Math: Question 1

A group of monarch butterflies migrated from Chicago, Illinois, to Michoacán, Mexico, flying a total of 2,100 miles. It took a single butterfly in the group 120 days to travel this route one way. On average, how many miles did the butterfly travel per day?

A. 0.057
B. 0.729
C. 17.5
D. 24

Choice C is correct. If the butterfly traveled 2,100 miles in 120 days, then it traveled, on average, $\frac{2{,}100 \text{ miles}}{120 \text{ days}} = 17.5$ miles per day.

Choice A is incorrect. This is approximately the average amount of time, in days, it took the butterfly to fly one mile: $\frac{120 \text{ days}}{2{,}100 \text{ miles}} = 0.057$ days per mile. Choice B is incorrect and may result from an arithmetic error. Choice D is incorrect. This is the number of hours in a day rather than the number of miles flown per day.

Question Difficulty: Easy

Math: Question 2

A chemistry experiment requires three beakers containing different amounts, in milliliters (mL), of a saline solution. The three beakers contain 120 mL, 340 mL, and 275 mL of solution, respectively. What is the approximate total number of ounces of saline solution contained in the three beakers? (Use 1 ounce = 29.5735 milliliters.)

A. 15.55
B. 20.80
C. 21.74
D. 24.85

Choice D is correct. The total amount, in milliliters (mL), of saline solution in the beakers is $120+340+275=735$ mL. Converting to ounces yields $(735 \text{ mL})\left(\frac{1 \text{ ounce}}{29.5735 \text{ mL}}\right)=24.85333$ ounces, or approximately 24.85 ounces.

Choice A is incorrect and may result from calculating the amount of saline solution in the first two beakers while omitting the amount in the third. Choice B is incorrect and may result from calculating the amount of saline solution in the second and third beakers while omitting the amount in the first. Choice C is incorrect. This is the number of liters that corresponds to 735 ounces.

Question Difficulty: Easy

Math: Question 3

$\frac{3}{4}x + ax = 10$

In the equation above, a is a constant. If $x = 24$ is the solution to the equation, what is the value of a ?

A. $-\frac{4}{3}$

B. $-\frac{1}{3}$

C. $\frac{40}{99}$

D. $\frac{7}{6}$

Choice B is correct. If $x = 24$ is the solution to the equation, then a must satisfy $\frac{3}{4}(24) + a(24) = 10$. Simplifying gives $18 + 24a = 10$, which can be further simplified to $24a = -8$, or $a = -\frac{1}{3}$.

Choice A is incorrect and may result from taking the negative reciprocal of the coefficient $\frac{3}{4}$ in the given equation. The solution when $a = -\frac{4}{3}$ is $x = -\frac{120}{7}$, which isn't the given solution. Choice C is incorrect. This is the value of x that is the solution to the equation when $a = 24$, not the value of a that produces $x = 24$ as the solution to the equation. Choice D is incorrect and may result from adding 18 to 10 rather than subtracting 18 from 10 when solving $18 + 24a = 10$ for a.

Question Difficulty: Medium

Math: Question 4

$C = 1.6(30w + 70)$

The formula above can be used to approximate the daily energy requirement C, in calories, of an adult dog in terms of the dog's weight w, in kilograms. Based on the formula, if a dog has a daily energy requirement of at least 1,120 calories and at most 1,216 calories, which of the following inequalities represents the range of all possible values of the dog's body weight, to the nearest tenth of a kilogram?

A. $21.0 \le w \le 23.0$
B. $21.9 \le w \le 23.9$
C. $24.8 \le w \le 26.8$
D. $25.7 \le w \le 27.7$

Choice A is correct. If a dog requires 1,120 calories per day, then the value 1,120 can be substituted for C in the given equation and its weight w must satisfy $1{,}120 = 1.6(30w + 70)$. Expanding the right-hand side of the equation yields $1{,}120 = 48w + 112$. This equation simplifies to $1{,}008 = 48w$, or $w = 21$ kilograms. Similarly, if a dog requires 1,216 calories per day, then the value 1,216 can be substituted for C in the given equation and its weight w must satisfy $1{,}216 = 1.6(30w + 70)$. This simplifies to $1{,}216 = 48w + 112$, or $1{,}104 = 48w$, so $w = 23$ kilograms. Therefore, if a dog requires at least 1,120 calories per day but no more than 1,216 calories per day, its approximate weight must fall between those two values, so $21 \le w \le 23$.

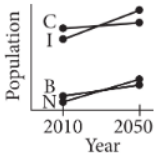
Choice B is incorrect and may result from neglecting to distribute the factor of 1.6 across the 70 term. Choice C is incorrect and may result from neglecting to distribute the factor of 1.6 across the 70 term and then adding 70 to the left-hand side of the equation. Choice D is incorrect and may result from adding 112 to, rather than subtracting 112 from, the left-hand side of the equation.

Question Difficulty: Medium

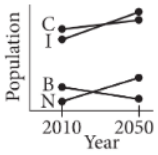
Math: Question 5

	2010	2050 (projected)
China (C)	1,371	1,437
India (I)	1,150	1,628
Brazil (B)	193	260
Nigeria (N)	160	299

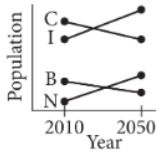
The table above shows the population, in millions, of four countries in 2010 and the projected population of each country in 2050. If the population of each country were to increase at a constant rate from 2010 to 2050, which of the following graphs could model the populations from 2010 to 2050?



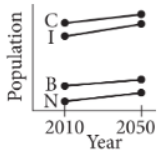
A.



B.



C.



D.

Choice A is correct. All four countries have projected populations for 2050 that are greater than their respective actual populations in 2010; therefore, all four lines in the graph must have a positive slope. Additionally, Nigeria had a smaller population than Brazil in 2010 but is projected to have a greater population than Brazil in 2050, so the N and B lines must cross. Likewise, India had a smaller population than China in 2010 but is projected to have a greater population than China in

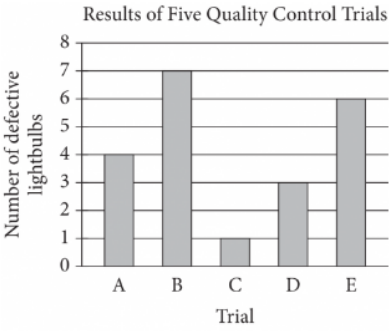
2050, so the I and C lines must also cross. Choice A is the only choice with a graph where all the lines have positive slope, the N and B lines cross, and the I and C lines cross.

Choices B and C are incorrect. According to the table, Brazil is projected to have a larger population in 2050 than it did in 2010, but these graphs show Brazil with a smaller population in 2050 than in 2010. Choice D is incorrect. According to the table, Nigeria is projected to have a larger population than Brazil in 2050, but this graph shows Nigeria with a smaller population than Brazil in 2050.

Question Difficulty: Medium

Math: Question 6

Questions 6-8 refer to the following information.



For quality control, a company that manufactures lightbulbs conducted five different trials. In each trial, 500 different lightbulbs were tested. The bar graph above shows the number of defective lightbulbs found in each trial.

What is the mean number of defective lightbulbs for the five trials?

A. 4.0
B. 4.2
C. 4.6
D. 5.0

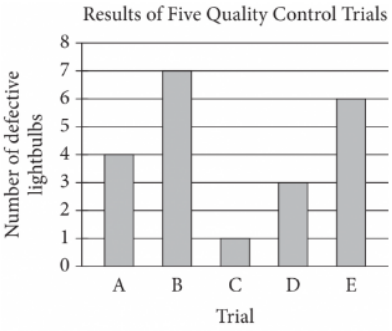
Choice B is correct. The numbers of defective lightbulbs found for the five trials are 4, 7, 1, 3, and 6, respectively. The mean is therefore $\frac{4+7+1+3+6}{5}=4.2$.

