 added 5 to 500 instead of multiplying. The student needs to focus on understanding the mathematical operations (+, −, ×, ÷) needed to represent the solution to a real-world problem.
	Option C is incorrect	The student likely misread the mass on the scale as 600 grams rather than 500 grams, resulting in $5 \times 600 = 3,000$ grams. The student needs to focus on reading the mass of an object from a scale.
	Option D is incorrect	The student likely identified the mass of one piece of clay rather than 5 pieces of clay. The student needs to focus on attending to the details to accurately solve the problem.

Item Position	Rationales	
2	1,000,000; 10,000; 1,000; 0.01	To determine the expanded notation (the form of a number shown as a sum of each digit multiplied by its place value) for the number two million, forty-six thousand, and eight hundredths, the student could have written the sum (the result when two or more quantities are added together) of the values represented by the digits. The two in the millions place should be written as $(2 \times 1,000,000)$, the forty-six thousand should be written as $(4 \times 10,000) + (6 \times 1,000)$, and the eight hundredths should be written as (8×0.01) . This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
3	Option C is correct	To determine the area (amount of space covered by a two-dimensional figure) of the picture in square inches, the student should have used the formula for the area of a rectangle ($A = l \times w$, where A = area, l = length, and w = width). Since the length of the rectangle is 16 inches and the width is 12 inches, the student should have multiplied 16 by 12 to determine that the area is 192 square inches. 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 $2 \times 12 \times 16$, resulting in 384 square inches. The student needs to focus on applying the area formula correctly.
	Option B is incorrect	The student likely added the length and the width of the rectangle: $12 + 16 = 28$ square inches. The student needs to focus on applying the area formula correctly.
	Option D is incorrect	The student likely found the perimeter (distance around the outside of a figure) of the rectangle rather than the area: $(2 \times 16) + (2 \times 12) = 56$ square inches. The student needs to focus on understanding the difference between area and perimeter calculations.

Item Position	Rationales	
4	Second option is correct	To determine which dot plot (a graphical way of showing the frequency of an event by placing a dot or dots above a value on a number line) correctly represents the data, the student could have put the values in the list in order from least to greatest and then counted the number of times each value occurs in the list. Then the student could have matched the counts of the values in the list to the numbers of dots shown above the labeled values in the dot plot. The list contains one 10, one 12, one 13, two 15s, one 18, two 22s, one 24, and three 26s. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Fifth option is correct	To determine which stem and leaf plot (a display of data with each number split into a stem [the first digit or digits of the number, in this case the tens place] and a leaf [the last digit of the number, in this case the ones place]) correctly represents the data in the list, the student could have written the data in order from least to greatest and systematically checked that each data point appears in the stem and leaf plot. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	First option is incorrect	The student likely chose a dot plot that excluded one value of 26. The student needs to focus on organizing the data given in data analysis problems.
	Third option is incorrect	The student likely chose a dot plot with only one dot for each unique value, ignoring additional occurrences of values in the list. The student needs to focus on understanding that each element in a set of data should be represented by one dot on a dot plot.
	Fourth option is incorrect	The student likely ignored repeated values when determining which stem and leaf plot represents the data in the list. The student needs to focus on representing data in stem and leaf plots.

Item Position	Rationales	
5	Option D is correct	To determine the fraction that is greater than the value represented by the model, the student should have identified that the model shows 3 shaded squares out of a total of 15 squares, which is represented by the fraction $\frac{3}{15}$. The student then could have reduced (put in simplest form) the fraction $\frac{3}{15}$ by dividing the numerator and denominator by 3, resulting in $\frac{1}{5}$. Then the student could have compared the fractions $\frac{1}{5}$ and $\frac{2}{5}$. Since the fractions have a common denominator (bottom number of a fraction), the student could have compared the numerators (top numbers). Since $2 > 1$, $\frac{2}{5} > \frac{1}{5}$. 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 "greater than" with "equal to" and chose the value represented by the model, $\frac{1}{5}$. The student needs to focus on attending to the meaning of words used when comparing fractions with different numerators and denominators.
	Option B is incorrect	The student likely compared the fractions $\frac{3}{15}$ and $\frac{3}{16}$ and thought that the fraction with the greater denominator was the greater fraction. The student needs to focus on understanding how to compare fractions with different denominators when the numerator is the same.
	Option C is incorrect	The student likely reversed the comparison of the two values and chose a fraction less than, rather than greater than, $\frac{3}{15}$. The student needs to focus on attending to the meaning of words used when comparing fractions with different numerators and denominators.

