Math: Question 1

$4x+3y=24$

Mario purchased 4 binders that cost x dollars each and 3 notebooks that cost y dollars each. If the given equation represents this situation, which of the following is the best interpretation of 24 in this context?

A. The total cost, in dollars, for all binders purchased
B. The total cost, in dollars, for all notebooks purchased
C. The total cost, in dollars, for all binders and notebooks purchased
D. The difference in the total cost, in dollars, between the number of binders and notebooks purchased

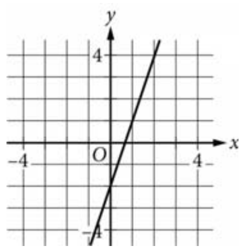
Choice C is correct. Since Mario purchased 4 binders that cost x dollars each, the expression $4x$ represents the total cost, in dollars, of the 4 binders he purchased. Since Mario purchased 3 notebooks that cost y dollars each, the expression $3y$ represents the total cost, in dollars, of the 3 notebooks he purchased. Therefore, the expression $4x+3y$ represents the total cost, in dollars, for all binders and notebooks he purchased. In the given equation, the expression $4x+3y$ is equal to 24. Therefore, it follows that 24 is the total cost, in dollars, for all binders and notebooks purchased.

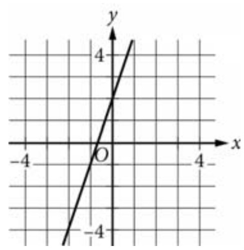
Choice A is incorrect. This is represented by the expression $4x$ in the given equation. Choice B is incorrect. This is represented by the expression $3y$ in the given equation. Choice D is incorrect. This is represented by the expression $|4x-3y|$.

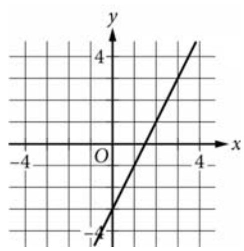
Question Difficulty: Easy

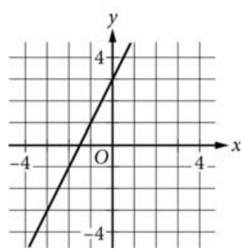
Math: Question 2

The function c is defined by $c(x) = 2x + 3$. Which of the following is the graph of $y = c(x)$?

A. 

B. 

C. 

D. 

Choice D is correct. The function c is a linear function, and thus the graph of $y = c(x)$ is a line in the xy-plane. The equation defining this function is in the form $c(x) = mx + b$, where m is the slope and b is the y-coordinate of the y-intercept of the line. Since $c(x) = 2x + 3$, it follows that the graph of $y = c(x)$ has a slope of 2 and a y-intercept with a y-coordinate of 3. Of the given choices, only the line graphed in choice D has a y-intercept with a y-coordinate of 3. Also, since this line passes through the points $(-1,1)$ and $(0,3)$, it has a slope of $\frac{(3)-(1)}{(0)-(-1)}$, or 2. Therefore, the line graphed in choice D is the graph of $y = c(x)$.

Choices A and B are incorrect. These lines both have a slope of 3, not 2. Additionally, the y-coordinates of the y-intercepts of these lines are -2 and 2, respectively, not 3. Choice C is incorrect. The y-coordinate of the y-intercept of this line is -3, not 3.

Question Difficulty: Medium

Math: Question 3

A city's total expense budget for one year was x million dollars. The city budgeted y million dollars for departmental expenses and 201 million dollars for all other expenses. Which of the following represents the relationship between x and y in this context?

A. $x + y = 201$

B. $x - y = 201$

C. $2x - y = 201$

D. $y - x = 201$

Choice B is correct. Of the city's total expense budget for one year, the city budgeted y million dollars for departmental expenses and 201 million dollars for all other expenses. This means that the expression $y + 201$ represents the total expense budget, in millions of dollars, for one year. It's given that the total expense budget for one year is x million dollars. It follows then that the expression $y + 201$ is equivalent to x, or $y + 201 = x$. Subtracting y from both sides of this equation yields $201 = x - y$. By the symmetric property of equality, this is the same as $x - y = 201$.

