

Math: Question 1

$$6x + 9 = 4x + 11$$

Which of the following values satisfies the equation above?

- A. -2
- B. -1
- C. 1
- D. 2

Choice C is correct. Subtracting $4x$ from both sides of the equation gives $2x + 9 = 11$. Then, subtracting 9 from both sides of the equation gives $2x = 2$. Finally, dividing both sides of the equation by 2 gives $x = 1$.

Choice A is incorrect. Substituting -2 for x gives $6(-2) + 9 = 4(-2) + 11$, or $-3 = 3$, which is a false statement. Choice B is incorrect. Substituting -1 for x gives $6(-1) + 9 = 4(-1) + 11$, or $3 = 7$, which is a false statement. Choice D is incorrect. Substituting 2 for x gives $6(2) + 9 = 4(2) + 11$, or $21 = 19$, which is a false statement.

Question Difficulty: Easy

Math: Question 2

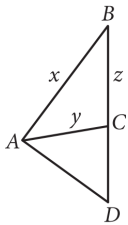
A babysitter charges \$8 per hour for each babysitting job she works and charges a travel allowance of \$10 for each job. Which of the following equations gives the number of hours, h , the babysitter worked at a job for which she charged \$78 ?

- A. $18h = 78$
- B. $10h + 8 = 78$
- C. $8h + 10 = 78$
- D. $8(10 + h) = 78$

Choice C is correct. The total amount that the babysitter charges for a job can be represented by \$8 times the number of hours, h , the babysitter works plus the one-time travel allowance of \$10, which can be represented by $8h + 10$. Since the babysitter charged \$78 for this job, the equation that gives the number of hours the babysitter worked is $8h + 10 = 78$.

Choice A is incorrect and represents the misconception of adding the hourly fee and the one-time travel allowance and then multiplying this sum by h . Choice B is incorrect and represents the misconception of multiplying the one-time travel allowance instead of the hourly rate by the number of hours worked. Choice D is incorrect and represents the misconception of multiplying the one-time \$10 travel allowance as well as the number of hours by 8.

Question Difficulty: Easy

Math: Question 3

In triangle ABD shown above, \overline{AC} bisects $\angle DAB$. Which of the following is equivalent to the ratio $AD:DC$?

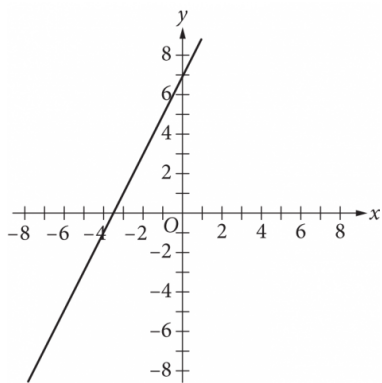
- A. $x : z$
- B. $y : z$
- C. $z : x$
- D. $z : y$

Choice A is correct. Since \overline{AC} bisects $\angle DAB$, $\frac{BC}{DC} = \frac{AB}{AD}$ according to the angle bisector theorem. It follows that the ratio $AD:DC$ is equivalent to $AB:BC$, or $x:z$.

Choices B, C, and D are incorrect and represent a conceptual error when applying the angle bisector theorem.

Question Difficulty: Medium

Math: Question 5



The graph of line k in the xy -plane is shown above. Which of the following is an equation of a line that, when graphed in the xy -plane, could be parallel to line k ?

- A. $y = -2x - 7$
- B. $y = -\frac{1}{2}x + 2$
- C. $y = x + 7$
- D. $y = 2x - 6$

Choice D is correct. Parallel lines in the xy -plane have the same slope. The slope of the line drawn is $\frac{7-0}{0-(-3.5)} = \frac{7}{3.5} = 2$. Choice D is the only option with an equation whose graph has a slope of 2.

Choice A is incorrect and represents a line with a slope of -2 . Choice B is incorrect and represents a line with a slope of $-\frac{1}{2}$. Choice C is incorrect and represents a line with a slope of 1.