Item Position	Rationales	
6	Acute, Obtuse, Right, Acute	To determine the type of triangle described by each set of angles, the student should have first understood that if a triangle has one angle measure greater than 90°, then it must be classified as an obtuse triangle. Therefore, triangle <i>X</i> is an obtuse triangle. Next, the student should have understood that if a triangle has one angle measure equal to 90°, then it must be classified as a right triangle. Therefore, triangle <i>Y</i> is a right triangle. Last, the student should have understood that if all three angle measures in a triangle are less than 90°, then the triangle must be classified as an acute triangle. Therefore, triangle <i>W</i> and triangle <i>Z</i> are acute triangles. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
7	Option C is correct	To determine which fraction represents the weight of the bag of onions, the student could have determined that the given weight in ounces, 20.04, is equal to $20 + 0.04$. The student could have then determined that the decimal 0.04 (4 hundredths) is equal to $\frac{4}{100}$. Finally, the student could have added $20 + \frac{4}{100}$ to determine that $20\frac{4}{100}$ is equivalent to 20.04. 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 ignored the zero in the ones place and determined that the whole number was 2 instead of 20. The student needs to focus on understanding the value of each digit in a decimal.
	Option B is incorrect	The student likely concluded that the decimal part 0.04 represented 4 tenths rather than 4 hundredths. The student needs to focus on understanding the value of each digit in a decimal and how to convert decimals to fractions.
	Option D is incorrect	The student likely ignored the zero in the ones place and determined that the whole number was 2 instead of 20. The student also likely concluded that the decimal part 0.04 represents 4 tenths rather than 4 hundredths. The student needs to focus on understanding the value of each digit in a decimal and how to convert decimals to fractions.

Item Position	Rationales	
8	First option is correct	To determine which statements are true about the fractional amount of each pie that is left, the student could have used benchmark (commonly known) fractions to estimate the value of $\frac{5}{8}$ as a little more than $\frac{1}{2}$. The student then could have determined that since more than $\frac{1}{2}$ of the apple pie was eaten, there is less than $\frac{1}{2}$ of the apple pie left. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Fourth option is correct	To determine which statements are true about the fractional amount of each pie that is left, the student could have used benchmark (commonly known) fractions to determine the value of $\frac{3}{6}$ as $\frac{1}{2}$. The student then could have determined that since $\frac{1}{2}$ of the peach pie was eaten, there is exactly $\frac{1}{2}$ of the peach pie left. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Second option is incorrect	The student likely estimated $\frac{3}{6}$ as greater than $\frac{1}{2}$ rather than equal to $\frac{1}{2}$. The student needs to focus on understanding how to relate a given fraction to benchmark fractions to find a reasonable sum or difference.
	Third option is incorrect	The student likely estimated $\frac{5}{8}$ to be equal to $\frac{1}{2}$ rather than greater than $\frac{1}{2}$. The student needs to focus on understanding how to relate a given fraction to benchmark fractions to find a reasonable sum or difference.
	Fifth option is incorrect	The student likely estimated $\frac{5}{8}$ as less than $\frac{1}{2}$ rather than greater than $\frac{1}{2}$. The student needs to focus on understanding how to relate a given fraction to benchmark fractions to find a reasonable sum or difference.

Item Position	Rationales	
9	Option C is correct	To determine the value of 754,123 when rounded to the nearest hundred thousand, the student should have identified the digit in the hundred-thousands place, 7. Then the student should have looked at the digit one place to the right, 5, and concluded that since 5 is greater than or equal to 5, the number 754,123 rounds up to 800,000.
	Option A is incorrect	The student likely confused the hundred-thousands place with the hundreds place and rounded 754,123 to the nearest hundred. The student needs to focus on understanding the value of each digit in a number.
	Option B is incorrect	The student likely confused the hundred-thousands place with the ten-thousands place and rounded 754,123 to the nearest ten thousand. The student needs to focus on understanding the value of each digit in a number.
	Option D is incorrect	The student likely identified the digit in the hundred-thousands place, 7, but rounded down to 700,000 instead of up to 800,000. The student needs to focus on understanding how to round numbers to a given place value.