Choice A is incorrect. This is the median number of defective lightbulbs for the five trials. Choice C is incorrect and may result from an arithmetic error. Choice D is incorrect and may result from mistaking the number of trials for the number of defective lightbulbs.

Question Difficulty: Easy

Math: Question 7

Questions 6-8 refer to the following information.



For quality control, a company that manufactures lightbulbs conducted five different trials. In each trial, 500 different lightbulbs were tested. The bar graph above shows the number of defective lightbulbs found in each trial.

What is the ratio of the number of defective lightbulbs in Trial D to the median number of defective lightbulbs for the five trials?

A. 1:7
B. 1:6
C. 3:5
D. 3:4

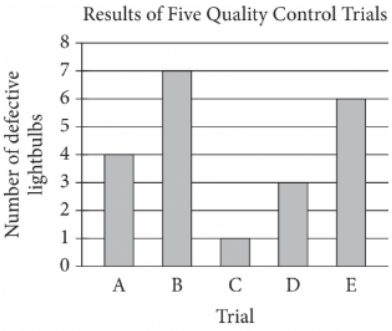
Choice D is correct. The numbers of defective lightbulbs found for the five trials are 4, 7, 1, 3, and 6, respectively. Ordered from least to greatest, the numbers are 1, 3, 4, 6, and 7. The middle value of these is 4, so that is the median. According to the bar graph, there were 3 defective lightbulbs in Trial D, so the ratio of defective lightbulbs to the median is 3:4.

Choice A is incorrect. This is the ratio of the least number of defective lightbulbs in a single trial to the greatest number of defective lightbulbs in a single trial. Choice B is incorrect. This is the ratio of the number of defective lightbulbs in Trial C to the number in Trial E. Choice C is incorrect. This is the ratio of the number of defective lightbulbs in Trial D to the number of trials.

Question Difficulty: Medium

Math: Question 8

Questions 6-8 refer to the following information.



For quality control, a company that manufactures lightbulbs conducted five different trials. In each trial, 500 different lightbulbs were tested. The bar graph above shows the number of defective lightbulbs found in each trial.

In Trial B, what percent of the lightbulbs were defective?

A. 0.70%
B. 0.84%
C. 1.40%
D. 7.00%

Choice C is correct. Each trial involved 500 lightbulbs. In Trial B, 7 lightbulbs were defective. Therefore, the fraction of lightbulbs that were defective is $\frac{7}{500} = 0.014$, or 1.40%.

Choice A is incorrect and may result from calculating the percent using 1,000 instead of 500 as the denominator. Choice B is incorrect. This is the percent of defective lightbulbs across all five trials. Choice D is incorrect and may result from mistaking the number of defective lightbulbs in Trial B for the percent.

Question Difficulty: Hard

Math: Question 9

On a certain day, an air traffic controller determined the number of airplanes that took off from runway M was 3 times the number that took off from runway Q. And on that day, a total of 120 airplanes took off from the two runways. If m and q represent the number of airplanes that took off from runways M and Q, respectively, which of the following systems of equations models the situation?

A. $m = 3q$
$m + q = 120$

B. $3m = q$
$m + q = 120$

C. $m = q$
$m + q = 120$

D. $3m = q$
$m + 3q = 120$

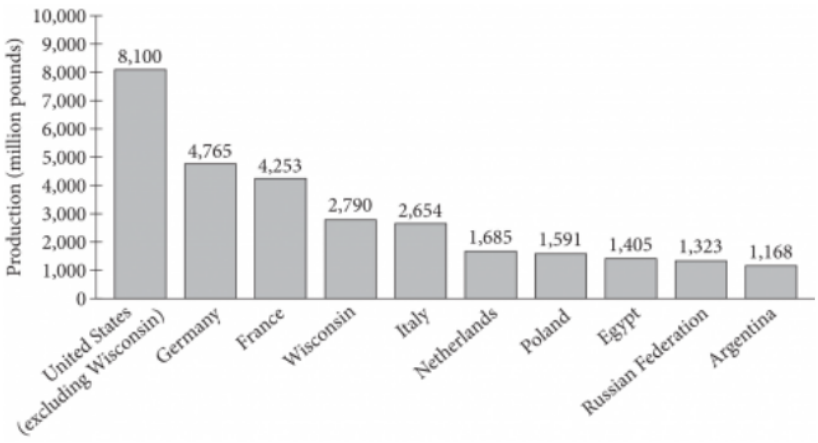
Choice A is correct. It's given that the number of planes that took off from runways M and Q are represented by m and q, respectively. If 3 times as many planes took off from runway M as from runway Q, then $m = 3q$. The total number of planes that took off from runways M and Q combined was 120, so $m + q = 120$. Choice A includes both of these equations.

Choices B and D are incorrect. Both choices include the equation $3m = q$, which represents a situation where 3 times as many planes took off from runway Q as from runway M. Choice C is incorrect. This choice includes the equation $m = q$, which represents a situation where the same number of planes took off from runways M and Q.

Question Difficulty: Medium

Math: Question 10

Questions 10 and 11 refer to the following information.



The bar graph above shows information from 2012 on the production of cheese in Wisconsin and comparative production figures for the nine top cheese-producing countries.

In 2012, Wisconsin produced 951,571,000 pounds of mozzarella cheese. Which of the following is closest to the percent of Wisconsin cheese production that was mozzarella? (1 million = 1,000,000)

A. 15%
B. 22%
C. 34%
D. 42%

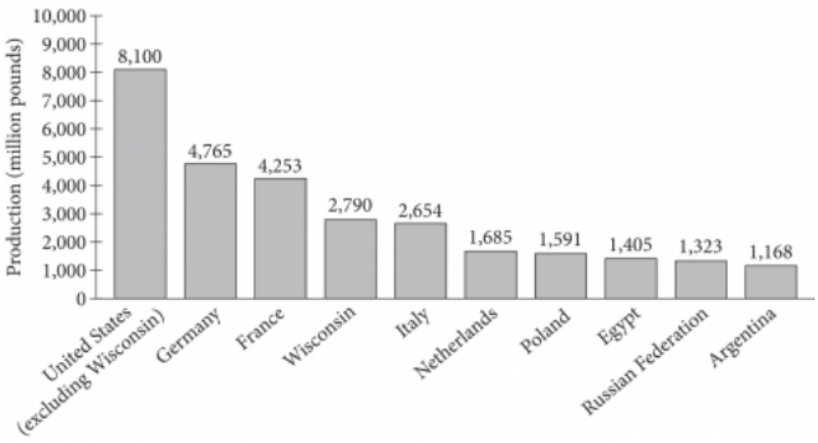
Choice C is correct. According to the bar graph, Wisconsin's total cheese production in 2012 was 2,790,000,000 pounds. It's given that 951,571,000 pounds of mozzarella were produced in Wisconsin in 2012. Therefore, the fraction of the total production that was mozzarella was $\frac{951,571,000}{2,790,000,000} = 0.34106...$, which rounds to 0.34, or 34%.

Choices A, B, and D are incorrect and may result from misreading Wisconsin's total cheese production from the bar graph or making a calculation error.

Question Difficulty: Medium

Math: Question 11

Questions 10 and 11 refer to the following information.



The bar graph above shows information from 2012 on the production of cheese in Wisconsin and comparative production figures for the nine top cheese-producing countries.

Of the following, which best approximates the ratio of the cheese production in the United States (excluding Wisconsin) to that in Wisconsin in 2012?

A. 1:3
B. 2:5
C. 5:2
D. 3:1

Choice D is correct. According to the bar graph, the total cheese production in the United States (excluding Wisconsin) was 8,100 million pounds, while the total production in Wisconsin was 2,790 million pounds. The ratio is therefore 8,100:2,790. The fraction $\frac{8,100}{2,790}$ reduces to approximately 2.903, which rounds to 3, so the ratio can be approximated as 3:1.

