Assignment 1 Solutions

1

Choice C is correct. Subtracting 6 from each side of $5x + 6 = 10$ yields $5x = 4$. Dividing both sides of $5x = 4$ by 5 yields $x \; \frac{4}{5}$. The value of x can now be substituted into the expression $10x + 3$, giving $10\left(\frac{4}{5}\right) + 3 = 11$. Alternatively, the expression $10x + 3$ can be rewritten as $2(5x + 6) - 9$, and 10 can be substituted for $5x + 6$, giving $2(10) - 9 = 11$.

Choices A, B, and D are incorrect. Each of these choices leads to $5x + 6 \neq 10$, contradicting the given equation, $5x + 6 = 10$. For example, choice A is incorrect because if the value of $10x + 3$ were 4, then it would follow that $x = 0.1$, and the value of $5x + 6$ would be 6.5, not 10.

2

Choice A is correct. The expression $|x - 1| - 1$ will equal 0 if $|x - 1| = 1$. This is true for $x = 2$ and for $x = 0$. For example, substituting $x = 2$ into the expression $|x - 1| - 1$ and simplifying the result yields $|2 - 1| - 1 = |1| - 1 = 1 - 1 = 0$. Therefore, there is a value of x for which $|x - 1| - 1$ is equal to 0.

Choices B, C, and D are incorrect. By definition, the absolute value of any expression is a nonnegative number. For example, in answer choice B, substituting any value for x into the expression $|x + 1|$ will yield a nonnegative number. Because the sum of a nonnegative number and a positive number is positive, $|x + 1| + 1$ will be a positive number for any value of x. Therefore, $|x + 1| + 1 \neq 0$ for any value of x. Similarly, the expressions given in answer choices C and D are not equivalent to zero for any value of x.

3

Choice A is correct. The price of the job, in dollars, is calculated using the expression $60 + 12nh$, where 60 is a fixed price and $12nh$ depends on the number of landscapers, n, working the job and the number of hours, h, the job takes those n landscapers. Since nh is the total number of hours of work done when n landscapers work h hours, the cost of the job increases by \$12 for each hour each landscaper works. Therefore, of the choices given, the best interpretation of the number 12 is that the company charges \$12 per hour for each landscaper.

Choice B is incorrect because the number of landscapers that will work each job is represented by n in the equation, not by the number 12. Choice C is incorrect because the price of the job increases by $12n$ dollars each hour, which will not equal 12 dollars unless $n = 1$. Choice D is incorrect because the total number of hours each landscaper works is equal to h. The number of hours each landscaper works in a day is not provided.

4

Choice B is correct. Multiplying each side of $x + y = 0$ by 2 gives $2x + 2y = 0$. Then, adding the corresponding sides of $2x + 2y = 0$ and $3x - 2y = 10$ gives $5x = 10$. Dividing each side of $5x = 10$ by 5 gives $x = 2$. Finally, substituting 2 for x in $x + y = 0$ gives $2 + y = 0$, or $y = -2$. Therefore, the solution to the given system of equations is $(2, -2)$.

Alternatively, the equation $x + y = 0$ can be rewritten as $x = -y$, and substituting x for $-y$ in $3x - 2y = 10$ gives $5x = 10$, or $x = 2$. The value of y can then be found in the same way as before.

Choices A, C, and D are incorrect because when the given values of x and y are substituted into $x + y = 0$ and $3x - 2y = 10$, either one or both of the equations are not true. These answers may result from sign errors or other computational errors.

5

Choice A is correct. The first equation can be rewritten as $x = 6y$. Substituting $6y$ for x in the second equation gives $4(y + 1) = 6y$. The left-hand side can be rewritten as $4y + 4$, giving $4y + 4 = 6y$. Subtracting $4y$ from both sides of the equation gives $4 = 2y$, or $y = 2$.

Choices B, C, and D are incorrect and may be the result of a computational or conceptual error when solving the system of equations.

6

Choice D is correct. Since lines ℓ and k are parallel, the lines have the same slope. The slope m of a line that passes through two points (x_1, y_1) and (x_2, y_2) can be found as $m = \frac{y_2 - y_1}{x_2 - x_1}$. Line ℓ passes through the points $(0, 2)$ and $(-5, 0)$, so its slope is $\frac{0 - 2}{-5 - 0}$, which is $\frac{2}{5}$. The slope of line k must also be $\frac{2}{5}$. Since line k has slope $\frac{2}{5}$ and passes through the points $(p, 0)$ and $(0, -4)$, it follows that $\frac{-4 - 0}{0 - p} = \frac{2}{5}$, or $\frac{4}{p} = \frac{2}{5}$. Multiplying each side of $\frac{4}{p} = \frac{2}{5}$ by $5p$ gives $20 = 2p$, and therefore, $p = 10$.