Item Position	Rationales	
10	Second option is correct	To determine which strip diagram can be used to find b , the total number of baseballs the baseball team has, the student should have first recognized that the total number of baseballs, b , is represented by the entire length of the strip diagram. Next, the student should have recognized that the bar should have 5 sections of 12 to represent the 5 boxes of 12 baseballs and should have 1 section of 9 to represent the 9 baseballs in the bag.
	Third option is correct	To determine the equations that can be used to find b , the total number of baseballs the baseball team has, the student should have recognized that the number of baseballs in the boxes is represented by $5 \times 12 = 60$. Next, the student should have recognized that the number of baseballs in the boxes, 60, plus the number of baseballs in the bag, 9, equals the total number of baseballs, resulting in $60 + 9 = b$.
	First option is incorrect	The student likely concluded that the 9 baseballs in the bag should be added to the total, rather than to the number of baseballs in the boxes. The student needs to focus on attending to the details of a multistep problem and understanding how a strip diagram can be used to represent it.
	Fourth option is incorrect	The student likely added the number of baseballs in each box to the number of boxes, instead of multiplying, and then found the product of that sum (the result when two or more quantities are added together), 17, and the number of baseballs in the bag, 9. The student needs to focus on attending to the details of a multistep problem and understanding how equations can be used to represent it.
	Fifth option is incorrect	The student likely found the total number of baseballs in the boxes, 60, correctly but multiplied that number by 9 rather than increasing it by 9. The student needs to focus on attending to the details of a multistep problem and understanding how equations can be used to represent it.

Item Position	Rationales	
11	Option D is correct	To determine the difference between the shortest time and the longest time it took students to run the 100-meter race, the student should have first used the key to identify the greatest and least value from the stem and leaf plot (a display of data with each number split into a stem [the first digit or digits of the number, in this case the ones and tens places] and a leaf [the last digit of the number, in this case the tenths place]). The student should have recognized that the greatest value is represented by a stem of 17 and a leaf of 1, which is the value 17.1 seconds, and that the least value is represented by a stem of 14 and a leaf of 5, which is the value 14.5 seconds. The student then should have subtracted the values to determine the difference, resulting in $17.1 - 14.5 = 2.6$ seconds.
	Option A is incorrect	The student likely considered the least value in the stem and leaf plot to be 14.7 because it is the last value listed in the top row, and the student likely then found that $17.1 - 14.7 = 2.4$. The student needs to focus on understanding how to read data represented in a stem and leaf plot.
	Option B is incorrect	The student likely ignored the decimal point and interpreted the values in the stem and leaf plot as representing the hundreds, tens, and ones places. The student also likely determined that the greatest value was 170 rather than 171, and the least value was 147 rather than 145, resulting in $170 - 147 = 23.0$ seconds. The student needs to focus on understanding how to read data represented in a stem and leaf plot.
	Option C is incorrect	The student likely found the sum of, rather than the difference between, the least and greatest values, resulting in $17.1 + 14.5 = 31.6$ seconds. The student needs to focus on attending to the details to accurately solve the problem.

Item Position	Rationales	
12	Option B is correct	To determine the total number of fragile items that Weston moves, the student could have first determined that since Weston moved 18 boxes and split them into 3 equal groups, each group has 6 boxes ($18 \div 3 = 6$). The student then could have determined that there are 6 boxes, or 1 group of boxes, labeled "fragile." Since each box in the fragile group has 13 items, the student then could have determined that there are 78 fragile items ($6 \times 13 = 78$). 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 determined the number of items that are not fragile ($6 \times 13 \times 2 = 156$). The student needs to focus on attending to the details of the question being asked.
	Option C is incorrect	The student likely multiplied 18 by 3 instead of dividing, resulting in 54, and then multiplied 54×13 , resulting in 702 items. The student needs to focus on understanding the mathematical operations (+, −, ×, ÷) needed to represent the solution to a real-world problem.
	Option D is incorrect	The student likely determined the total number of items ($6 \times 13 \times 3 = 234$). The student needs to focus on attending to the details of the question being asked.

Item Position	Rationales	
13	Option C is correct	To determine which decimal has a value greater than the model shown, the student should have first determined that the model shows 89 shaded squares out of 100 and therefore represents 0.89 (eighty-nine hundredths). The student then could have determined that 0.91 is greater than 0.89 by comparing the values in the tenths place: $9 > 8$. 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 value equal to the value represented by the model. The student needs to focus on attending to the meaning of words used when comparing decimals to the hundredths using concrete and visual models.
	Option B is incorrect	The student likely confused "greater than" and "less than." The student needs to focus on attending to the meaning of words used when comparing decimals to the hundredths using concrete and visual models.
	Option D is incorrect	The student likely identified the value represented by the unshaded portion of the model. The student needs to focus on understanding how to read a model representing a decimal.