Choice A is incorrect and results from computing the approximate ratio of cheese production in Wisconsin to that in the United States, not the reverse. Choices B and C are incorrect and may result from misreading Wisconsin's total cheese production from the bar graph.

Question Difficulty: Medium

Math: Question 12

The table below shows the number of state parks in a certain state that contain camping facilities and bicycle paths.

	Has bicycle paths	Does not have bicycle paths
Has camping facilities	20	5
Does not have camping facilities	8	4

If one of these state parks is selected at random, what is the probability that it has camping facilities but does not have bicycle paths?

A. $\frac{5}{37}$

B. $\frac{5}{25}$

C. $\frac{8}{28}$

D. $\frac{5}{9}$

Choice A is correct. The total number of state parks in the state is $20+5+8+4=37$. According to the table, 5 of these have camping facilities but not bicycle paths. Therefore, if a state park is selected at random, the probability that it has camping facilities but not bicycle paths is $\frac{5}{37}$.

Choice B is incorrect. This is the probability that a state park selected at random from the state parks with camping facilities does not have bicycle paths. Choice C is incorrect. This is the probability that a state park selected at random from the state parks with bicycle paths does not have camping facilities. Choice D is incorrect. This is the probability that a state park selected at random from the state parks without bicycle paths does have camping facilities.

Question Difficulty: Medium

Math: Question 13

The results of two independent surveys are shown in the table below.

		Men's Height	
Group	Sample size	Mean (centimeters)	Standard deviation (centimeters)
A	2,500	186	12.5
B	2,500	186	19.1

Which statement is true based on the table?

A. The Group A data set was identical to the Group B data set.
B. Group B contained the tallest participant.
C. The heights of the men in Group B had a larger spread than the heights of the men in Group A.
D. The median height of Group B is larger than the median height of Group A.

Choice C is correct. Standard deviation is a measure of spread, so data sets with larger standard deviations tend to have larger spread. The standard deviation of the heights of the men in Group B is larger than the standard deviation of the heights of the men in Group A. Therefore, the heights of the men in Group B had a larger spread than the heights of the men in Group A.

Choice A is incorrect. If two data sets are identical, they will have equivalent means and equivalent standard deviations. Since the two data sets have different standard deviations, they cannot be identical. Choice B is incorrect. Without knowing the maximum value for each data set, it's impossible to know which group contained the tallest participant. Choice D is incorrect. Since the means of the two groups are equivalent, the medians could also be the same or could be different, but it's impossible to tell from the given information.

Question Difficulty: Medium

Math: Question 14

$p(m) = 2m + 8$

The function p above models the total price $p(m)$, in dollars, of streaming m movies per month from an online movie subscription service. The subscription service charges an $8 monthly fee plus an additional fee per movie streamed. Which of the following is the best interpretation of $p(10)$ in this context?

A. The total price for streaming 1 movie in a month is $10.
B. The total price for streaming 2 movies in a month is $10.
C. When 10 movies are streamed in a month, the total price that month is $18.
D. When 10 movies are streamed in a month, the total price that month is $28.

Choice D is correct. The expression $p(10)$ refers to the value of p when $m = 10$. Since $p(m)$ is the price of streaming m movies per month, $p(10)$ is the price when 10 movies are streamed in a month. Substituting these values into the given function $p(m)$ yields $p(10) = 2(10) + 8$, which simplifies to 28. Therefore, the interpretation of the expression $p(10)$ is that when 10 movies are streamed in a month, the total price that month is $28.

Choice A is incorrect. This is the interpretation of the equation $p(1) = 10$. Choice B is incorrect and may result from making a calculation error and interpreting the equation $p(2) = 10$. Choice C is incorrect and may result from ignoring the coefficient of 2 when evaluating $p(10)$.

Question Difficulty: Medium

Math: Question 15

$$\frac{4x}{2(x^2-1)}-\frac{3x}{3(x^2-1)}$$

Which of the following is equivalent to the expression above for $x \neq -1$ and $x \neq 1$?

A. $\frac{1}{6(x-1)}$

B. $\frac{x}{6(x^2-1)}$

C. $\frac{1}{x-1}$

D. $\frac{x}{x^2-1}$

Choice D is correct. Multiplying the first fraction by $\frac{3}{3}$ and multiplying the second fraction by $\frac{2}{2}$ results in both fractions having a common denominator: $\frac{4x}{2(x^2-1)}-\frac{3x}{3(x^2-1)}=\frac{(3)(4x)}{(3)(2)(x^2-1)}-\frac{(2)(3x)}{(2)(3)(x^2-1)}$. Simplifying yields $\frac{12x}{6(x^2-1)}-\frac{6x}{6(x^2-1)}=\frac{6x}{6(x^2-1)}$. Reducing this fraction then yields $\frac{x}{x^2-1}$.

Choice A is incorrect and may result from misreading a term in the denominator as (x^2-x) and from neglecting to cancel the factor of 6 in the denominator. Choice B is incorrect and may result from neglecting to cancel the factor of 6 in the denominator. Choice C is incorrect and may result from misreading a term in the denominator as (x^2-x).

Question Difficulty: Medium

Math: Question 16

In the xy-plane, line l contains the points $(2,6)$ and $(8,10)$. Which of the following is an equation of line l ?

A. $y=\frac{2}{3}x+\frac{14}{3}$

B. $y=\frac{3}{2}x-2$

C. $y=2x+6$

D. $y=8x+10$

Choice A is correct. Given two points on a line, (x_1, y_1) and (x_2, y_2), the slope of the line can be calculated as $\frac{y_2-y_1}{x_2-x_1}$. Therefore, the slope of line l is $\frac{10-6}{8-2}=\frac{4}{6}$, which simplifies to $\frac{2}{3}$. The equation for line l can thus be written in slope-intercept form as $y=\frac{2}{3}x+b$ for some value of b. The value of b can be found by substituting the x- and y-values of one of the given points into the equation. So $6=\frac{2}{3}(2)+b$, which solves to $b=\frac{14}{3}$. Substituting this value into the slope-intercept form of the equation gives $y=\frac{2}{3}x+\frac{14}{3}$.

Choice B is incorrect and may result from reversing x and y when calculating the slope. Choice C is incorrect and may result from using the x- and y-coordinates of the first given point as the slope and constant, respectively, in the equation. Choice D is incorrect and may result from using the x- and y-coordinates of the second given point as the slope and constant, respectively, in the equation.

Question Difficulty: Hard

Math: Question 17

If $x \neq 0$, which of the following expressions is equivalent to $\frac{\sqrt{16x^4y^8}}{x^3}$?

A. $8x^2y^4$

B. $4xy^4$

C. $4x^{-2}y^2$

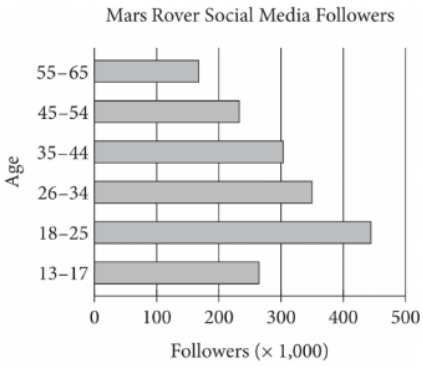
D. $4x^{-1}y^4$

Choice D is correct. Taking the square root of an exponential expression halves the exponent, so $\frac{\sqrt{16x^4y^8}}{x^3} = \frac{4x^2y^4}{x^3}$, which further reduces to $\frac{4y^4}{x}$. This can be rewritten as $4x^{-1}y^4$.