Choices A and C are incorrect. Because it's given that the total expense budget for one year, x million dollars, is comprised of the departmental expenses, y million dollars, and all other expenses, 201 million dollars, the expressions $x + y$ and $2x - y$ both must be equivalent to a value greater than 201 million dollars. Therefore, the equations $x + y = 201$and $2x - y = 201$aren't true. Choice D is incorrect. The value of x must be greater than the value of y. Therefore, $y - x = 201$ can't represent this relationship.

Question Difficulty: Medium

Math: Question 4

$y \leq x$

$y \leq -x$

Which of the following ordered pairs (x, y) is a solution to the system of inequalities above?

A. $(1, 0)$

B. $(-1, 0)$

C. $(0, 1)$

D. $(0, -1)$

Choice D is correct. The solutions to the given system of inequalities is the set of all ordered pairs (x, y) that satisfy both inequalities in the system. For an ordered pair to satisfy the inequality $y \leq x$, the value of the ordered pair's y-coordinate must be less than or equal to the value of the ordered pair's x-coordinate. This is true of the ordered pair $(0, -1)$, because $-1 \leq 0$. To satisfy the inequality $y \leq -x$, the value of the ordered pair's y-coordinate must be less than or equal to the value of the additive inverse of the ordered pair's x-coordinate. This is also true of the ordered pair $(0, -1)$. Because 0 is its own additive inverse, $-1 \leq -(0)$ is the same as $-1 \leq 0$. Therefore, the ordered pair $(0, -1)$ is a solution to the given system of inequalities.

Choice A is incorrect. This ordered pair satisfies only the inequality $y \leq x$ in the given system, not both inequalities. Choice B incorrect. This ordered pair satisfies only the inequality $y \leq -x$ in the system, but not both inequalities. Choice C is incorrect. This ordered pair satisfies neither inequality.

Question Difficulty: Medium

Math: Question 5

If $2(x-5)+3(x-5)=10$, what is the value of $x-5$?

A. 2
B. 5
C. 7
D. 12

Choice A is correct. Adding the like terms on the left-hand side of the given equation yields $5(x-5)=10$. Dividing both sides of this equation by 5 yields $x-5=2$.

Choice B is incorrect and may result from subtracting 5, not dividing by 5, on both sides of the equation $5(x-5)=10$. Choice C is incorrect. This is the value of x, not the value of $x-5$. Choice D is incorrect. This is the value of $x+5$, not the value of $x-5$.

Question Difficulty: Medium

Math: Question 6

$6x^2 + 5x - 7 = 0$

What are the solutions to the given equation?

A. $\frac{-5 \pm \sqrt{25 + 168}}{12}$

B. $\frac{-6 \pm \sqrt{25 + 168}}{12}$

C. $\frac{-5 \pm \sqrt{36 - 168}}{12}$

D. $\frac{-6 \pm \sqrt{36 - 168}}{12}$

Choice A is correct. The quadratic formula, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, can be used to find the solutions to an equation in the form $ax^2 + bx + c = 0$. In the given equation, $a = 6$, $b = 5$, and $c = -7$. Substituting these values into the quadratic formula gives $\frac{-5 \pm \sqrt{5^2 - 4(6)(-7)}}{2(6)}$, or $\frac{-5 \pm \sqrt{25 + 168}}{12}$.

Choice B is incorrect and may result from using $\frac{-a \pm \sqrt{b^2 - 4ac}}{2a}$ as the quadratic formula. Choice C is incorrect and may result from using $\frac{-b \pm \sqrt{a^2 + 4ac}}{2a}$ as the quadratic formula. Choice D is incorrect and may result from using $\frac{-a \pm \sqrt{a^2 + 4ac}}{2a}$ as the quadratic formula.

Question Difficulty: Hard

Math: Question 7

$(2x+5)^2-(x-2)+2(x+3)$

Which of the following is equivalent to the expression above?