Item Position	Rationales	
14	rectangle, kite, trapezoid, pentagon	To determine where each figure should be placed in the table, the student should have first determined that the two figures that contain at least one pair of perpendicular sides (sides that intersect at a 90° angle) are the rectangle and the kite (the first option). Since the rectangle also has at least one pair of parallel sides (sides that are always the same distance apart and will never intersect, no matter how far they are extended), the student should have determined that the rectangle belongs in the top left box. Since the kite has no pairs of parallel sides, the student should have determined that the kite belongs in the top right box. Next, the student should have determined that the trapezoid and the pentagon have no pairs of perpendicular sides. Since the trapezoid has at least one pair of parallel sides, the student should have determined that the trapezoid belongs in the bottom left box. Since the pentagon has no pairs of parallel sides, the student should have determined that the pentagon belongs in the bottom right box.

Item Position	Rationales	
15	Option D is correct	To determine which expression can be used to find the fraction of animals in the store that are dogs or cats, the student should have first determined the total number of animals at the pet store. Since there are 2 dogs, 3 cats, and 9 fish, the student should have added $2 + 3 + 9$, resulting in a total of 14 animals. The student then should have determined that the fraction of animals at the pet store that are dogs is $\frac{2}{14}$ and the fraction of animals at the pet store that are cats is $\frac{3}{14}$. Finally, the student should have added the two fractions to find the fraction of animals in the store that are dogs or cats, resulting in $\frac{2}{14} + \frac{3}{14}$.
	Option A is incorrect	In each fraction, the student likely used the number of dogs or the number of cats as both the numerator and the denominator. The student needs to focus on understanding how to determine denominators in problems involving fractions.
	Option B is incorrect	The student likely used the total number of dogs and cats, instead of the total number of animals, as the denominator. The student needs to focus on understanding how to determine denominators in problems involving fractions.
	Option C is incorrect	The student likely used the number of fish, instead of the total number of animals, as the denominator. The student needs to focus on understanding how to determine denominators in problems involving fractions.

Item Position	Rationales	
16	65°, 145°, 80° OR 65°, 100°, 35°	To determine the measure (amount of turn between two rays around their common point) of angle L, the student should have found the two measures from the same scale (one sequence of measurement values on the protractor) through which the angle's two rays (shown by arrows; a part of a line with only one endpoint) pass. The student then could have subtracted the smaller measure from the larger measure. On the outside scale, the right ray passes through 145°, and the left ray passes through 80°, so the measure of the angle is 65° ($145^\circ - 80^\circ$). On the inside scale, the left ray passes through 100°, and the right ray passes through 35°, so the measure of the angle is 65° ($100^\circ - 35^\circ$). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
17	Option C is correct	To determine the missing data point in the stem and leaf plot (a display of data with each number split into a stem [the first digit or digits of the number, in this case the hundreds and tens places] and a leaf [the last digit of the number, in this case the ones place]), the student could have written the data in order from least to greatest and systematically checked each data point against the stem and leaf plot. The student should have identified that 119 is missing. 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 determined that every stem in the plot must have a leaf of 1. The student needs to focus on representing data in stem and leaf plots.
	Option B is incorrect	The student likely determined that every stem in the plot must have a corresponding leaf. The student needs to focus on representing data in stem and leaf plots.
	Option D is incorrect	The student likely determined that the stem with the greatest number of leaves was missing a data point. The student needs to focus on representing data in stem and leaf plots.

Item Position	Rationales	
18	Option B is correct	To determine which table represents the relationship between the position of a number and the value of a number in the pattern, the student should have first determined that each number in the pattern is equal to its position multiplied by 4. The student should have determined that the table that shows the values for positions 7, 9, and 12 correctly shows those numbers multiplied by 4 to obtain 28, 36, and 48 respectively. 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 reversed the position and the value of the numbers. The student needs to focus on understanding the relationship between the position of a number in a pattern and its value.
	Option C is incorrect	The student likely chose a table that continued the pattern in the value column but did not contain the correct corresponding positions or expressions. The student needs to focus on representing a relationship using an input-output table.
	Option D is incorrect	The student likely chose a table that shows an additive relationship of $+ 4$, rather than a multiplicative relationship of $\times 4$, between the position column and value column. The student needs to focus on representing a relationship using an input-output table.