Choice A is incorrect and may result from neglecting the denominator of the given expression and from incorrectly calculating the square root of 16. Choice B is incorrect and may result from rewriting $\frac{1}{x}$ as x^1 rather than x^{-1}. Choice C is incorrect and may result from taking the square root of the variables in the numerator twice instead of once.

Question Difficulty: Hard

Math: Question 18



The total number of followers of a Mars rover's social media account is 1,764,000, as summarized by age in the graph above. Which of the following could be the median age of the followers?

A. 37
B. 29
C. 20
D. 16

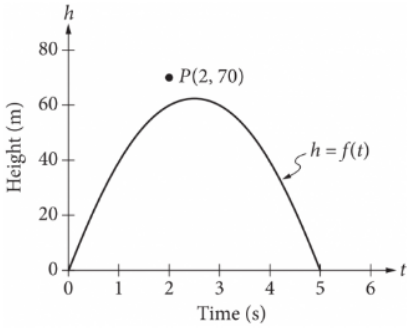
Choice B is correct. Half of 1,764,000 is 882,000, so the median age is equal to the age of the 882,000th follower when all the followers are ordered by age. According to the graph, about 260,000 followers are ages 13–17, and about 440,000 followers are ages 18–25, so about 700,000 followers are ages 13–25. Therefore, the median age of the followers must be greater than 25. About 350,000 followers are ages 26–34, so about 1,050,000 followers are ages 13–34. Therefore, the median age of the followers must be less than or equal to 34. The only choice given that is greater than 25 but less than or equal to 34 is 29.

Choice A is incorrect. According to the graph, about 710,000 followers are ages 35–65, and $710{,}000 < 882{,}000$, so the median age of the followers must be less than 35. Choice C is incorrect and may result from choosing a value that falls into the age grouping with the greatest number of followers. Choice D is incorrect and may result from choosing a value that falls into the youngest age grouping.

Question Difficulty: Hard

Math: Question 19

The height, in meters, of a golf ball t seconds after it was hit is given by the function $f(t) = at^2 + bt + c$, where a, b, and c are constants. The graph of f is shown below.



The point $P(2,70)$ represents the height of a bird at a given point in time. Which of the following expressions correctly compares the height of the ball and the height of the bird at that point in time?

A. $f(70) > 2$

B. $f(70) < 2$

C. $f(2) > 70$

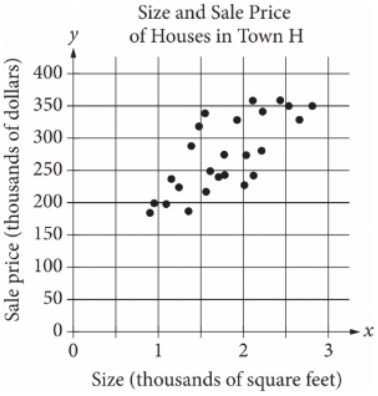
D. $f(2) < 70$

Choice D is correct. The function graphed in the th-plane is $f(t)$, and at point P, $t = 2$ and $h = 70$. Therefore, the comparison should involve $f(2)$. At $f(2)$, the graph of $h = f(t)$ lies below 70, so $f(2)$ must be less than 70. Therefore, $f(2) < 70$.

Choice A is incorrect and may result from confusing the t- and h-values of point P and reversing the inequality. Choice B is incorrect and may result from confusing the t- and h-values of point P. Choice C is incorrect and may result from reversing the inequality.

Question Difficulty: Hard

Math: Question 20



The scatterplot above shows the size x and the sale price y of 25 houses for sale in Town H. Which of the following could be an equation for a line of best fit for the data?

A. $y = 200x + 100$

B. $y = 100x + 100$

C. $y = 50x + 100$

D. $y = 100x$

Choice B is correct. From the shape of the cluster of points, the line of best fit should pass roughly through the points $(1,200)$ and $(2.5,350)$. Therefore, these two points can be used to find an approximate equation for the line of best fit. The slope of this line of best fit is therefore $\frac{y_2 - y_1}{x_2 - x_1} = \frac{350 - 200}{2.5 - 1}$, or 100. The equation for the line of best fit, in slope-intercept form, is $y = 100x + b$ for some value of b. Using the point $(1,200)$, 1 can be substituted for x and 200 can be substituted for y: $200 = 100(1) + b$, or $b = 100$. Substituting this value into the slope-intercept form of the equation gives $y = 100x + 100$.

Choice A is incorrect. The line defined by $y = 200x + 100$ passes through the points $(1,300)$ and $(2,500)$, both of which are well above the cluster of points, so it cannot be a line of best fit. Choice C is incorrect. The line defined by $y = 50x + 100$ passes through the points $(1,150)$ and $(2,200)$, both of which lie at the bottom of the cluster of points, so it cannot be a line of best fit. Choice D is incorrect and may result from correctly calculating the slope of a line of best fit but incorrectly assuming the y-intercept is at $(0,0)$.

Question Difficulty: Hard

Math: Question 21

Trisha and Stacy each work at their own constant rate, whether they work alone or work together. If working alone, Trisha can finish a job 15 minutes faster than Stacy can. The equation $\frac{1}{x}+\frac{1}{x+15}=\frac{1}{18}$ can be used to find the time x, in minutes, it takes Trisha to finish the job working alone. Which of the following is the best interpretation of the number 18 in the equation?

A. The number of minutes it takes Trisha to finish the job working alone
B. The number of minutes it takes Stacy to finish the job working alone
C. The number of minutes it takes both of them to finish the job working together
D. The sum of the number of minutes it takes Trisha and the number of minutes it takes Stacy to each finish the job working alone

Choice C is correct. Since x is the time, in minutes, it takes Trisha to finish the job working alone, and Stacy takes 15 minutes longer than Trisha, the time it takes Stacy to finish the job working alone is $x+15$ minutes. Therefore, the reciprocals of those times, $\frac{1}{x}$ and $\frac{1}{x+15}$, represent the fraction of the job Trisha and Stacy, respectively, can each finish in a minute. The sum of those two reciprocals is thus the fraction of the job the two of them can finish in a minute when they work together. Since it's given that the sum of the two reciprocals is $\frac{1}{18}$, they can finish $\frac{1}{18}$ of the job in one minute when they work together. Therefore, they can finish the entire job in 18 minutes when working together. The best interpretation of 18 in the equation is the number of minutes it takes both of them to finish the job working together.

Choice A is incorrect. This is represented by x in the equation. Choice B is incorrect. This is represented by $x+15$ in the equation. Choice D is incorrect and may result from assuming that the time it takes Stacy and Trisha to do the job together is the same as the combined time it takes each of them to do the job alone.

Question Difficulty: Hard

Math: Question 22

If $2y = x + 40$ and $3x = y + 20$, what is the value of $x + y$?

A. 28
B. 34
C. 38
D. 44

Choice D is correct. The second equation can be rewritten as $y = 3x - 20$. Substituting $3x - 20$ for y in the first equation yields $2(3x - 20) = x + 40$, which expands to $6x - 40 = x + 40$. Rearranging yields $5x = 80$, so $x = 16$. Substituting 16 for x in the rewritten second equation yields $y = 3(16) - 20$, so $y = 28$. Therefore, $x + y = 16 + 28$, or 44.

Choice A is incorrect. This is the value of y. Choice B is incorrect and may result from an arithmetic error when adding the values of x and y. Choice C is incorrect and may result from solving for y and from an arithmetic error.

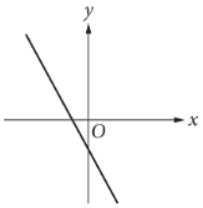
Question Difficulty: Hard

Math: Question 23

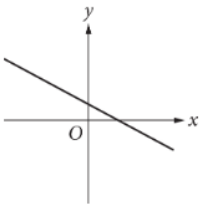
$Ax + By = C$

In the equation above, A, B, and C are positive constants. Which of the following could be the graph of the equation in the xy-plane?