A. $4x^2+21x+33$

B. $4x^2+21x+29$

C. $4x^2+x+29$

D. $4x^2+x+33$

Choice A is correct. The given expression can be rewritten as $(2x+5)^2+(-1)(x-2)+2(x+3)$. Applying the distributive property, the expression $(-1)(x-2)+2(x+3)$can be rewritten as $-1(x)+(-1)(-2)+2(x)+2(3)$, or $-x+2+2x+6$. Adding like terms yields $x+8$. Substituting $x+8$ for $(-1)(x-2)+2(x+3)$ in the given expression yields $(2x+5)^2+x+8$. By the rules of exponents, the expression $(2x+5)^2$ is equivalent to $(2x+5)(2x+5)$. Applying the distributive property, this expression can be rewritten as $2x(2x)+2x(5)+5(2x)+5(5)$, or $4x^2+10x+10x+25$. Adding like terms gives $4x^2+20x+25$. Substituting $4x^2+20x+25$ for $(2x+5)^2$ in the rewritten expression yields $4x^2+20x+25+x+8$, and adding like terms yields $4x^2+21x+33$.

Choices B, C, and D are incorrect. Choices C and D may result from rewriting the expression $(2x+5)^2$ as $4x^2+25$, instead of as $4x^2+20x+25$. Choices B and C may result from rewriting the expression $-(x-2)$ as $-x-2$, instead of $-x+2$.

Question Difficulty: Medium

Math: Question 8

What is the y-intercept of the graph of $y = 3^{x+3}$ in the xy-plane?

A. $(0,0)$
B. $(0,3)$
C. $(0,9)$
D. $(0,27)$

Choice D is correct. The y-intercept of the graph of $y = 3^{x+3}$ in the xy-plane is the point (x,y), where $x = 0$. Substituting 0 for x into the equation $y = 3^{x+3}$ yields $y = 3^{(0)+3}$, or $y = 27$. Therefore, when $x = 0$, $y = 27$, and so the point $(0,27)$is the y-intercept of this graph.

Choices A, B, and C are incorrect. These points don't lie on the graph of $y = 3^{x+3}$ and may result from conceptual or computational errors.

Question Difficulty: Hard

Math: Question 9

Which expression is equivalent to $\sqrt{16x^{16}}$, where $x > 0$?

A. $4x^4$

B. $4x^8$

C. $8x^4$

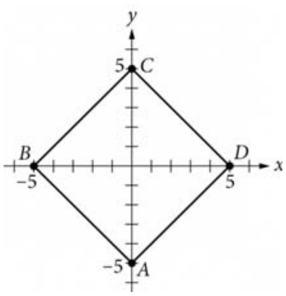
D. $8x^8$

The correct answer is B. According to the definition of rational exponents, for all positive real numbers a and positive integers n, $\sqrt[n]{a} = (a)^{\frac{1}{n}}$. When the definition is applied, the given expression can be rewritten as $(16x^{16})^{\frac{1}{2}}$. Using the product rule of exponents, the expression $(16x^{16})^{\frac{1}{2}}$ can be further rewritten as $(16)^{\frac{1}{2}}(x^{16})^{\frac{1}{2}}$. By definition, the expression $16^{\frac{1}{2}} = \sqrt{16}$, or 4. Applying the power rule of exponents, the expression $(x^{16})^{\frac{1}{2}}$ can be rewritten as $x^{\left(16 \cdot \frac{1}{2}\right)}$, or x^8. Substituting 4 for $(16)^{\frac{1}{2}}$ and x^8 for $(x^{16})^{\frac{1}{2}}$ in the expression $(16)^{\frac{1}{2}}(x^{16})^{\frac{1}{2}}$ yields $4x^8$. Therefore, the given expression is equivalent to $4x^8$.

Choices A, C, and D are incorrect and may result from incorrectly applying the properties of exponents when rewriting the given expression.

Question Difficulty: Hard

Math: Question 10



In the xy-plane shown, square ABCD has its diagonals on the x- and y-axes. What is the area, in square units, of the square?