Question Difficulty: Medium

Math: Question 6

Janelle wants to buy meat and vegetables for a barbecue. At her grocery store, the cost per pound of meat is x dollars, and the cost per pound of vegetables is y dollars. The equation $6x + 3y = 42$ shows how x and y are related when Janelle spends a total of \$42 on meat and vegetables. Based on the equation, which of the following statements must be true?

- A. The cost per pound of meat is \$6.
- B. Janelle can buy a maximum of 7 pounds of meat.
- C. Janelle can buy a maximum of 14 pounds of vegetables.
- D. Janelle buys twice as many pounds of meat as pounds of vegetables.

Choice D is correct. Since x is the cost per pound of meat and y is the cost per pound of vegetables in the given equation, the 6 in the equation represents the number of pounds of meat Janelle buys and the 3 represents the number of pounds of vegetables she buys. Therefore, it follows that Janelle buys twice as many pounds of meat as pounds of vegetables.

Choice A is incorrect because the cost per pound of meat is represented by x , which may not be equal to 6. Choices B and C are incorrect because the maximum number of pounds of meat and vegetables Janelle could buy cannot be determined without knowing the values of x and y .

Question Difficulty: Medium

Math: Question 7

Which of the following expressions is equivalent to $\sqrt[3]{x^7}$?

A. x^{10}

B. x^4

C. $x^{\frac{7}{3}}$

D. $x^{\frac{3}{7}}$

Choice C is correct. An expression in the form $\sqrt[a]{x^b}$ is equivalent to $x^{\frac{b}{a}}$. Therefore, $\sqrt[3]{x^7}$ is equivalent to $x^{\frac{7}{3}}$.

Choices A, B, and D are incorrect and may be the result of conceptual errors made when identifying equivalent expressions.

Question Difficulty: Medium

Math: Question 8

The interior temperature of a particular gas oven is determined by its dial setting, which goes from 1 (lowest) to 10 (highest). The relationship between the dial setting N and the corresponding temperature $T(N)$ is linear. When the dial setting is 2, the temperature is 150°C , and when the dial setting is 6, the temperature is 202°C . Which of the following functions represents the temperature as a function of the dial setting?

- A. $T(N) = 13N + 150$
- B. $T(N) = 13N + 124$
- C. $T(N) = \frac{1}{13}N + 154$
- D. $T(N) = \frac{1}{13}N + 150$

Choice B is correct. It is given that the temperature of the oven is 150°C when the dial setting is 2, and the temperature is 202°C when the dial setting is 6. Since the relationship between temperature and dial setting is linear, the rate of change is the change in temperature divided by the corresponding change in dial setting. Therefore, the rate of change $\frac{(202 - 150)}{(6 - 2)} =$

$\frac{52^{\circ}\text{C}}{4} = 13^{\circ}\text{C}$. The relationship can now be expressed in the format $T(N) = 13N + b$, where b is

a constant that can be determined by substituting the values 150 and 2 (or other corresponding values) for $T(N)$ and N , respectively, which yields $150 = 13(2) + b$, and then solving for b , which yields $b = 124$. Note that other corresponding values of $T(N)$ and N can be substituted into the function to find the value of b . Hence, the function that represents the temperature as a function of the dial setting is $T(N) = 13N + 124$.

Choice A is incorrect and is the result of using the dial setting of 2 for b instead of calculating b using the given information. Choices C and D are incorrect and may be the result of using the wrong rates of change of the function.

Question Difficulty: Medium

Math: Question 9

$$f(x) = -\sqrt{-x}$$

If the range of the function f above is the set of all real numbers less than or equal to zero, then which of the following describes the domain of f ?