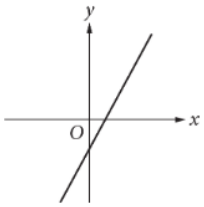
A.



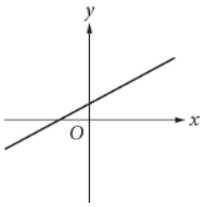
B.



C.



D.



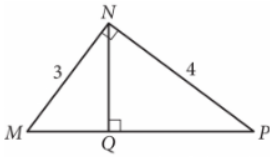
Choice B is correct. The equation $Ax + By = C$ can be rearranged as $By = -Ax + C$. Dividing both sides of the equation by B yields $y = -\frac{A}{B}x + \frac{C}{B}$. This is the equation of a line with slope $-\frac{A}{B}$ and a y-intercept at $\left(0, \frac{C}{B}\right)$. Since A and B are both positive, $\frac{A}{B}$ is positive and $-\frac{A}{B}$ must be negative. Therefore, the slope of the line is negative. Since B and C are both positive, $\frac{C}{B}$ must be positive, so the y-coordinate of the y-intercept of the line must be positive. The only graph of a line with a negative slope and positive y-coordinate of the y-intercept is choice B.

Choices A and C are incorrect. The y-intercept of the line represented by the equation is $\left(0, \frac{C}{B}\right)$. Since constants C and B are both positive, the y-coordinate of the y-intercept of the line must be positive. However, the lines graphed in choices A and C both have y-intercepts with negative y-

coordinates. Choice D is incorrect. The slope of the line represented by the equation is $-\frac{A}{B}$. Since constants A and B are both positive, $-\frac{A}{B}$ must be negative. However, this graphed line has a positive slope.

Question Difficulty: Hard

Math: Question 24



In the figure above, what is the length of $\overline{NQ}$?

A. 2.2
B. 2.3
C. 2.4
D. 2.5

Choice C is correct. First, $\overline{MP}$ is the hypotenuse of right $\triangle MNP$, whose legs have lengths 3 and 4. Therefore, $(MP)^2 = 3^2 + 4^2$, so $(MP)^2 = 25$ and $MP = 5$. Second, because $\angle MNP$ corresponds to $\angle NQP$ and because $\angle MPN$ corresponds to $\angle NPQ$, $\triangle MNP$ is similar to $\triangle NQP$. The ratio of corresponding sides of similar triangles is constant, so $\frac{NQ}{MN} = \frac{NP}{MP}$. Since $MP = 5$ and it's given that $MN = 3$ and $NP = 4$, $\frac{NQ}{3} = \frac{4}{5}$. Solving for NQ results in $NQ = \frac{12}{5}$, or 2.4.

Choices A, B, and D are incorrect and may result from setting up incorrect ratios.

Question Difficulty: Hard

Math: Question 25

The table below shows the distribution of US states according to whether they have a state-level sales tax and a state-level income tax.

	2013 State-Level Taxes	
	State sales tax	No state sales tax
State income tax	39	4
No state income tax	6	1

To the nearest tenth of a percent, what percent of states with a state-level sales tax do not have a state-level income tax?

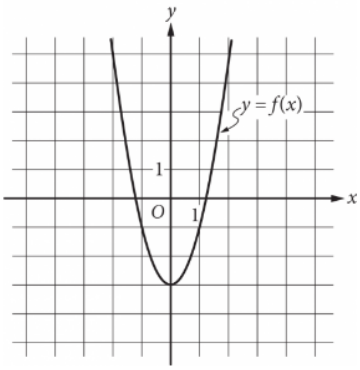
A. 6.0%
B. 12.0%
C. 13.3%
D. 14.0%

Choice C is correct. The sum of the number of states with a state-level sales tax is $39 + 6 = 45$. Of these states, 6 don't have a state-level income tax. Therefore, $\frac{6}{45} = 0.1333...$, or about 13.3%, of states with a state-level sales tax don't have a state-level income tax.

Choice A is incorrect. This is the number of states that have a state-level sales tax and no state-level income tax. Choice B is incorrect. This is the percent of states that have a state-level sales tax and no state-level income tax. Choice D is incorrect. This is the percent of states that have no state-level income tax.

Question Difficulty: Hard

Math: Question 26



The graph of $f(x)$ is shown above. If $g(x)=(x-1)(x-5)$, what is the value of $g(0)-f(0)$?

A. 8
B. 2
C. 0
D. -2

Choice A is correct. From the graph, it is evident that the graph passes through the point $(0,-3)$. Therefore, $f(0)=-3$. Also, $g(0)=(0-1)(0-5)=5$. Therefore, $g(0)-f(0)=5-(-3)=8$.

Choice B is incorrect and may result from incorrectly calculating $5-(-3)$ as 2. Choice C is incorrect and may result from misreading the input values as output values. Choice D is incorrect and may result from incorrectly calculating $5-(-3)$ as -2.

Question Difficulty: Hard

Math: Question 27

$ax + b = 3x - 4$

In the equation above, a and b are constants. If the equation has no solution, which of the following statements must be true about a and b ?

A. $a \neq 3$ and $b \neq 4$

B. $a = 3$ and $b \neq -4$

C. $a = 3$ and $b = -4$

D. $a = -3$ and $b = 4$

Choice B is correct. A linear equation has no solution when the variable terms cancel out of the equation and the remaining statement is false. Rearranging the equation so the variable terms are on the left-hand side and the constant terms are on the right-hand side produces $ax - 3x = -4 - b$. The variable terms will cancel if $a = 3$. Substituting 3 for a in the rearranged equation produces $3x - 3x = -4 - b$, which simplifies to $0 = -4 - b$ or $b = -4$. This equation will be true for all values of x if $b = -4$, and it will be false, or have no solution, when $b \neq -4$. Therefore, the original equation isn't true if $a = 3$ and $b \neq -4$.

Choices A and D are incorrect and may result from sign errors. Choice C is incorrect. These values will result in an equation with infinitely many solutions rather than no solution.

Question Difficulty: Hard

Math: Question 28

Genre	Percent of video game sales
Action	29%
Family	28%
Sports	32%
Strategy	6%
Other	5%

The table above shows the distribution of genres of video games sold by a gaming company in 2010. If the total number of games sold by the gaming company was 250,000, in how many of the genres were more than 40,000 games sold?

The correct answer is 3. Since a total of 250,000 games were sold, 40,000 games is equivalent to $\left(\frac{40{,}000}{250{,}000}\right)100 = 16\%$ of the games. Therefore, any genre that accounts for 16% or more of the total number of games sold had more than 40,000 games sold. Action, Family, and Sports fit this condition, so 3 genres sold more than 40,000 games.

Question Difficulty: Medium

Math: Question 29

$(x-9)(x+3)=-36$

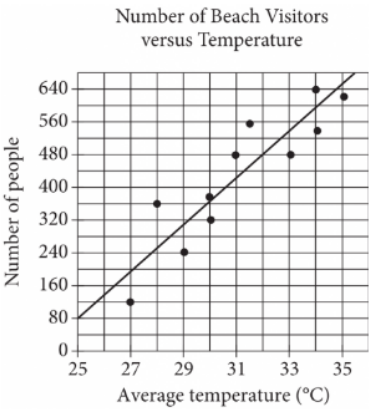
In the equation above, what is the value of $x+3$?

The correct answer is 6. Distributing the expressions in parentheses results in $x^2-6x-27=-36$. Adding 36 to both sides results in $x^2-6x+9=0$. Factoring yields $(x-3)(x-3)=0$. Setting each factor equal to 0 yields $x-3=0$ and $x-3=0$. Solving for x produces $x=3$. Substituting 3 for x in the expression $x+3$ yields $3+3=6$.