Item Position	Rationales	
19	21, 5	To determine the decimal that has the same value as $\frac{215}{10}$, the student could have rewritten the fraction as $\frac{210}{10} + \frac{5}{10}$. The student then could have reduced (put in simplest form) the fraction $\frac{210}{10}$ as 21 and represented the fraction $\frac{5}{10}$ as the decimal 0.5 (five tenths) and added the two values, resulting in $21 + 0.5 = 21.5$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
20	Option A is correct	To determine which figure appears to have exactly 4 lines of symmetry (an imaginary line that divides a figure into halves that are reflections of each other), the student could have visualized the different ways to draw a line through each figure to create two shapes that are mirror images of each other. The student should have determined that the figure has 4 lines of symmetry, which pass through the center of the figure vertically, horizontally, diagonally from top left to bottom right, and diagonally from top right to bottom left.
	Option B is incorrect	The student likely determined that a figure with 4 acute angles would have exactly 4 lines of symmetry. The student needs to focus on identifying lines of symmetry, if they exist, for all two-dimensional figures.
	Option C is incorrect	The student likely determined that a figure with four sides has exactly 4 lines of symmetry. The student needs to focus on identifying lines of symmetry, if they exist, for all two-dimensional figures.
	Option D is incorrect	The student likely considered only the lines of symmetry that pass through the figure's vertices, ignoring the 4 additional lines of symmetry that pass through the middle of the opposite sides. The student needs to focus on identifying lines of symmetry, if they exist, for all two-dimensional figures.

Item Position	Rationales	
21	Option B is correct	To determine which equation the model represents, the student could have interpreted each shape in the area model (model representing the amount of space covered) to represent a multiplication problem, leading to a total number of square units. The area of the large square is 100 square units because the area is found by multiplying the side lengths (10×10). The area of each bar is 10 square units because the area is found by multiplying the side lengths (10×1). The area of each small square is 1 square unit because the area is found by multiplying the side lengths (1×1). The student could have determined that the area model contains 1 large square that represents 100 square units, 7 horizontal bars that together represent 70 square units, 3 vertical bars that together represent 30 square units, and 21 small squares that together represent 21 square units. The student then could have determined that the total area is $100 + 70 + 30 + 21 = 221$ square units. Since the length of the area model is 17 units and the width of the area model is 13 units, the student could have determined that the model represents the equation $13 \times 17 = 221$. 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 placed the numbers that compose the length and the width ($10 + 3$ and $10 + 7$) next to each other rather than adding them together, resulting in $103 \times 107 = 11,021$. The student needs to focus on understanding how an area model represents the result of a multiplication problem.
	Option C is incorrect	The student likely determined that 10 is used as a place value only once, resulting in $(10 + 3) \times (7) = 13 \times 7 = 91$. The student needs to focus on understanding how an area model represents the result of a multiplication problem.
	Option D is incorrect	The student likely multiplied 3 by 10 and 7 by 10 instead of adding. The student needs to focus on understanding how an area model represents the result of a multiplication problem.

Item Position	Rationales	
22	$\frac{2}{3}$ or $\frac{4}{6}$, $\frac{5}{9}$	To determine a true comparison of two of the fractions, the student could have first determined that the fractions $\frac{2}{3}$ and $\frac{4}{6}$ are equivalent because $\frac{2 \times 2}{3 \times 2} = \frac{4}{6}$. Then the student could have compared the fractions $\frac{2}{3}$ and $\frac{5}{9}$ by finding a common denominator (a multiple of both bottom numbers). The student could have multiplied the fraction $\frac{2}{3}$ by $\frac{3}{3}$ to obtain $\frac{2 \times 3}{3 \times 3} = \frac{6}{9}$, which shares a denominator with $\frac{5}{9}$. Finally, the student could have compared the numerators (top numbers) of the fractions. Since 6 is greater than 5, $\frac{6}{9} > \frac{5}{9}$, and therefore $\frac{2}{3} > \frac{5}{9}$ and $\frac{4}{6} > \frac{5}{9}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
23	Option A is correct	To determine which set of equations (mathematical statements that demonstrate that two numbers, expressions, or other objects are equal) can be used to find how many states, s , Sam has visited, the student should have determined that since Sam sends 3 postcards to his grandparents and keeps the remaining 11 postcards, those values could be added to determine that Sam had a total of $3 + 11 = 14$ postcards. The student then should have determined that since Sam buys 2 postcards in each state, the number of postcards must be divided by 2 to determine how many states Sam has visited.
	Option B is incorrect	The student likely subtracted the number of postcards Sam sends to his grandparents from the number of postcards he keeps for himself, rather than adding. The student needs to focus on attending to the details of a multistep problem and understanding how equations can be used to represent it.
	Option C is incorrect	The student likely multiplied the total number of postcards by 2 rather than dividing. The student needs to focus on attending to the details of a multistep problem and understanding how equations can be used to represent it.
	Option D is incorrect	The student likely subtracted the number of postcards Sam sends to his grandparents from the number of postcards he keeps for himself, rather than adding, and then multiplied the result by 2 instead of dividing. The student needs to focus on attending to the details of a multistep problem and understanding how equations can be used to represent it.