Choices A, B, and C are incorrect and may result from conceptual or calculation errors.

7

Choice C is correct. Multiplying each side of the equation $2x - 3y = -14$ by 3 gives $6x - 9y = -42$. Multiplying each side of the equation $3x - 2y = -6$ by 2 gives $6x - 4y = -12$. Then, subtracting the sides of $6x - 4y = -12$ from the corresponding sides of $6x - 9y = -42$ gives $-5y = -30$. Dividing each side of the equation $-5y = -30$ by -5 gives $y = 6$. Finally, substituting 6 for y in $2x - 3y = -14$ gives $2x - 3(6) = -14$, or $x = 2$. Therefore, the value of $x - y$ is $2 - 6 = -4$.

Alternatively, adding the corresponding sides of $2x - 3y = -14$ and $3x - 2y = -6$ gives $5x - 5y = -20$, from which it follows that $x - y = -4$.

Choices A and B are incorrect and may be the result of an arithmetic error when solving the system of equations. Choice D is incorrect and may be the result of finding $x + y$ instead of $x - y$.

8

Choice C is correct. The relationship between n and A is given by the equation $nA = 360$. Since n is the number of sides of a polygon, n must be a positive integer, and so $nA = 360$ can be rewritten as $A = \frac{360}{n}$. If the value of A is greater than 50, it follows that $\frac{360}{n} > 50$ is a true statement. Thus, $50n < 360$, or $n < \frac{360}{50}$ 7.2. Since n must be an integer, the greatest possible value of n is 7.

Choices A and B are incorrect. These are possible values for n, the number of sides of a regular polygon, if $A > 50$, but neither is the greatest possible value of n. Choice D is incorrect. If $A < 50$, then $n = 8$ is the least possible value of n, the number of sides of a regular polygon. However, the question asks for the greatest possible value of n if $A > 50$, which is $n = 7$.

9

Choice B is correct. Since the slope of the first line is 2, an equation of this line can be written in the form $y = 2x + c$, where c is the y-intercept of the line. Since the line contains the point (1, 8), one can substitute 1 for x and 8 for y in $y = 2x + c$, which gives $8 = 2(1) + c$, or $c = 6$. Thus, an equation of the first line is $y = 2x + 6$. The slope of the second line is equal to $\frac{1-2}{2-1}$ or -1. Thus, an equation of the second line can be written in the form $y = -x + d$, where d is the y-intercept of the line. Substituting 2 for x and 1 for y gives $1 = -2 + d$, or $d = 3$. Thus, an equation of the second line is $y = -x + 3$.

Since a is the x-coordinate and b is the y-coordinate of the intersection point of the two lines, one can substitute a for x and b for y in the two equations, giving the system $b = 2a + 6$ and $b = -a + 3$. Thus, a can be found by solving the equation $2a + 6 = -a + 3$, which gives $a = -1$. Finally, substituting -1 for a into the equation $b = -a + 3$ gives $b = -(-1) + 3$, or $b = 4$. Therefore, the value of $a + b$ is 3.

Alternatively, since the second line passes through the points (1, 2) and (2, 1), an equation for the second line is $x + y = 3$. Thus, the intersection point of the first line and the second line, (a, b) lies on the line with equation $x + y = 3$. It follows that $a + b = 3$.

Choices A and C are incorrect and may result from finding the value of only a or b, but not calculating the value of $a + b$. Choice D is incorrect and may result from a computation error in finding equations of the two lines or in solving the resulting system of equations.

10

Choice A is correct. For an equation of a line in the form $y = mx + b$, the constant m is the slope of the line. Thus, the line represented by $y = -3x + 4$ has slope -3. Lines that are parallel have the same slope. To determine which of the given equations represents a line with the same slope as the line represented by $y = -3x + 4$, one can rewrite each equation in the form $y = mx + b$, that is, solve each equation for y. Choice A, $6x + 2y = 15$, can be rewritten as $2y = -6x + 15$ by subtracting $6x$ from each side of the equation. Then, dividing each side of $2y = -6x + 15$ by 2 gives $y = -\frac{6}{2}x + \frac{15}{2}$, which simplifies to $y \quad -3\ x + \frac{15}{2}$. Therefore, this line has slope -3 and is parallel to the line represented by $y = -3x + 4$. (The lines are parallel, not coincident, because they have different y-intercepts.)