Question Difficulty: Hard

Math: Question 30

Questions 30 and 31 refer to the following information.



Each dot in the scatterplot above represents the temperature and the number of people who visited a beach in Lagos, Nigeria, on one of eleven different days. The line of best fit for the data is also shown.

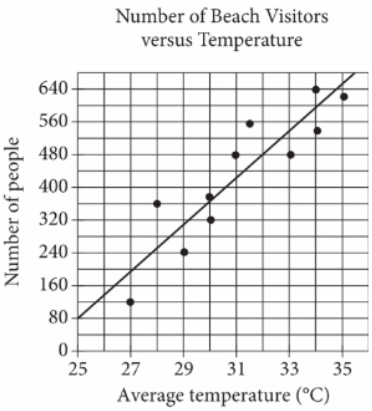
According to the line of best fit, what is the number of people, rounded to the nearest 10, predicted to visit this beach on a day with an average temperature of 32°C?

The correct answer is 480. An average temperature of 32°C corresponds to the value 32 on the x-axis. On the line of best fit, an x-value of 32 corresponds to a y-value of 480. The values on the y-axis correspond to the number of people predicted to visit this beach. Therefore, 480 people are predicted to visit this beach on a day with an average temperature of 32°C.

Question Difficulty: Medium

Math: Question 31

Questions 30 and 31 refer to the following information.



Each dot in the scatterplot above represents the temperature and the number of people who visited a beach in Lagos, Nigeria, on one of eleven different days. The line of best fit for the data is also shown.

The line of best fit for the data has a slope of approximately 57. According to this estimate, how many additional people per day are predicted to visit the beach for each 5°C increase in average temperature?

The correct answer is 285. The number of people predicted to visit the beach each day is represented by the y-values of the line of best fit, and the average temperature, in degrees Celsius ($°C$), is represented by the x-values. Since the slope of the line of best fit is approximately 57, the y-value, or the number of people predicted to visit the beach each day, increases by 57 for every x-value increase of 1, or every $1°C$ increase in average temperature. Therefore, an increase of $5°C$ in average temperature corresponds to a y-value increase of $57(5) = 285$ additional people per day predicted to visit the beach.

Question Difficulty: Hard

Math: Question 1

$51 = 7 + 2x$

What value of x satisfies the equation above?

A. 58
B. 44
C. 29
D. 22

Choice D is correct. Subtracting 7 from both sides of the equation results in $44 = 2x$. Dividing both sides by 2 yields $x = 22$.

Choice A is incorrect and may result from adding 7 to, rather than subtracting 7 from, both sides of the equation and from not dividing both sides by 2. Choice B is incorrect and may result from subtracting 7 from both sides of the equation but not dividing both sides by 2. Choice C is incorrect and may result from adding 7 to, rather than subtracting 7 from, both sides of the equation and then dividing both sides by 2.

Question Difficulty: Easy

Math: Question 2

$3a+4b=25$

A shipping company charged a customer $25 to ship some small boxes and some large boxes. The equation above represents the relationship between a, the number of small boxes, and b, the number of large boxes, the customer had shipped. If the customer had 3 small boxes shipped, how many large boxes were shipped?

A. 3
B. 4
C. 5
D. 6

Choice B is correct. It's given that a represents the number of small boxes and b represents the number of large boxes the customer had shipped. If the customer had 3 small boxes shipped, then $a=3$. Substituting 3 for a in the equation $3a+4b=25$ yields $3(3)+4b=25$ or $9+4b=25$. Subtracting 9 from both sides of the equation yields $4b=16$. Dividing both sides of this equation by 4 yields $b=4$. Therefore, the customer had 4 large boxes shipped.

Choices A, C, and D are incorrect. If the number of large boxes shipped is 3, then $b=3$. Substituting 3 for b in the given equation yields $3a+4(3)=25$ or $3a+12=25$. Subtracting 12 from both sides of the equation and then dividing by 3 yields $a=\frac{13}{3}$. However, it's given that the number of small boxes shipped, a, is 3, not $\frac{13}{3}$, so b cannot equal 3. Similarly, if $b=5$ or $b=6$, then $a=\frac{5}{3}$ or $a=\frac{1}{3}$, respectively, which is also not true.

Question Difficulty: Easy

Math: Question 3

On January 1, 2015, a city's minimum hourly wage was $9.25. It will increase by $0.50 on the first day of the year for the next 5 years. Which of the following functions best models the minimum hourly wage, in dollars, x years after January 1, 2015, where $x = 1, 2, 3, 4, 5$?

A. $f(x) = 9.25 - 0.50x$

B. $f(x) = 9.25x - 0.50$

C. $f(x) = 9.25 + 0.50x$

D. $f(x) = 9.25x + 0.50$

Choice C is correct. It's given that the city's minimum hourly wage will increase by $0.50 on the first day of the year for the 5 years after January 1, 2015. Therefore, the total increase, in dollars, in the minimum hourly wage x years after January 1, 2015, is represented by $0.50x$. Since the minimum hourly wage on January 1, 2015, was $9.25, it follows that the minimum hourly wage, in dollars, x years after January 1, 2015, is represented by $9.25 + 0.50x$. Therefore, the function $f(x) = 9.25 + 0.50x$ best models this situation.

Choices A, B, and D are incorrect. In choice A, the function models a situation where the minimum hourly wage is $9.25 on January 1, 2015, but decreases by $0.50 on the first day of the year for the next 5 years. The functions in choices B and D both model a situation where the minimum hourly wage is increasing by $9.25 on the first day of the year for the 5 years after January 1, 2015.

Question Difficulty: Medium

Math: Question 4

$F = 2.50x + 7.00y$

In the equation above, F represents the total amount of money, in dollars, a food truck charges for x drinks and y salads. The price, in dollars, of each drink is the same, and the price, in dollars, of each salad is the same. Which of the following is the best interpretation for the number 7.00 in this context?

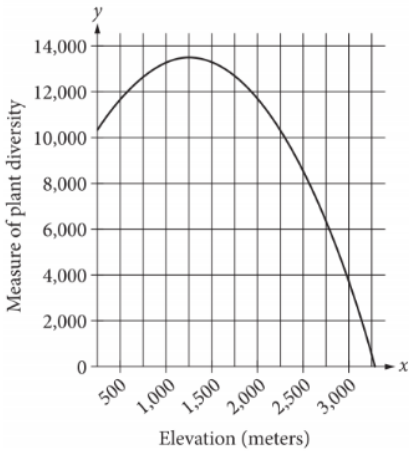
A. The price, in dollars, of one drink
B. The price, in dollars, of one salad
C. The number of drinks bought during the day
D. The number of salads bought during the day

Choice B is correct. It's given that $2.50x + 7.00y$ is equal to the total amount of money, in dollars, a food truck charges for x drinks and y salads. Since each salad has the same price, it follows that the total charge for y salads is $7.00y$ dollars. When $y = 1$, the value of the expression $7.00y$ is 7.00×1, or 7.00. Therefore, the price for one salad is 7.00 dollars.

Choice A is incorrect. Since each drink has the same price, it follows that the total charge for x drinks is $2.50x$ dollars. Therefore, the price, in dollars, for one drink is 2.50, not 7.00. Choices C and D are incorrect. In the given equation, F represents the total charge, in dollars, when x drinks and y salads are bought at the food truck. No information is provided about the number of drinks or the number of salads that are bought during the day. Therefore, 7.00 doesn't represent either of these quantities.

Question Difficulty: Medium

Math: Question 5



The quadratic function graphed above models a particular measure of plant diversity as a function of the elevation in a region of Switzerland. According to the model, which of the following is closest to the elevation, in meters, at which plant diversity is greatest?