A. 20
B. 25
C. 50
D. 100

Choice C is correct. The two diagonals of square ABCD divide the square into 4 congruent right triangles, where each triangle has a vertex at the origin of the graph shown. The formula for the area of a triangle is $A = \frac{1}{2}bh$, where b is the base length of the triangle and h is the height of the triangle. Each of the 4 congruent right triangles has a height of 5 units and a base length of 5 units. Therefore, the area of each triangle is $A = \frac{1}{2}(5)(5)$, or 12.5 square units. Since the 4 right triangles are congruent, the area of each is $\frac{1}{4}$ of the area of square ABCD. It follows that the area of the square ABCD is equal to 4×12.5, or 50 square units.

Choices A and D are incorrect and may result from using 5 or 25, respectively, as the area of one of the 4 congruent right triangles formed by diagonals of square ABCD. However, the area of these triangles is 12.5. Choice B is incorrect and may result from using 5 as the length of one side of square ABCD. However, the length of a side of square ABCD is $5\sqrt{2}$.

Question Difficulty: Hard

Math: Question 11

$$x^2 = 6x + y$$
$$y = -6x + 36$$

A solution to the given system of equations is (x, y). Which of the following is a possible value of xy ?

A. 0
B. 6
C. 12
D. 36

Choice A is correct. Solutions to the given system of equations are ordered pairs (x, y) that satisfy both equations in the system. Adding the left-hand and right-hand sides of the equations in the system yields $x^2 + y = 6x + -6x + y + 36$, or $x^2 + y = y + 36$. Subtracting y from both sides of this equation yields $x^2 = 36$. Taking the square root of both sides of this equation yields $x = 6$ and $x = -6$. Therefore, there are two solutions to this system of equations, one with an x-coordinate of 6 and the other with an x-coordinate of -6. Substituting 6 for x in the second equation yields $y = -6(6) + 36$, or $y = 0$; therefore, one solution is $(6, 0)$. Similarly, substituting -6 for x in the second equation yields $y = -6(-6) + 36$, or $y = 72$; therefore, the other solution is $(-6, 72)$. It follows then that if (x, y) is a solution to the system, then possible values of xy are $(6)(0) = 0$ and $(-6)(72) = -432$. Only 0 is among the given choices.

Choice B is incorrect. This is the x-coordinate of one of the solutions, $(6, 0)$. Choice C is incorrect and may result from conceptual or computational errors. Choice D is incorrect. This is the square of the x-coordinate of one of the solutions, $(6, 0)$.

Question Difficulty: Hard

Math: Question 12

Ms. Tabanelli deposits $20,000 in an account that has a 5% annual interest rate compounded yearly. If she does not add to or withdraw from the account for 2 years, how much interest will she have earned for the 2-year period?

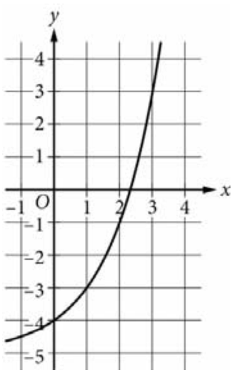
A. $50
B. $550
C. $2,000
D. $2,050

Choice D is correct. It's given that Ms.Tabanelli deposited $20,000 into an account that has a 5% annual interest rate compounded yearly. Therefore, the amount of money in the account after a t-year period can be represented by the expression $20{,}000(1.05)^t$. It follows that the amount of money, in dollars, in the account after a 2-year period is $20{,}000(1.05)^2$ or 22,050. Therefore, the amount of interest she earned for the 2-year period is $\$22{,}050 - \$20{,}000$, or $2,050.

Choice A is incorrect. This is the result of evaluating the expression $20{,}000(0.05)^2$. Choice B is incorrect and may result from a conceptual or calculation error. Choice C is incorrect and may result from finding the amount of interest earned at the end of the first year and doubling it. However, this approach doesn't account for the interest earned during the first year when compounding the interest for the second year.

Question Difficulty: Hard

Math: Question 13



What is an equation of the graph shown?