Choices B, C, and D are incorrect and may be the result of common misunderstandings about which value in the equation of a line represents the slope of the line.

11

Choice D is correct. In Amelia's training schedule, her longest run in week 16 will be 26 miles and her longest run in week 4 will be 8 miles. Thus, Amelia increases the distance of her longest run by 18 miles over the course of 12 weeks. Since Amelia increases the distance of her longest run each week by a constant amount, her rate of increase is $\frac{26 - 8}{16 - 4} = \frac{18}{12}$ miles per week, which is equal to 1.5 miles per week. So each week she increases the distance of her longest run by 1.5 miles.

Choices A, B, and C are incorrect because none of these training schedules would result in increasing Amelia's longest run from 8 miles in week 4 to 26 miles in week 16. For example, choice A is incorrect because if Amelia increases the distance of her longest run by 0.5 miles each week and has her longest run of 8 miles in week 4, her longest run in week 16 would be $8 + 0.5 \cdot 12 = 14$ miles, not 26 miles.

12

Choice C is correct. Since the price of Ken's sandwich was x dollars, and Paul's sandwich was \$1 more, the price of Paul's sandwich was $x + 1$ dollars. Thus, the total cost of the sandwiches was $2x + 1$ dollars. Since this cost was split evenly between two people, Ken and Paul each paid $\frac{2x + 1}{2} = x + 0.5$ dollars plus a 20% tip. After adding the 20% tip, each of them paid $(x + 0.5) + 0.2(x + 0.5) = 1.2(x + 0.5)$ $1.2x + 0.6$ dollars.

Choices A, B, and D are incorrect. These expressions do not model the given context. They may be the result of errors in setting up the expression or of calculation errors.

13

Choice A is correct. If a system of two linear equations has no solution, then the lines represented by the equations in the coordinate plane are parallel. The equation $kx - 3y = 4$ can be rewritten as $y = \frac{k}{3}x - \frac{4}{3}$, where $\frac{k}{3}$ is the slope of the line, and the equation $4x - 5y = 7$ can be rewritten as $y = \frac{4}{5}x - \frac{7}{5}$, where $\frac{4}{5}$ is the slope of the line. If two lines are parallel, then the slopes of the line are equal. Therefore, $\frac{4}{5} = \frac{k}{3}$, or $k = \frac{12}{5}$. (Since the y-intercepts of the lines represented by the equations are $-\frac{4}{3}$ and $-\frac{7}{5}$, the lines are parallel, not identical.)

Choices B, C, and D are incorrect and may be the result of a computational error when rewriting the equations or solving the equation representing the equality of the slopes for k.

14

Choice D is correct. If C is graphed against F, the slope of the line is equal to $\frac{5}{9}$ degrees Celsius/degrees Fahrenheit, which means that for an increase of 1 degree Fahrenheit, the increase is $\frac{5}{9}$ of 1 degree Celsius. Thus, statement I is true. This is the equivalent to saying that an increase of 1 degree Celsius is equal to an increase of $\frac{9}{5}$ degrees Fahrenheit.

Since $\frac{9}{5} = 1.8$, statement II is true. On the other hand, statement III is not true, since a temperature increase of $\frac{9}{5}$ degrees Fahrenheit, not $\frac{5}{9}$ degree Fahrenheit, is equal to a temperature increase of 1 degree Celsius.

Choices A, B, and C are incorrect because each of these choices omits a true statement or includes a false statement.

Section 4: Math Test – Calculator

1

Choice C is correct. Since the musician earns \$0.09 for each download, the musician earns $0.09d$ dollars when the song is downloaded d times. Similarly, since the musician earns \$0.002 each time the song is streamed, the musician earns $0.002s$ dollars when the song is streamed s times. Therefore, the musician earns a total of $0.09d + 0.002s$ dollars when the song is downloaded d times and streamed s times.

Choice A is incorrect because the earnings for each download and the earnings for time streamed are interchanged in the expression. Choices B and D are incorrect because in both answer choices, the musician will lose money when a song is either downloaded or streamed. However, the musician only earns money, not loses money, when the song is downloaded or streamed.

2

Choice C is correct. In the equation $y = 0.56x + 27.2$, the value of x increases by 1 for each year that passes. Each time x increases by 1, y increases by 0.56 since 0.56 is the slope of the graph of this equation. Since y represents the average number of students per classroom in the year represented by x, it follows that, according to the model, the estimated increase each year in the average number of students per classroom at Central High School is 0.56.

