QUESTION 40.

Choice B is the best answer because it provides the singular nouns “writer” and “speaker” to agree with the singular pronoun “anyone.”

Choices A, C, and D are incorrect because none creates pronoun-referent agreement.

QUESTION 41.

Choice D is the best answer because it expresses in the clearest, simplest way the idea that many game designers start out as programmers.

Choices A, B, and C are incorrect because each is unnecessarily wordy and obscures meaning.

QUESTION 42.

Choice D is the best answer because it logically and appropriately modifies the phrase “collaboration skills.”

Choices A, B, and C are incorrect because none appropriately describes the value of collaboration skills.

QUESTION 43.

Choice A is the best answer because it provides a logical subject for the modifying phrase “demanding and deadline driven.”

Choices B, C, and D are incorrect because each creates a dangling modifier.

QUESTION 44.

Choice B is the best answer because sentence 5 expresses the main point upon which the paragraph elaborates.

Choices A, C, and D are incorrect because none places sentence 5 in the appropriate position to set up the details contained in the paragraph.

Section 3: Math Test — No Calculator

QUESTION 1.

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.

Choice B is incorrect. By definition, the absolute value of any expression is a nonnegative number. Substituting any value for x into the expression

$|x + 1|$ will yield a nonnegative number as the result. 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. Choice C is incorrect. By definition, the absolute value of any expression is a nonnegative number. Substituting any value for x into the expression $|1 - x|$ will yield a nonnegative number as the result. Because the sum of a nonnegative number and a positive number is positive, $|1 - x| + 1$ will be a positive number for any value of x. Therefore, $|1 - x| + 1 \neq 0$ for any value of x. Choice D is incorrect. By definition, the absolute value of any expression is a nonnegative number. Substituting any value for x into the expression $|x - 1|$ will yield a nonnegative number as the result. 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.

QUESTION 2.

Choice A is correct. Since $f(x) = \frac{3}{2}x + b$ and $f(6) = 7$, substituting 6 for x in $f(x) = \frac{3}{2}x + b$ gives $f(6) = \frac{3}{2}(6) + b = 7$. Then, solving the equation $\frac{3}{2}(6) + b = 7$ for b gives $\frac{18}{2} + b = 7$, or $9 + b = 7$. Thus, $b = 7 - 9 = -2$. Substituting this value back into the original function gives $f(x) = \frac{3}{2}x - 2$; therefore, one can evaluate $f(-2)$ by substituting -2 for x: $\frac{3}{2}(-2) - 2 = -\frac{6}{2} - 2 = -3 - 2 = -5$.

Choice B is incorrect as it is the value of b, not of $f(-2)$. Choice C is incorrect as it is the value of $f(2)$, not of $f(-2)$. Choice D is incorrect as it is the value of $f(6)$, not of $f(-2)$.

QUESTION 3.

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.

QUESTION 4.

Choice B is correct. If $f(x) = -2x + 5$, then one can evaluate $f(-3x)$ by substituting $-3x$ for every instance of x. This yields $f(-3x) = -2(-3x) + 5$, which simplifies to $6x + 5$.

Choices A, C, and D are incorrect and may be the result of miscalculations in the substitution or of misunderstandings of how to evaluate $f(-3x)$.

QUESTION 5.

Choice C is correct. The expression $3(2x + 1)(4x + 1)$ can be simplified by first distributing the 3 to yield $(6x + 3)(4x + 1)$, and then expanding to obtain $24x^2 + 12x + 6x + 3$. Combining like terms gives $24x^2 + 18x + 3$.

Choice A is incorrect and may be the result of performing the term-by-term multiplication of $3(2x + 1)(4x + 1)$ and treating every term as an x-term. Choice B is incorrect and may be the result of correctly finding $(6x + 3)(4x + 1)$, but then multiplying only the first terms, $(6x)(4x)$, and the last terms, $(3)(1)$, but not the outer or inner terms. Choice D is incorrect and may be the result of incorrectly distributing the 3 to both terms to obtain $(6x + 3)(12x + 3)$, and then adding $3 + 3$ and $6x + 12x$ and incorrectly adding the exponents of x.

QUESTION 6.

Choice B is correct. The equation $\frac{a-b}{b} = \frac{3}{7}$ can be rewritten as $\frac{a}{b} - \frac{b}{b} = \frac{3}{7}$, from which it follows that $\frac{a}{b} - 1 = \frac{3}{7}$, or $\frac{a}{b} = \frac{3}{7} + 1 = \frac{10}{7}$.

Choices A, C, and D are incorrect and may be the result of calculation errors in rewriting $\frac{a-b}{b} = \frac{3}{7}$. For example, choice A may be the result of a sign error in rewriting $\frac{a-b}{b}$ as $\frac{a}{b} + \frac{b}{b} = \frac{a}{b} + 1$.