A. $y = 2^x + 4$

B. $y = 2^x - 4$

C. $y = 2^x - 5$

D. $y = 2^x + 5$

Choice C is correct. An equation of a graph is satisfied by the ordered pairs of any points on the graph. Three of the points the graph shown passes through are $(0, -4)$, $(1, -3)$, and $(3,3)$. Therefore, an equation of the graph is satisfied by x- and y-coordinates of these ordered pairs. Substituting 0 for x and -4 for y in the equation $y = 2^x - 5$ yields $(-4) = 2^{(0)} - 5$, or $-4 = 1 - 5$, which is a true statement. Similarly, substituting 1 for x and -3 for y in this equation yields $(-3) = 2^{(1)} - 5$, or $-3 = 2 - 5$, and substituting 3 for x and 3 for y in this equation yields $(3) = 2^{(3)} - 5$, or $3 = 8 - 5$, which are true statements. Only the equation in choice C is satisfied by the ordered pairs of these points on the graph shown.

Choices A, B, and D are incorrect. These equations aren't satisfied by the ordered pairs of any of the points on the graph shown. For example, substituting 0 for x and -4 for y in the equation in choice A yields $(-4) = 2^{(0)} + 4$, or $-4 = 1 + 4$, which isn't true. Similarly, substituting 0 for x and -4 for y in the equations in choices B and D yields $-4 = 1 - 4$ and $-4 = 1 + 5$, respectively, which also aren't true.

Question Difficulty: Hard

Math: Question 14

The function g is defined by $g(x) = \frac{1}{2}x - 1$. What is the value of $g(6)$?

The correct answer is 2. The value of $g(6)$ is the value of $g(x)$ when $x = 6$. Substituting 6 for x in the given equation results in $g(6) = \frac{1}{2}(6) - 1$, or $g(6) = 3 - 1$. Subtracting $3 - 1$ gives $g(6) = 2$.

Question Difficulty: Medium

Math: Question 15

$3(2x-1)=4x+12$

What value of x satisfies the equation above?

The correct answer is 7.5. Applying the distributive property on the left-hand side of the given equation yields $6x-3=4x+12$. Subtracting $4x$ from both sides of this equation yields $2x-3=12$. Adding 3 to both sides of this equation yields $2x=15$. Dividing both sides of this equation by 2 yields $x=7.5$. Therefore, the value of x that satisfies the given equation is 7.5. Either 7.5 or 15/2 may be entered as correct answers.

Question Difficulty: Medium

Math: Question 16

$$y = \frac{1}{2}x + 8$$
$$y = cx + 10$$

In the system of equations above, c is a constant. If the system has no solution, what is the value of c ?

The correct answer is .5. A system of two linear equations has no solution when the graphs of the equations have the same slope and different y-intercepts. Each of the given linear equations is written in the slope-intercept form, $y = mx + b$, where m is the slope and b is the y-coordinate of the y-intercept of the graph of the equation. For these two linear equations, the y-intercepts are $(0,8)$ and $(0,10)$. Thus, if the system of equations has no solution, the slopes of the graphs of the two linear equations must be the same. The slope of the graph of the first linear equation is $\frac{1}{2}$. Therefore, for the system of equations to have no solution, the value of c must be $\frac{1}{2}$. Either .5 or 1/2 may be entered as correct answers.

Question Difficulty: Hard

Math: Question 17

If $\frac{1}{x}+\frac{1}{3x}=5$, what is the value of $\frac{3x}{4}$?

The correct answer is .2. The rational expressions on the left-hand side of the given equation, $\frac{1}{x}$ and $\frac{1}{3x}$, can be added together by first finding their common denominator. Since x is a factor of $3x$, $3x$ is a common denominator. Rewriting $\frac{1}{x}$ with a denominator of $3x$ yields $\frac{3}{3x}$. The given equation can be rewritten as $\frac{3}{3x}+\frac{1}{3x}=5$. Adding the rational expressions on the left-hand side of this equation yields $\frac{4}{3x}=5$. Because $\frac{4}{3x}$ is the reciprocal of $\frac{3x}{4}$ (their product is equal to 1), the value of $\frac{3x}{4}$ is the reciprocal of 5, which is $\frac{1}{5}$, or .2. Either .2 or 1/5 may be entered as correct answers.

Question Difficulty: Hard