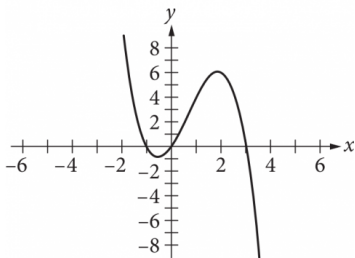
- A. The set of all real numbers
- B. The set of all real numbers less than or equal to zero
- C. The set of all real numbers less than or equal to one
- D. The set of all real numbers greater than or equal to zero

Choice B is correct. Since the range of the given function f is the set of all real numbers less than or equal to zero, then $-\sqrt{-x} \leq 0$. If $-\sqrt{-x} \leq 0$, then $\sqrt{-x} \geq 0$. If $\sqrt{-x} \geq 0$, then $x \leq 0$. This means that the domain of function f is all real numbers less than or equal to zero.

Choice A is incorrect and may be the result of not remembering that if $\sqrt{-x}$ is a real number, then the value of $-x$ must be greater than or equal to zero. Choice C is incorrect and may be the result of not remembering that if $\sqrt{-x}$ is a real number, then the value of $-x$ must be greater than or equal to zero; it is not necessary that the value of $-x$ be greater than or equal to -1 . Choice D is incorrect. For the function f , if x were a value greater than zero, then the value of $-x$ would be less than zero and so the value of $\sqrt{-x}$ would be undefined in the real numbers. Therefore, the domain of f cannot be the set of all real numbers greater than or equal to zero.

Question Difficulty: Medium

Math: Question 10



Which of the following is an equation of the graph shown on the xy -plane above?

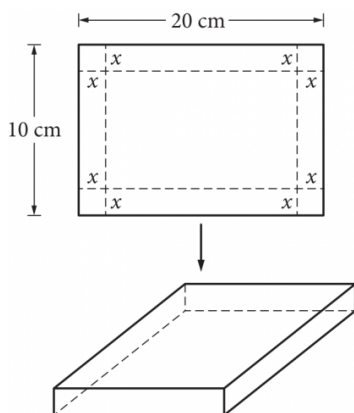
- A. $y = x^3 + 2x^2 - 3$
- B. $y = x^3 - 2x^2 - 3x$
- C. $y = -x^3 + 2x^2 + 3x$
- D. $y = -x^3 - 2x^2 + 3$

Choice C is correct. The given graph represents an equation with zeros at -1 , 0 , and 3 , since zeros are the values of x when $y = 0$. Therefore, the equation for the graph will be of the form $y = ax(x + 1)(x - 3)$, where a is a constant. Using the distributive property to multiply the two binomials in the equation gives $y = a(x^3 - 2x^2 - 3x)$. If $a = -1$, this equation is choice C.

Choice A is incorrect and can be rewritten in factored form as $y = (x - 1)(x^2 + 3x + 3)$, which shows a zero at $x = 1$. Choice B is incorrect and can be rewritten in factored form as $y = x(-x + 3)(x + 1)$, which shows zeros at $x = -1$, $x = 0$, and $x = 3$. Choice D is incorrect and can be rewritten in factored form as $y = (x - 1)(-x^2 - 3x - 3)$, which shows a zero at $x = 1$.

Question Difficulty: Hard

Math: Question 11



A box with an open top is formed by cutting out square corners, each with an area of x^2 square centimeters, from a rectangular piece of cardboard and then folding up the sides, as shown. Which of the following forms of the equation for the volume, in cubic centimeters, of the box includes an expression that represents the area, in square centimeters, of the base of the box?

- A. $V = 4x^3 - 60x^2 + 200x$
- B. $V = x(4x^2 - 60x + 200)$
- C. $V = (20 - 2x)(10x - 2x^2)$
- D. $V = (20x - 2x^2)(10 - 2x)$

Choice B is correct. The length of the base of the box can be represented by $20 - 2x$, and the width of the base of the box can be represented by $10 - 2x$. The area of the base of the box can be represented by the product of the two dimensions, or $4x^2 - 60x + 200$. The only option with the expression that represents the area of the base of the box is $V = x(4x^2 - 60x + 200)$.

Choices A, C, and D are incorrect because they do not contain expressions that represent the area of the box.