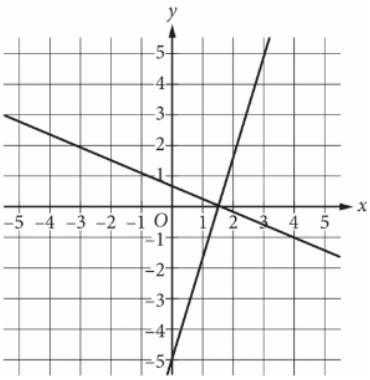
A. 13,500
B. 3,000
C. 1,250
D. 250

Choice C is correct. Each point (x, y) on the graph represents the elevation x, in meters, and the corresponding measure of plant diversity y in a region of Switzerland. Therefore, the point on the graph with the greatest y-coordinate represents the location that has the greatest measure of plant diversity in the region. The greatest y-coordinate of any point on the graph is approximately 13,500. The x-coordinate of that point is approximately 1,250. Therefore, the closest elevation at which the plant diversity is the greatest is 1,250 meters.

Choice A is incorrect. This value is closest to the greatest y-coordinate of any point on the graph and therefore represents the greatest measure of plant diversity, not the elevation where the greatest measure of plant diversity occurs. Choice B is incorrect. At an elevation of 3,000 meters the measure of plant diversity is approximately 4,000. Because there are points on the graph with greater y-coordinates, 4,000 can't be the greatest measure of plant diversity, and 3,000 meters isn't the elevation at which the greatest measure of plant diversity occurs. Choice D is incorrect. At an elevation of 250 meters, the measure of plant diversity is approximately 11,000. Because there are points on the graph with greater y-coordinates, 11,000 can't be the greatest measure of plant diversity and 250 meters isn't the elevation at which the greatest measure of plant diversity occurs.

Question Difficulty: Medium

Math: Question 6



Which of the following systems of equations has the same solution as the system of equations graphed above?

A. $y = 0$, $x = \frac{3}{2}$

B. $y = \frac{3}{2}$, $x = 0$

C. $y = 0$, $x = 1$

D. $y = 1$, $x = 0$

Choice A is correct. The solution to a system of equations is the coordinates of the intersection point of the graphs of the equations in the xy-plane. Based on the graph, the solution to the given system of equations is best approximated as $(\frac{3}{2},0)$. In the xy-plane, the graph of $y = 0$ is a horizontal line on which every y-coordinate is 0, and the graph of $x = \frac{3}{2}$ is a vertical line on which every x-coordinate is $\frac{3}{2}$. These graphs intersect at the point $(\frac{3}{2},0)$. Therefore, the system of equations in choice A has the same solution as the given system.

Choices B, C, and D are incorrect. If graphed in the xy-plane, these choices would intersect at the points $(0,\frac{3}{2})$, $(1,0)$, and $(0,1)$, respectively, not $(\frac{3}{2},0)$.

Question Difficulty: Medium

Math: Question 7

The function f defined by $f(x)=x^2$ is graphed in the xy-plane. The graph of the function g in the xy-plane is the graph of f shifted 4 units upward. Which of the following defines $g(x)$?

A. $g(x)=f(x+4)$

B. $g(x)=f(x-4)$

C. $g(x)=f(x)+4$

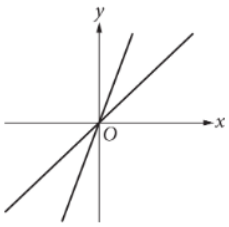
D. $g(x)=f(x)-4$

Choice C is correct. In the xy-plane, the graph of the function f is the set of all ordered pairs $(x, f(x))$. The graph of f is shifted up 4 units when the output of each of these ordered pairs is increased by 4, resulting in the set of ordered pairs $(x, f(x)+4)$. Since the function g is the function f shifted up 4 units in the xy-plane, it follows that $g(x)=f(x)+4$.

Choices A, B, and D are incorrect. In the xy-plane, the graph of $g(x)=f(x+4)$ is the graph of the function f shifted 4 units left, the graph of $g(x)=f(x-4)$ is the graph of f shifted 4 units right, and the graph of $g(x)=f(x)-4$ is the graph of f shifted 4 units down.

Question Difficulty: Medium

Math: Question 8



In the xy-plane above, two lines intersect at the origin. Which of the following pairs of equations could represent these lines, where a and b are positive constants?

A. $y = ax$
$y = bx$

B. $y = ax$
$y = -bx$

C. $y = -ax$
$y = -bx$

D. $y = ax$
$y = ax + b$

Choice A is correct. Any line in the xy-plane can be represented by an equation in the form $y = hx + k$, where h is the slope and k is the y-intercept of the line. Each of the graphed lines shown has positive slope and a y-intercept of zero. Since a and b are positive constants, of the equations given in the options, only $y = ax$ and $y = bx$ could represent the graphed lines shown.

Choices B, C, and D are incorrect. Each of the graphed lines shown has a positive slope and intersects the origin, and it is given that a and b are positive constants. In choice B the equation $y = ax$ represents a line with a positive slope that intersects the origin; however, $y = -bx$ represents a line with a negative slope that intersects the origin. In choice C each equation $y = -ax$ and $y = -bx$ represents a line with a negative slope that intersects the origin. Therefore, the equations in choice C cannot represent the graphed lines. In choice D the equation $y = ax$ represents a line with positive slope that intersects the origin; however, $y = ax + b$ represents a line with positive slope and a positive y-intercept. Therefore, the equations in choice D cannot represent the graphed lines.

Question Difficulty: Medium

Math: Question 9

$3x^2+4x-2-(x^2+2x-1)$

Which of the following is equivalent to the expression above?

A. $2x^2+2x-1$

B. $2x^2+6x-3$

C. $4x^2+2x-1$

D. $4x^2+6x-3$

Choice A is correct. The given expression $3x^2+4x-2-(x^2+2x-1)$ can be rewritten as $3x^2+4x-2+(-1)(x^2+2x-1)$. Distributing the factor of -1 yields $3x^2+4x-2-x^2-2x+1$. Regrouping like terms, this expression can be rewritten as $(3x^2-x^2)+(4x-2x)+(-2+1)$, which is equivalent to $2x^2+2x-1$.

Choices B, C, and D are incorrect and may result from errors made when applying the distributive property or errors made when adding like terms.

Question Difficulty: Medium

Math: Question 10

Which of the following expressions is equivalent to the sum of (r^3+5r^2+7) and $(r^2+8r+12)$?

A. r^5+13r^3+19

B. $2r^3+13r^2+19$

C. $r^3+5r^2+7r+12$

D. $r^3+6r^2+8r+19$

Choice D is correct. Grouping like terms, the given expressions can be rewritten as $r^3+(5r^2+r^2)+8r+(7+12)$. This can be rewritten as $r^3+6r^2+8r+19$.

Choice A is incorrect and may result from adding the two sets of unlike terms, r^3 and r^2 as well as $5r^2$ and $8r$, and then adding the respective exponents. Choice B is incorrect and may result from adding the unlike terms r^3 and r^2 as if they were r^3 and r^3 and adding the unlike terms $5r^2$ and $8r$ as if they were $5r^2$ and $8r^2$. Choice C is incorrect and may result from errors when combining like terms.

Question Difficulty: Medium

Math: Question 11

According to Moore's law, the number of transistors included on microprocessors doubles every 2 years. In 1985, a microprocessor was introduced that had 275,000 transistors. Based on this information, in which of the following years does Moore's law estimate the number of transistors to reach 1.1 million?