QUESTION 7.

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, the amount she increases the distance of her longest run each week is $\frac{26-8}{16-4} = \frac{18}{12} = \frac{3}{2} = 1.5$ 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.

QUESTION 8.

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 find out 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 $y = -\frac{6}{2}x + \frac{15}{2} = -3x + \frac{15}{2}$. 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.

QUESTION 9.

Choice D is correct. The question states that $\sqrt{x - a} = x - 4$ and that $a = 2$, so substituting 2 for a in the equation yields $\sqrt{x - 2} = x - 4$. To solve for x, square each side of the equation, which gives $\left(\sqrt{x - 2}\right)^2 = (x - 4)^2$, or $x - 2 = (x - 4)^2$. Then, expanding $(x - 4)^2$ yields $x - 2 = x^2 - 8x + 16$, or $0 = x^2 - 9x + 18$. Factoring the right-hand side gives $0 = (x - 3)(x - 6)$, and so $x = 3$ or $x = 6$. However, for $x = 3$, the original equation becomes $\sqrt{3 - 2} = 3 - 4$, which yields $1 = -1$, which is not true. Hence, $x = 3$ is an extraneous solution that arose from squaring each side of the equation. For $x = 6$, the original equation becomes $\sqrt{6 - 2} = 6 - 4$, which yields $\sqrt{4} = 2$, or $2 = 2$. Since this is true, the solution set of $\sqrt{x - 2} = x - 4$ is $\{6\}$.

Choice A is incorrect because it includes the extraneous solution in the solution set. Choice B is incorrect and may be the result of a calculation or factoring error. Choice C is incorrect because it includes only the extraneous solution, and not the correct solution, in the solution set.

QUESTION 10.

Choice D is correct. Multiplying each side of $\frac{t + 5}{t - 5} = 10$ by $t - 5$ gives $t + 5 = 10(t - 5)$. Distributing the 10 over the values in the parentheses yields $t + 5 = 10t - 50$. Subtracting t from each side of the equation gives $5 = 9t - 50$, and then adding 50 to each side gives $55 = 9t$. Finally, dividing each side by 9 yields $t = \frac{55}{9}$.

Choices A, B, and C are incorrect and may be the result of calculation errors or using the distribution property improperly.

QUESTION 11.

Choice C is correct. Since $y = (2x - 3)(x + 9)$ and $x = 2y + 5$, it follows that $x = 2\left((2x - 3)(x + 9)\right) + 5 = 4x^2 + 30x - 54$. This can be rewritten as $4x^2 + 29x - 54 = 0$. Because the discriminant of this quadratic equation, $29^2 - (4)(-54) = 29^2 + 4(54)$, is positive, this equation has 2 distinct roots. Using each of the roots as the value of x and finding y from the equation $x = 2y + 5$ gives 2 ordered pairs (x, y) that satisfy the given system of equations. Since no other value of x satisfies $4x^2 + 29x - 54 = 0$, there are no other ordered pairs that satisfy the given system. Therefore, there are 2 ordered pairs (x, y) that satisfy the given system of equations.

Choices A and B are incorrect and may be the result of either a miscalculation or a conceptual error. Choice D is incorrect because a system of one quadratic equation and one linear equation cannot have infinitely many solutions.

QUESTION 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, 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.

QUESTION 13.

Choice B is correct. One can find the intersection points of the two graphs by setting the functions $f(x)$ and $g(x)$ equal to one another and then solving for x. This yields $8x^2 - 2 = -8x^2 + 2$. Adding $8x^2$ and 2 to each side of the equation gives $16x^2 = 4$. Then dividing each side by 16 gives $x^2 = \frac{1}{4}$, and then taking the square root of each side gives $x = \pm\frac{1}{2}$. From the graph, the value of k is the x-coordinate of the point of intersection on the positive x-axis. Therefore, $k = \frac{1}{2}$.

Alternatively, since $(k, 0)$ lies on the graph of both f and g, it follows that $f(k) = g(k) = 0$. Thus, evaluating $f(x) = 8x^2 - 2$ at $x = k$ gives $0 = 8k^2 - 2$. Adding 2 to each side yields $2 = 8k^2$ and then dividing each side by 8 gives $\frac{1}{4} = k^2$. Taking the square root of each side then gives $k = \pm\frac{1}{2}$. From the graph, k is positive, so $k = \frac{1}{2}$.

Choices A, C, and D are incorrect and may be the result of calculation errors in solving for x or k.

QUESTION 14.