Question Difficulty: Hard

Math: Question 12

If $\frac{x-10}{x-4} = \frac{3x}{x-2}$ for $x \neq 4$ and $x \neq 2$, what is the value of $2x^2$?

- A. $\sqrt{10}$
- B. $2\sqrt{10}$
- C. 10
- D. 20

Choice D is correct. Multiplying both sides of the equation by $(x - 2)$ and $(x - 4)$ gives $(x - 10)(x - 2) = (x - 4)(3x)$. Applying the distributive property on both sides of the equation gives $x^2 - 12x + 20 = 3x^2 - 12x$. Subtracting x^2 and adding $12x$ to both sides of the equation gives $20 = 2x^2$.

Choices A and C are incorrect and are the values of x and x^2 , respectively, not $2x^2$. Choice B is incorrect and may be the result of a calculation error.

Question Difficulty: Hard

Math: Question 13

The cost C , in dollars, to make n units of a certain product is given by $C = an^2 + b$, where a and b are constants. If it costs \$17.00 to make 3 units and \$62.50 to make 10 units, what is the value of b ?

- A. 0.25
- B. 0.50
- C. 7.50
- D. 12.50

Choice D is correct. If it costs \$17.00 to make 3 units and \$62.50 to make 10 units, then the equations $17 = a3^2 + b$ and $62.5 = a10^2 + b$ describe the situation. Rewriting both equations in terms of b and setting them equal to each other yields $17 - 9a = 62.5 - 100a$. Solving for a yields $a = \frac{1}{2}$, and then substituting $\frac{1}{2}$ for a in either equation yields $b = 12.5$.

Choices A, B, and C are incorrect and may be the result of calculation errors.

Question Difficulty: Hard

Math: Question 14

Edgar earns \$12 per hour at his job during weekdays. His hourly earnings are increased by 50% when he works during weekends. Edgar worked 20 hours this week on weekdays. What is the minimum whole number of hours Edgar will have to work during this weekend in order to earn at least \$400 this week?

The correct answer is 9. If Edgar earns \$12 per hour at his job on weekdays and 50% more when he works on weekends, Edgar makes \$18 per hour on weekends. Let x equal the number of hours Edgar will have to work this weekend to earn at least \$400. If Edgar worked 20 hours this week on weekdays, then the inequality $400 \leq 12 \times 20 + 18x$ describes the situation. Solving

for x yields $\frac{80}{9} \leq x$. Therefore, Edgar will have to work a minimum of 9 whole hours.

Question Difficulty: Hard

Math: Question 15

$$4x(x-2)-5=7$$

What is the sum of the solutions to the equation shown above?

The correct answer is 2. Distributing $4x$ through the expression $(x - 2)$ and then subtracting 7 from both sides of the equation yields $4x^2 - 8x - 12 = 0$. Factoring out the greatest common

factor of the three terms, 4, gives $4(x^2 - 2x - 3) = 0$. The expression $x^2 - 2x - 3$ can be factored by determining two values with a sum of -2 and a product of -3 . These values are -3 and 1 .

Therefore, the equation $4(x^2 - 2x - 3) = 0$ can be rewritten as $4(x - 3)(x + 1) = 0$, and the solutions to the equation are 3 and -1 . The sum of 3 and -1 is 2 .

Question Difficulty: Hard

Math: Question 16

$$y = 2x^2 + 5$$

$$y = 2x + 9$$

If (x, y) is the solution to the system of equations above such that $x < 0$ and $y > 0$, what is the value of y ?

The correct answer is 7. Since both equations are written in terms of y , then the right sides of both equations can be set equal to each other, $2x^2 + 5 = 2x + 9$. Next, rewriting the equation in terms of 0 yields $2x^2 - 2x - 4 = 0$. Factoring the left side of the equation gives $2(x - 2)(x + 1)$.

Therefore, $x = 2$ and $x = -1$; but since $x < 0$, then x can only be equal to -1 . Substituting -1 for x in either of the given equations yields $y = 7$.

Question Difficulty: Hard