Item Position	Rationales	
24	point Z	To determine the point that the second ray (shown by an arrow; a part of a line with only one endpoint) of the angle should pass through to create a 150° angle measure (amount of turn between two rays around their common point), the student could have determined that the first ray passes through 10° on the outer scale. The student then could have determined that the second ray should pass through a measure 150° away from 10°, resulting in $10^\circ + 150^\circ = 160^\circ$. Finally, the student should have identified that point Z is located at 160°. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
25	Option B is correct	To determine the total length of the three pieces of wood Harrison measures, the student could have added the lengths of the two pieces that are each 4.25 feet long to the length of the piece that is 6.8 feet long, making sure to line up the place value of each digit in the three numbers, resulting in $4.25 + 4.25 + 6.8 = 15.3$ ft. 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 total length of the two pieces of wood that are each 4.25 feet long ($4.25 + 4.25 = 8.5$). The student needs to focus on attending to the details of the question.
	Option C is incorrect	The student likely added $4.25 + 4.25$, resulting in 8.5. The student then likely added the tenths place digits, $5 + 8 = 13$, in the sum $8.5 + 6.8$ without regrouping the 1 to the sum of the ones place digits, resulting in 14.3. The student needs to focus on understanding how to accurately solve problems that involve whole numbers and decimals.
	Option D is incorrect	The student likely added 4.25 one time instead of twice ($4.25 + 6.8 = 11.05$). The student needs to focus on attending to the details of the question.

Item Position	Rationales	
26	Option B is correct	To determine the number of milliliters of vinegar in the larger container, the student could have first determined that each horizontal line on the beaker represents 25 mL because the measurement 100 mL is divided into 4 equal parts ($100 \div 4 = 25$). The student then could have determined that the amount of vinegar in the beaker is 75 mL, because the shading on the beaker represents 3 groups of 25, or $25 + 25 + 25 = 75$. The student then could have multiplied that amount by the number of students in the science class, resulting in $75 \times 8 = 600$ mL. 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 determined that there were 3 milliliters of vinegar in the beaker because the liquid reaches the third line from the bottom of the beaker. The student then likely multiplied 3 by 8, resulting in 24 mL. The student needs to focus on accurately reading measurements of liquid volumes.
	Option C is incorrect	The student likely determined that there are 100 milliliters of vinegar in the beaker because that is the greatest labeled value. The student then likely multiplied 100 by 8, resulting in 800 mL. The student needs to focus on accurately reading measurements of liquid volumes.
	Option D is incorrect	The student likely determined the number of milliliters of vinegar in one beaker rather than in the larger container. The student needs to focus on attending to the details to accurately solve the problem.

Item Position	Rationales	
27	Option D is correct	To determine which table shows the rule (relationship) $- 5$ when given the position (input value) and the value (output value), the student should have subtracted 5 from each input value and identified the table that correctly lists the paired output values ($5 - 5 = 0$; $10 - 5 = 5$; $15 - 5 = 10$; $20 - 5 = 15$).
	Option A is incorrect	The student likely determined that the value for every position must be 5. The student needs to focus on understanding the relationship between the position of a number in a pattern and its value.
	Option B is incorrect	The student likely determined that the position for every value must be 5. The student needs to focus on understanding the relationship between the position of a number in a pattern and its value.
	Option C is incorrect	The student likely determined that the expression must always be $5 - 0$ and the value must always be 5. The student needs to focus on understanding the relationship between the position of a number in a pattern and its value.