Choice A is incorrect because the total number of students in the school in 2000 is the product of the average number of students per classroom and the total number of classrooms, which would appropriately be approximated by the y-intercept (27.2) times the total number of classrooms, which is not given. Choice B is incorrect because the average number of students per classroom in 2000 is given by the y-intercept of the graph of the equation, but the question is asking for the meaning of the number 0.56, which is the slope. Choice D is incorrect because 0.56 represents the estimated yearly change in the average number of students per classroom. The estimated difference between the average number of students per classroom in 2010 and 2000 is 0.56 times the number of years that have passed between 2000 and 2010, that is, $0.56 \times 10 = 5.6$.

3

Choice A is correct. The value of m when ℓ is 73 can be found by substituting the 73 for ℓ in $\ell = 24 + 3.5m$ and then solving for m. The resulting equation is $73 = 24 + 3.5m$; subtracting 24 from each side gives $49 = 3.5m$. Then, dividing each side of $49 = 3.5m$ by 3.5 gives $14 = m$. Therefore, when ℓ is 73, m is 14.

Choice B is incorrect and may result from adding 24 to 73, instead of subtracting 24 from 73, when solving $73 = 24 + 3.5m$. Choice C is incorrect because 73 is the given value for ℓ, not for m. Choice D is incorrect and may result from substituting 73 for m, instead of for ℓ, in the equation $\ell = 24 + 3.5m$.

4

Choice D is correct. To solve the equation for w, multiply both sides of the equation by the reciprocal of $\frac{3}{5}$, which is $\frac{5}{3}$. This gives $\left(\frac{5}{3}\right) \cdot \frac{3}{5}w = \frac{4}{3} \cdot \left(\frac{5}{3}\right)$, which simplifies to $w = \frac{20}{9}$.

Choices A, B, and C are incorrect and may be the result of errors in arithmetic when simplifying the given equation.

5

Choice C is correct. The amount of money the performer earns is directly proportional to the number of people who attend the performance. Thus, by the definition of direct proportionality, $M = kP$, where M is the amount of money the performer earns, in dollars, P is the number of people who attend the performance, and k is a constant.

Since the performer earns \$120 when 8 people attend the performance, one can substitute 120 for M and 8 for P, giving $120 = 8k$. Hence, $k = 15$, and the relationship between the number of people who attend the performance and the amount of money, in dollars, the performer earns is $M = 15P$. Therefore, when 20 people attend the performance, the performer earns $15(20) = 300$ dollars.

Choices A, B, and D are incorrect and may result from either misconceptions about proportional relationships or computational errors.

6

Choice C is correct. If 43% of the money earned is used to pay for costs, then the rest, 57%, is profit. A performance where 8 people attend earns the performer \$120, and 57% of \$120 is \$120 × 0.57 = \$68.40.

Choice A is incorrect. The amount \$51.60 is 43% of the money earned from a performance where 8 people attend, which is the cost of putting on the performance, not the profit from the performance. Choice B is incorrect. It is given that 57% of the money earned is profit, but 57% of \$120 is not equal to \$57.00. Choice D is incorrect. The profit can be found by subtracting 43% of \$120 from \$120, but 43% of \$120 is \$51.60, not \$43.00. Thus, the profit is \$120 – \$51.60 = \$68.40, not \$120 – \$43.00 = \$77.00.

7

Choice B is correct. When 4 times the number x is added to 12, the result is $12 + 4x$. Since this result is equal to 8, the equation $12 + 4x = 8$ must be true. Subtracting 12 from each side of $12 + 4x = 8$ gives $4x = -4$, and then dividing both sides of $4x = -4$ by 4 gives $x = -1$. Therefore, 2 times x added to 7, or $7 + 2x$, is equal to $7 + 2(-1) = 5$.

Choice A is incorrect because -1 is the value of x, not the value of $7 + 2x$. Choices C and D are incorrect and may result from calculation errors.

8

Choice D is correct. Since a player starts with k points and loses 2 points each time a task is not completed, the player's score will be $k - 2n$ after n tasks are not completed (and no additional points are gained). Since a player who fails to complete 100 tasks has a score of 200 points, the equation $200 = k - 100(2)$ must be true. This equation can be solved by adding 200 to each side, giving $k = 400$.

Choices A, B, and C are incorrect and may result from errors in setting up or solving the equation relating the player's score to the number of tasks the player fails to complete. For example, choice A may result from subtracting 200 from the left-hand side of $200 = k - 100(2)$ and adding 200 to the right-hand side.