Choice A is correct. To rewrite $\frac{8-i}{3-2i}$ in the standard form $a + bi$, multiply the numerator and denominator of $\frac{8-i}{3-2i}$ by the conjugate, $3 + 2i$. This gives $\left(\frac{8-i}{3-2i}\right)\left(\frac{3+2i}{3+2i}\right) = \frac{24 + 16i - 3i + (-i)(2i)}{3^2 - (2i)^2}$. Since $i^2 = -1$, this last fraction can be rewritten as $\frac{24 + 16i - 3i + 2}{9 - (-4)} = \frac{26 + 13i}{13}$, which simplifies to $2 + i$. Therefore, when $\frac{8 - i}{3 - 2i}$ is rewritten in the standard form $a + bi$, the value of a is 2.

Choices B, C, and D are incorrect and may be the result of errors in symbolic manipulation. For example, choice B could be the result of mistakenly rewriting $\frac{8 - i}{3 - 2i}$ as $\frac{8}{3} + \frac{1}{2}i$.

QUESTION 15.

Choice B is correct. The given quadratic equation can be rewritten as $2x^2 - kx - 4p = 0$. Applying the quadratic formula, $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, to this equation with $a = 2$, $b = -k$, and $c = -4p$ gives the solutions $\frac{k}{4} \pm \frac{\sqrt{k^2 + 32p}}{4}$.

Choices A, C, and D are incorrect and may be the result of errors in applying the quadratic formula.

QUESTION 16.

The correct answer is 9. Since the three shelves of the triangular shelf system are parallel, the three triangles in the figure are similar. Since the shelves divide the left side of the largest triangle in the ratio 2 to 3 to 1, the similarity ratios of the triangles are as follows.

- Smallest to middle: 2 to 5
- Smallest to largest: 2 to 6, or 1 to 3
- Middle to largest: 5 to 6

The height of the largest shampoo bottle that can stand upright on the middle shelf is equal to the height of the middle shelf. The height of the entire triangular shelf system is 18 inches. This is the height of the largest triangle. The height of the middle shelf is the height of the middle triangle minus the height of the smallest triangle. Since the similarity ratio of the middle triangle to the largest triangle is 5 to 6, the height of the middle shelf is $\frac{5}{6}(18) = 15$ inches. Since the similarity ratio of the smallest triangle to the largest triangle is 1 to 3, the height of the middle shelf is $\frac{1}{3}(18) = 6$ inches. Therefore, the height of the middle shelf is 9 inches.

QUESTION 17.

The correct answer is .6 or $\frac{3}{5}$. The angles marked $x°$ and $y°$ are acute angles in a right triangle. Thus, they are complementary angles. By the complementary angle relationship between sine and cosine, it follows that $\sin(x°) = \cos(y°)$. Therefore, the cosine of $y°$ is .6. Either .6 or the equivalent fraction $\frac{3}{5}$ may be gridded as the correct answer.

Alternatively, since the sine of $x°$ is .6, the ratio of the side opposite the $x°$ angle to the hypotenuse is .6. The side opposite the $x°$ angle is the side adjacent to the $y°$ angle. Thus, the ratio of the side adjacent to the $y°$ angle to the hypotenuse, which is equal to the cosine of $y°$, is equal to .6.

QUESTION 18.

The correct answer is 5. The four-term polynomial expression can be factored completely, by grouping, as follows:

$$\left(x^3 - 5x^2\right) + \left(2x - 10\right) = 0$$
$$x^2\left(x - 5\right) + 2\left(x - 5\right) = 0$$
$$\left(x - 5\right)\left(x^2 + 2\right) = 0$$

By the zero product property, set each factor of the polynomial equal to 0 and solve each resulting equation for x. This gives $x = 5$ or $x = \pm i\sqrt{2}$, respectively. Because the question asks for the real value of x that satisfies the equation, the correct answer is 5.

QUESTION 19.

The correct answer is 0. Multiplying each side of $-3x + 4y = 20$ by 2 gives $-6x + 8y = 40$. Adding each side of $-6x + 8y = 40$ to the corresponding side of $6x + 3y = 15$ gives $11y = 55$, or $y = 5$. Finally, substituting 5 for y in $6x + 3y = 15$ gives $6x + 3(5) = 15$, or $x = 0$.

QUESTION 20.

The correct answer is 25. In the mesosphere, an increase of 10 kilometers in the distance above Earth results in a decrease in the temperature by $k°$ Celsius where k is a constant. Thus, the temperature in the mesosphere is linearly dependent on the distance above Earth. Using the values provided and the slope formula, one can calculate the unit rate of change for the temperature in the mesosphere to be $\frac{-80 - (-5)}{80 - 50} = \frac{-75}{30} = \frac{-2.5}{1}$. The slope indicates that, within the mesosphere, if the distance above Earth increases by 1 kilometer, the temperature decreases by 2.5° Celsius. Therefore, if the distance above Earth increases by $\left(1 \times 10\right) = 10$ kilometers, the temperature will decrease by $\left(2.5 \times 10\right) = 25°$ Celsius. Thus, the value of k is 25.

Section 4: Math Test — Calculator

QUESTION 1.

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