Item Position	Rationales	
28	r, s, p, s or r, s, p, r	To determine which pair of lines appear to be parallel, the student should have recalled the definition of parallel. Parallel lines are always the same distance apart and will never intersect, no matter how far they are extended. Line r and line s appear to be parallel. To determine which pair of lines appear to be perpendicular, the student should have recalled the definition of perpendicular. Perpendicular lines intersect at a 90° angle. Line p and line s appear to be perpendicular, and line p and line r appear to be perpendicular.

Item Position	Rationales	
29	Option B is correct	To determine how many pencils Sophia put into the box, the student could have divided the total number of pencils, 167, by the number of groups, 7: $167 \div 7 = 23$ pencils with 6 pencils remaining. The student then should have interpreted the remainder as the number of colored pencils Sophia put into the box. 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 subtracted the number of groups from the total number of pencils. The student needs to focus on attending to the details of the question being asked in a one-step problem.
	Option C is incorrect	The student likely identified the number of groups of 7 pencils that can be created from 167 pencils. The student needs to focus on attending to the details of the question being asked in a one-step problem.
	Option D is incorrect	The student likely identified the number of pencils in one group. The student needs to focus on attending to the details of the question being asked in a one-step problem.

Item Position	Rationales	
30	Option B is correct	To determine which rectangle has the same area (amount of space covered by a two-dimensional figure) as a room with a perimeter (distance around the outside of a figure) of 32 feet and a width of 6 feet, the student could find the area of the rectangular room by first finding the length of the rectangle. The student could have used the formula for the perimeter (distance around the outside of a figure) of a rectangle ($P = l + w + l + w$, where P = perimeter, l = length, and w = width) to determine the width. Because the width of the rectangle is 6 feet and the perimeter is 32 feet, the student could have found the sum (total) of the two widths, 12 ($6 + 6 = 12$), and subtracted that from 32 to get 20 ($32 - 12 = 20$), which is equal to the sum of the two lengths. Then the student should have divided 20 by 2 to get 10, the length of the rectangle in feet. Next, the student should have used the formula for the area of a rectangle ($A = l \times w$, where A = area, l = length, and w = width). Since the length of the rectangle is 10 feet and the width is 6 feet, the student should have multiplied 10 by 6 to determine that the area is 60 square feet. The student then could have determined that the rectangle with a length of 12 feet and a width of 5 feet also has an area of $5 \times 12 = 60$ square feet. 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 identified a rectangle with the same perimeter ($P = 8 + 8 + 8 + 8 = 32$) as the room. The student needs to focus on attending to the details of the problem.
	Option C is incorrect	The student likely subtracted 12 from 32 but did not divide by 2 and determined that the width of the room was 20 feet. The student then likely determined that the area of the room was 120 square feet and chose a rectangle that also has an area of 120 square feet. The student needs to focus on understanding how to solve problems related to perimeter and area of rectangles.
	Option D is incorrect	The student likely determined that rectangles that share one dimension have the same area. The student needs to focus on understanding how to solve problems related to perimeter and area of rectangles.

Item Position	Rationales	
31	300, 400, 700 or other values that result in a sum of 700	To determine the equation to find the best estimate of the total number of oatmeal cookies and chocolate chip cookies the bakery sold last week, the student could have rounded the number of oatmeal cookies and the number of chocolate chip cookies to the nearest hundred and found the sum. The student could have used the digit in the tens place to determine whether the digit in the hundreds place should be rounded up or kept the same. The student should have determined that the 9 in the tens place of 298 causes the number to round to 300, and the 0 in the tens place of 406 causes the number to round to 400. The student then could have determined that $300 + 400 = 700$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item Position	Rationales	
32	Option A is correct	To determine the standard form of the number, the student could have evaluated each product in the expanded notation: $7 \times 1,000 = 7,000$; $2 \times 10 = 20$; $3 \times 0.1 = 0.3$. The student then should have found the sum (total) of the values, resulting in $7,000 + 20 + 0.3 = 7,020.3$. 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 considered the digits to represent consecutive place values, starting with the tens place. The student needs to focus on understanding the place values of digits in a number.
	Option C is incorrect	The student likely considered the digits to represent consecutive place values, starting with the hundreds place. The student needs to focus on understanding the place values of digits in a number.
	Option D is incorrect	The student likely determined that 3 belonged in the ones place rather than the tenths place. The student needs to focus on understanding the place values of digits in a number.