9

Choice A is correct. Since x is the number of 40-pound boxes, $40x$ is the total weight, in pounds, of the 40-pound boxes; and since y is the number of 65-pound boxes, $65y$ is the total weight, in pounds, of the 65-pound boxes. The combined weight of the boxes is therefore $40x + 65y$, and the total number of boxes is $x + y$. Since the forklift can carry up to 45 boxes or up to 2,400 pounds, the inequalities that represent these relationships are $40x + 65y \leq 2{,}400$ and $x + y \leq 45$.

Choice B is incorrect. The second inequality correctly represents the maximum number of boxes on the forklift, but the first inequality divides, rather than multiplies, the number of boxes by their respective weights. Choice C is incorrect. The combined weight of the boxes, $40x + 65y$, must be less than or equal to 2,400 pounds, not 45; the total number of boxes, $x + y$, must be less than or equal to 45, not 2,400. Choice D is incorrect. The second inequality correctly represents the maximum weight, in pounds, of the boxes on the forklift, but the total number of boxes, $x + y$, must be less than or equal to 45, not 2,400.

10

Choice B is correct. Let m be the number of movies Jill rented online during the month. Since the monthly membership fee is \$9.80 and there is an additional fee of \$1.50 to rent each movie online, the total of the membership fee and the movie rental fees, in dollars, can be written as $9.80 + 1.50m$. Since the total of these fees for the month was \$12.80, the equation $9.80 + 1.50m = 12.80$ must be true. Subtracting 9.80 from each side and then dividing each side by 1.50 yields $m = 2$.

Choices A, C, and D are incorrect and may be the result of errors in setting up or solving the equation that represents the context.

11

Choice C is correct. Donald believes he can increase his typing speed by 5 words per minute each month. Therefore, in m months, he believes he can increase his typing speed by $5m$ words per minute. Because he is currently able to type at a speed of 180 words per minute, he believes that in m months, he will be able to increase his typing speed to $180 + 5m$ words per minute.

Choice A is incorrect because the expression indicates that Donald currently types 5 words per minute and will increase his typing speed by 180 words per minute each month. Choice B is incorrect because the expression indicates that Donald currently types 225 words per minute, not 180 words per minute. Choice D is incorrect because the expression indicates that Donald will decrease, not increase, his typing speed by 5 words per minute each month.

12

Choice D is correct. Since there were 175,000 tons of trash in the landfill on January 1, 2000, and the amount of trash in the landfill increased by 7,500 tons each year after that date, the amount of trash, in tons, in the landfill y years after January 1, 2000, can be expressed as $175{,}000 + 7{,}500y$. The landfill has a capacity of 325,000 tons. Therefore, the set of years where the amount of trash in the landfill is at (equal to) or above (greater than) capacity is described by the inequality $175{,}000 + 7{,}500y \geq 325{,}000$.

Choice A is incorrect. This inequality does not account for the 175,000 tons of trash in the landfill on January 1, 2000, nor does it accurately account for the 7,500 tons of trash that are added to the landfill each year after January 1, 2000. Choice B is incorrect. This inequality does not account for the 175,000 tons of trash in the landfill on January 1, 2000. Choice C is incorrect. This inequality represents the set of years where the amount of trash in the landfill is at or below capacity.

13

Choice B is correct. The density of an object is equal to the mass of the object divided by the volume of the object, which can be expressed as density $= \frac{\text{mass}}{\text{volume}}$. Thus, if an object has a density of 3 grams per milliliter and a mass of 24 grams, the equation becomes 3 grams/milliliter $= \frac{\text{24 grams}}{\text{volume}}$. This can be rewritten as volume $= \frac{\text{24 grams}}{\text{3 grams/milliliter}} = 8$ milliliters.

Choice A is incorrect and be may be the result of confusing the density and the volume and setting up the density equation as $24 = \frac{3}{\text{volume}}$. Choice C is incorrect and may be the result of a conceptual error that leads to subtracting 3 from 24. Choice D is incorrect and may be the result of confusing the mass and the volume and setting up the density equation as $24 = \frac{\text{volume}}{3}$.

14

Choice A is correct. Let a be the number of hours Angelica worked last week. Since Raul worked 11 more hours than Angelica, Raul worked $a + 11$ hours last week. Since they worked a combined total of 59 hours, the equation $a + (a + 11) = 59$ can represent this situation This equation can be simplified to $2a + 11 = 59$, or $2a = 48$. Therefore, $a = 24$, and Angelica worked 24 hours last week.