A. 1987
B. 1989
C. 1991
D. 1994

Choice B is correct. Let x be the number of years after 1985. It follows that $\frac{x}{2}$ represents the number of 2-year periods that will occur within an x-year period. According to Moore's law, every 2 years, the number of transistors included on microprocessors is estimated to double. Therefore, x years after 1985, the number of transistors will double $\frac{x}{2}$ times. Since the number of transistors included on a microprocessor was 275,000, or .275 million, in 1985, the estimated number of transistors, in millions, included x years after 1985 can be modeled as $0.275 \cdot 2^{\frac{x}{2}}$. The year in which the number of transistors is estimated to be 1.1 million is represented by the value of x when $1.1 = 0.275 \cdot 2^{\frac{x}{2}}$. Dividing both sides of this equation by .275 yields $4 = 2^{\frac{x}{2}}$, which can be rewritten as $2^2 = 2^{\frac{x}{2}}$. Since the exponential equation has equal bases on each side, it follows that the exponents must also be equal: $2 = \frac{x}{2}$. Multiplying both sides of the equation $2 = \frac{x}{2}$ by 2 yields $x = 4$. Therefore, according to Moore's law, 4 years after 1985, or in 1989, the number of transistors included on microprocessors is estimated to reach 1.1 million.

Alternate approach: According to Moore's law, 2 years after 1985 (in 1987), the number of transistors included on a microprocessor is estimated to be $2 \cdot 275{,}000$, or 550,000, and 2 years after 1987 (in 1989), the number of transistors included on microprocessors is estimated to be $2 \cdot 550{,}000$, or 1,100,000. Therefore, the year that Moore's law estimates the number of transistors on microprocessors to reach 1.1 million is 1989.

Choices A, C, and D are incorrect. According to Moore's law, the number of transistors included on microprocessors is estimated to reach 550,000 in 1987, 2.2 million in 1991, and about 6.2 million in 1994.

Question Difficulty: Medium

Math: Question 12

x	$f(x)$
2	7
3	5
4	7

For the quadratic function f, the table above gives some values of x and their corresponding values of $f(x)$. Which of the following could define f ?

A. $f(x)=(x-3)^2+5$

B. $f(x)=(x-3)^2+9$

C. $f(x)=2(x-2)^2+7$

D. $f(x)=2(x-3)^2+5$

Choice D is correct. For the quadratic function f, the table shows $f(2)=7$, $f(3)=5$, and $f(4)=7$. For the quadratic equation $f(x)=2(x-3)^2+5$, $f(2)=2(2-3)^2+5=7$, $f(3)=2(3-3)^2+5=5$, and $f(4)=2(4-3)^2+5=7$, as shown in the table. Therefore, $f(x)=2(x-3)^2+5$ could define f.

Choices A, B, and C are incorrect. For the quadratic equation $f(x)=(x-3)^2+5$, $f(2)=6$, $f(3)=5$, and $f(4)=6$. For the quadratic equation, $f(x)=(x-3)^2+9$, $f(2)=10$, $f(3)=9$, and $f(4)=10$. For the quadratic equation, $f(x)=2(x-2)^2+7$, $f(2)=7$, $f(3)=9$, and $f(4)=15$. However, the table shows that for the quadratic function f, $f(2)=7$, $f(3)=5$, and $f(4)=7$. Therefore, the equations in choices A, B, and C cannot define the quadratic function f.

Question Difficulty: Medium

Math: Question 13

$3(x-5)^2+11=59$

What is the smallest value of x that satisfies the equation above?

A. 9
B. 7
C. 5
D. 1

Choice D is correct. Subtracting 11 from both sides of the given equation yields $3(x-5)^2=48$. Dividing both sides by 3 results in $(x-5)^2=16$. Taking the square root of both sides yields $x-5=-4$ or $x-5=4$. Adding 5 to both sides of each equation yields $x=1$ or $x=9$. It follows that the smallest possible value of x is 1.

Choice A is incorrect and may result from finding the greatest value of x. Choice B is incorrect. If $x=7$, then the left-hand side of the given equation becomes $3(7-5)^2+11$, which is equal to 23, not 59. Choice C is incorrect. If $x=5$, then the left-hand side of the given equation becomes $3(5-5)^2+11$, which is equal to 11, not 59.

Question Difficulty: Hard

Math: Question 14

$$x + y = 17$$
$$xy = 72$$

If one solution to the system of equations above is (x, y), what is one possible value of x ?

The correct answer is 8 or 9. The first equation can be rewritten as $y = 17 - x$. Substituting $17 - x$ for y in the second equation gives $x(17 - x) = 72$. By applying the distributive property, this can be rewritten as $17x - x^2 = 72$. Subtracting 72 from both sides of the equation yields $x^2 - 17x + 72 = 0$. Factoring the left-hand side of this equation yields $(x - 8)(x - 9) = 0$. Applying the Zero Product Property, it follows that $x - 8 = 0$ and $x - 9 = 0$. Solving each equation for x yields $x = 8$ and $x = 9$ respectively. Either 8 or 9 may be entered as the correct answer.

Question Difficulty: Medium

Math: Question 15

If $\frac{3x+3x}{6}=24$, what is the value of $6x$?

The correct answer is 144. Multiplying both sides of the equation by 6 results in $3x + 3x = 144$. Adding like terms yields $6x = 144$.

Question Difficulty: Medium

Math: Question 16

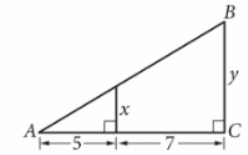
According to a model, the head width, in millimeters, of a worker bumblebee can be estimated by adding 0.6 to four times the body weight of the bee, in grams. According to the model, what would be the head width, in millimeters, of a worker bumblebee that has a body weight of 0.5 grams?

The correct answer is 2.6 or $\frac{13}{5}$. According to the model, the head width, in millimeters, of a worker bumblebee can be estimated by adding 0.6 to 4 times the body weight, in grams, of the bee. Let x represent the body weight, in grams, of a worker bumblebee and let y represent the head width, in millimeters. Translating the verbal description of the model into an equation yields $y = 0.6 + 4x$.

Substituting 0.5 grams for x in this equation yields $y = 0.6 + 4(0.5) = 2.6$. Therefore, a worker bumblebee with a body weight of 0.5 grams has an estimated head width of 2.6 millimeters. Either 2.6 or the equivalent fraction 13/5 may be entered as the correct answer.

Question Difficulty: Hard

Math: Question 17



Note: Figure not drawn to scale.

The area of triangle ABC above is at least 48 but no more than 60. If y is an integer, what is one possible value of x ?

The correct answer is $\frac{10}{3}$, $\frac{15}{4}$, or $\frac{25}{6}$. The area of triangle ABC can be expressed as $\frac{1}{2}(5+7)y$ or $6y$. It's given that the area of triangle ABC is at least 48 but no more than 60. It follows that $48 \le 6y \le 60$. Dividing by 6 to isolate y in this compound inequality yields $8 \le y \le 10$. Since y is an integer, $y = 8, 9, \text{ or } 10$. In the given figure, the two right triangles shown are similar because they have two pairs of congruent angles: their respective right angles and angle A. Therefore, the following proportion is true: $\frac{x}{y} = \frac{5}{12}$. Substituting 8 for y in the proportion results in $\frac{x}{8} = \frac{5}{12}$. Cross multiplying and solving for x yields $\frac{10}{3}$, which is approximately equivalent to 3.33.

Substituting 9 for y in the proportion results in $\frac{x}{9} = \frac{5}{12}$. Cross multiplying and solving for x yields $\frac{15}{4}$, which is equivalent to 3.75. Substituting 10 for y in the proportion results in $\frac{x}{10} = \frac{5}{12}$. Cross multiplying and solving for x yields $\frac{25}{6}$, which is approximately equivalent to 4.16 or 4.17. Either 10/3, 15/4, or 25/6, or the equivalent decimals 3.33, 3.75, 4.16, or 4.17 may be entered as the correct answer.

Question Difficulty: Hard