Choice B is incorrect because it is the number of hours Raul worked last week. Choice C is incorrect. If Angelica worked 40 hours and Raul worked 11 hours more, Raul would have worked 51 hours, and the combined total number of hours they worked would be 91, not 59. Choice D is incorrect and may be the result of solving the equation $a + 11 = 59$ rather than $a + (a + 11) = 59$.

15

Choice D is correct. The quadrants of the xy-plane are defined as follows: Quadrant I is above the x-axis and to the right of the y-axis; Quadrant II is above the x-axis and to the left of the y-axis; Quadrant III is below the x-axis and to the left of the y-axis; and Quadrant IV is below the x-axis and to the right of the y-axis. It is possible for line ℓ to pass through Quadrants II, III, and IV, but not Quadrant I, only if line ℓ has negative x- and y-intercepts. This implies that line ℓ has a negative slope, since between the negative x-intercept and the negative y-intercept the value of x increases (from negative to zero) and the value of y decreases (from zero to negative); so the quotient of the change in y over the change in x, that is, the slope of line ℓ, must be negative.

Choice A is incorrect because a line with an undefined slope is a vertical line, and if a vertical line passes through Quadrant IV, it must pass through Quadrant I as well. Choice B is incorrect because a line with a slope of zero is a horizontal line and, if a horizontal line passes through Quadrant II, it must pass through Quadrant I as well. Choice C is incorrect because if a line with a positive slope passes through Quadrant IV, it must pass through Quadrant I as well.

16

Choice A is correct. The total cost y, in dollars, of buying the materials and renting the tools for x days from Store A and Store B is found by substituting the respective values for these stores from the table into the given equation, $y \quad M + (W + K)x$, as shown below.

$$\text{Store A: } y = 750 + (15 + 65)x = 750 + 80x$$

$$\text{Store B: } y = 600 + (25 + 80)x = 600 + 105x$$

Thus, the number of days, x, for which the total cost of buying the materials and renting the tools from Store B is less than or equal to the total cost of buying the materials and renting the tools from Store A can be found by solving the inequality $600 + 105x \leq 750 + 80x$. Subtracting $80x$ and 600 from each side of $600 + 105x \leq 750 + 80x$ and combining like terms yields $25x \leq 150$. Dividing each side of $25x \leq 150$ by 25 yields $x \leq 6$.

Choice B is incorrect. The inequality $x \geq 6$ is the number of days for which the total cost of buying the materials and renting the tools from Store B is <u>greater than</u> or equal to the total cost of buying the materials and renting the tools from Store A. Choices C and D are incorrect and may be the result of an error in setting up or simplifying the inequality.

17

Choice D is correct. The total cost, y, of buying the materials and renting the tools in terms of the number of days, x, is given as $y = M + (W + K)x$. If this relationship is graphed in the xy-plane, the slope of the graph is equal to $W + K$, which is the daily rental cost of the wheelbarrow plus the daily rental cost of the concrete mixer, that is, the total daily rental costs of the tools.

Choice A is incorrect because the total cost of the project is y. Choice B is incorrect because the total cost of the materials is M, which is the y-intercept of the graph of $y = M + (W + K)x$. Choice C is incorrect because the total daily cost of the project is the total cost of the project divided by the total number of days the project took and, since materials cost more than 0 dollars, this is not the same as the total daily rental costs.

18

Choice A is correct. In the xy-plane, the slope m of the line that passes through the points (x_1, y_1) and $(x_2, y_2$ is given by the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. Thus, if the graph of the linear function f has intercepts at $(a, 0)$ and $(0, b$, then the slope of the line that is the graph of $y = f(x)$ is $m = \frac{0 - b}{a - 0} = -\frac{b}{a}$. It is given that $a + b = 0$, and so $a = -b$. Finally, substituting $-b$ for a in $m = -\frac{b}{a}$ gives $m = -\frac{b}{-b} = 1$, which is positive.

Choices B, C, and D are incorrect and may result from a conceptual misunderstanding or a calculation error.

19

Choice D is correct. The difference between the number of hours the project takes, y, and the number of hours the project was estimated to take, x, is $|y - x|$. If the goal is met, the difference is less than 10, which can be represented as $|y - x| < 10$, or $-10 < y - x < 10$.

Choice A is incorrect. This inequality states that the estimated number of hours plus the actual number of hours is less than 10, which cannot be true because the estimate is greater than 100. Choice B is incorrect. This inequality states that the actual number of hours is greater than the estimated number of hours plus 10, which could be true only if the goal of being within 10 hours of the estimate were not met. Choice C is incorrect. This inequality states that the actual number of hours is less than the estimated number of hours minus 10, which could be true only if the goal of being within 10 hours of the estimate were not met.

20

Choice B is correct. In the xy-plane, the slope m of the line that passes through the points (x_1, y_1) and (x_2, y_2) is $m = \frac{y_2 - y_1}{x_2 - x_1}$. Thus, the slope of the line through the points E 1, 0) and C 7, 2) is $\frac{2 - 0}{7 - 1}$, which simplifies to $\frac{2}{6} = \frac{1}{3}$. Therefore, diagonal AC has a slope of $\frac{1}{3}$. The other diagonal of the square is a segment of the line that passes through points B and D. The diagonals of a square are perpendicular, and so the product of the slopes of the diagonals is equal to −1. Thus, the slope of the line that passes through B and D is −3 because $\frac{1}{3}$ −3) = −1. Hence, an equation of the line that passes through B and D can be written as $y = -3x + b$, where b is the y-intercept of the line. Since diagonal BD will pass through the center of the square, $E(1, 0)$, the equation $0 = -3(1) + b$ holds. Solving this equation for b gives $b = 3$. Therefore, an equation of the line that passes through points B and D is $y = -3x + 3$, which can be rewritten as $y = -3(x - 1)$.

Choices A, C, and D are incorrect and may result from a conceptual error or a calculation error.

21

Choice A is correct. Adding 4 to each side of the inequality $3p - 2 \geq 1$ yields the inequality $3p + 2 \geq 5$. Therefore, the least possible value of $3p + 2$ is 5.

Choice B is incorrect because it gives the least possible value of $3p$, not of $3p + 2$. Choice C is incorrect. If the least possible value of $3p + 2$ were 2, then it would follow that $3p + 2 \geq 2$. Subtracting 4 from each side of this inequality would yield $3p - 2 \geq -2$. This contradicts the given inequality, $3p - 2 \geq 1$. Therefore, the least possible value of $3p + 2$ cannot be 2. Choice D is incorrect because it gives the least possible value of p, not of $3p + 2$.

22

Choice C is correct. The line passes through the origin, $(2, k)$, and $(k, 32)$. Any two of these points can be used to find the slope of the line. Since the line passes through $(0, 0)$ and $(2, k)$, the slope of the line is equal to $\frac{k - 0}{2 - 0} = \frac{k}{2}$. Similarly, since the line passes through $(0, 0)$ and $(k, 32)$, the slope of the line is equal to $\frac{32 - 0}{k - 0} = \frac{32}{k}$. Since each expression gives the slope of the same line, it must be true that $\frac{k}{2} = \frac{32}{k}$. Multiplying each side of $\frac{k}{2} = \frac{32}{k}$ by $2k$ gives $k^2 = 64$, from which it follows that $k = 8$ or $k = -8$. Therefore, of the given choices, only 8 could be the value of k.

Choices A, B, and D are incorrect and may be the result of computational errors.

23

Choice D is correct. On Mercury, the acceleration due to gravity is 3.6 m/sec^2. Substituting 3.6 for g and 90 for m in the formula $W = mg$ gives $W = 90(3.6) = 324$ newtons.

Choice A is incorrect and may be the result of dividing 90 by 3.6. Choice B is incorrect and may be the result of subtracting 3.6 from 90 and rounding to the nearest whole number. Choice C is incorrect because an object with a weight of 101 newtons on Mercury would have a mass of about 28 kilograms, not 90 kilograms.

24

Choice B is correct. On Earth, the acceleration due to gravity is 9.8 m/sec . Thus, for an object with a weight of 150 newtons, the formula $W = mg$ becomes $150 = m(9.8)$, which shows that the mass of an object with a weight of 150 newtons on Earth is about 15.3 kilograms. Substituting this mass into the formula $W = mg$ and now using the weight of 170 newtons gives $170 = 15.3g$, which shows that the second planet's acceleration due to gravity is about 11.1 m/sec^2. According to the table, this value for the acceleration due to gravity holds on Saturn.

Choices A, C, and D are incorrect. Using the formula $W = mg$ and the values for g in the table shows that an object with a weight of 170 newtons on these planets would not have the same mass as an object with a weight of 150 newtons on Earth.

25

Choice B is correct. The quantity of the product supplied to the market is given by the function $S(P) = \frac{1}{2}P + 40$. If the price P of the product increases by \$10, the effect on the quantity of the product supplied can be determined by substituting $P + 10$ for P in the function $S(P) = \frac{1}{2}P + 40$. This gives $S(P + 10) = \frac{1}{2}(P + 10) + 40 = \frac{1}{2}P + 45$, which shows that $S(P + 10) = S(P) + 5$. Therefore, the quantity supplied to the market will increase by 5 units when the price of the product is increased by \$10.

Alternatively, look at the coefficient of P in the linear function S. This is the slope of the graph of the function, where P is on the horizontal axis and $S(P)$ is on the vertical axis. Since the slope is $\frac{1}{2}$, for every increase of 1 in P, there will be an increase of $\frac{1}{2}$ in $S(P)$, and therefore, an increase of 10 in P will yield an increase of 5 in $S(P)$.

Choice A is incorrect. If the quantity supplied decreases as the price of the product increases, the function $S(P)$ would be decreasing, but $S(P) = \frac{1}{2}P + 40$ is an increasing function. Choice C is incorrect and may be the result of assuming the slope of the graph of $S(P)$ is equal to 1. Choice D is incorrect and may be the result of confusing the y-intercept of the graph of $S(P)$ with the slope, and then adding 10 to the y-intercept.

26

Choice B is correct. The quantity of the product supplied to the market will equal the quantity of the product demanded by the market if $S(P)$ is equal to $D(P)$, that is, if $\frac{1}{2}P + 40 = 220 - P$. Solving this equation gives $P = 120$, and so \$120 is the price at which the quantity of the product supplied will equal the quantity of the product demanded.

Choices A, C, and D are incorrect. At these dollar amounts, the quantities given by $S(P)$ and $D(P)$ are not equal.

27

Choice B is correct. One of the three numbers is x; let the other two numbers be y and z. Since the sum of three numbers is 855, the equation $x + y + z = 855$ is true. The statement that x is 50% more than the sum of the other two numbers can be represented as $x = 1.5(y + z)$, or $x = \frac{3}{2}(y + z)$. Multiplying both sides of the equation $x = \frac{3}{2}(y + z)$ by $\frac{2}{3}$ gives $\frac{2}{3}x = y + z$. Substituting $\frac{2}{3}x$ in $x + y + z = 855$ gives $x + \frac{2}{3}x = 855$, or $\frac{5x}{3} = 855$. Therefore, x equals $\frac{3}{5} \times 855 = 513$.

Choices A, C, and D are incorrect and may be the result of computational errors.

28

Choice D is correct. Let c be the number of students in Mr. Kohl's class. The conditions described in the question can be represented by the equations $n = 3c + 5$ and $n + 21 = 4c$. Substituting $3c + 5$ for n in the second equation gives $3c + 5 + 21 = 4c$, which can be solved to find $c = 26$.

Choices A, B, and C are incorrect because the values given for the number of students in the class cannot fulfill both conditions given in the question. For example, if there were 16 students in the class, then the first condition would imply that there are $3(16) + 5 = 53$ milliliters of solution in the beaker, but the second condition would imply that there are $4(16) - 21 = 43$ milliliters of solution in the beaker. This contradiction shows that there cannot be 16 students in the class.

29

Choice A is correct. Let x be the number of left-handed female students and let y be the number of left-handed male students. Then the number of right-handed female students will be $5x$ and the number of right-handed male students will be $9y$. Since the total number of left-handed students is 18 and the total number of right-handed students is 122, the system of equations below must be satisfied.

$$\begin{cases} x + y = 18 \\ 5x + 9y = 122 \end{cases}$$

Solving this system gives $x = 10$ and $y = 8$. Thus, 50 of the 122 right-handed students are female. Therefore, the probability that a right-handed student selected at random is female is $\frac{50}{122}$, which to the nearest thousandth is 0.410.

Choices B, C, and D are incorrect and may be the result of incorrectly calculating the missing values in the table.

30

Choice A is correct. Subtracting the sides of $3y + c = 5y - 7$ from the corresponding sides of $3x + b = 5x - 7$ gives $(3x - 3y) + (b - c) = (5x - 5y + (-7 - (-7))$. Since $b = c - \frac{1}{2}$, or $b - c = -\frac{1}{2}$, it follows that $(3x - 3y) + \left(-\frac{1}{2}\right) = (5x - 5y)$. Solving this equation for x in terms of y gives $x = y - \frac{1}{4}$. Therefore, x is y minus $\frac{1}{4}$.

Choices B, C, and D are incorrect and may be the result of making a computational error when solving the equations for x in terms of y.