Question ID ac472881

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: ac472881

$$\frac{12x+28}{4} - \frac{s}{13} = r(x-8)$$

In the given equation, s and r are constants, and $s > 0$. If the equation has infinitely many solutions, what is the value of s?

ID: ac472881 Answer

Correct Answer:
403

Rationale

The correct answer is 403. For a linear equation in one variable to have infinitely many solutions, the coefficients of the variable must be equal on both sides of the equation and the constant terms must also be equal on both sides of the equation. The given equation can be rewritten as $\frac{4(3x+7)}{4} - \frac{s}{13} = r(x-8)$, or $3x + 7 - \frac{s}{13} = r(x-8)$. Applying the distributive property to the right-hand side of this equation yields $3x + 7 - \frac{s}{13} = rx - 8r$. For this equation to have infinitely many solutions, the coefficients of x must be equal, so it follows that $3 = r$. Additionally, the constant terms must be equal, which means $7 - \frac{s}{13} = -8r$. Substituting 3 for r in this equation yields $7 - \frac{s}{13} = -8(3)$, or $7 - \frac{s}{13} = -24$. Adding $\frac{s}{13}$ to both sides of this equation yields $7 = -24 + \frac{s}{13}$. Adding 24 to both sides of this equation yields $31 = \frac{s}{13}$. Multiplying both sides of this equation by 13 yields $403 = s$. Therefore, if the equation has infinitely many solutions, the value of s is 403.

Question Difficulty:
Hard

Question ID d1b66ae6

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: d1b66ae6

$$-x + y = -3.5$$
$$x + 3y = 9.5$$

If (x, y) satisfies the system of equations above, what is the value of y ?

ID: d1b66ae6 Answer

Rationale

The correct answer is $\frac{3}{2}$. One method for solving the system of equations for y is to add corresponding sides of the two equations. Adding the left-hand sides gives $(-x + y) + (x + 3y)$, or 4y. Adding the right-hand sides yields $-3.5 + 9.5 = 6$. It follows that $4y = 6$. Finally, dividing both sides of $4y = 6$ by 4 yields $y = \frac{6}{4}$ or $\frac{3}{2}$. Note that 3/2 and 1.5 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 3cdbf026

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 3cdbf026

The graph of the equation $ax+ky=6$ is a line in the *xy*-plane, where *a* and *k* are constants. If the line contains the points $(-2,-6)$ and $(0,-3)$, what is the value of *k* ?

A. -2

B. -1

C. 2

D. 3

ID: 3cdbf026 Answer

Correct Answer:
A

Rationale

Choice A is correct. The value of k can be found using the slope-intercept form of a linear equation, $y=mx+b$, where m is the slope and b is the y-coordinate of the y-intercept. The equation $ax+ky=6$ can be rewritten in the form $y=-\frac{ax}{k}+\frac{6}{k}$. One of the given points, $(0,-3)$, is the y-intercept. Thus, the y-coordinate of the y-intercept -3 must be equal to $\frac{6}{k}$. Multiplying both sides by k gives $-3k=6$. Dividing both sides by -3 gives $k=-2$.

Choices B, C, and D are incorrect and may result from errors made rewriting the given equation.

Question Difficulty:
Hard

Question ID ff501705

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: ff501705

$$\frac{3}{2}y - \frac{1}{4}x = \frac{2}{3} - \frac{3}{2}y$$
$$\frac{1}{2}x + \frac{3}{2} = py + \frac{9}{2}$$

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

ID: ff501705 Answer

Correct Answer:
6

Rationale

The correct answer is 6. A system of two linear equations in two variables, x and y, has no solution if the lines represented by the equations in the *xy*-plane are parallel and distinct. Lines represented by equations in standard form, $Ax + By = C$ and $Dx + Ey = F$, are parallel if the coefficients for x and y in one equation are proportional to the corresponding coefficients in the other equation, meaning $\frac{D}{A} = \frac{E}{B}$; and the lines are distinct if the constants are not proportional, meaning $\frac{F}{C}$ is not equal to $\frac{D}{A}$ or $\frac{E}{B}$. The first equation in the given system is $\frac{3}{2}y - \frac{1}{4}x = \frac{2}{3} - \frac{3}{2}y$. Multiplying each side of this equation by 12 yields $18y - 3x = 8 - 18y$. Adding $18y$ to each side of this equation yields $36y - 3x = 8$, or $-3x + 36y = 8$. The second equation in the given system is $\frac{1}{2}x + \frac{3}{2} = py + \frac{9}{2}$. Multiplying each side of this equation by 2 yields $x + 3 = 2py + 9$. Subtracting $2py$ from each side of this equation yields $x + 3 - 2py = 9$. Subtracting 3 from each side of this equation yields $x - 2py = 6$. Therefore, the two equations in the given system, written in standard form, are $-3x + 36y = 8$ and $x - 2py = 6$. As previously stated, if this system has no solution, the lines represented by the equations in the *xy*-plane are parallel and distinct, meaning the proportion $\frac{1}{-3} = \frac{-2p}{36}$, or $-\frac{1}{3} = -\frac{p}{18}$, is true and the proportion $\frac{6}{8} = \frac{1}{-3}$ is not true. The proportion $\frac{6}{8} = \frac{1}{-3}$ is not true. Multiplying each side of the true proportion, $-\frac{1}{3} = -\frac{p}{18}$, by -18 yields $6 = p$. Therefore, if the system has no solution, then the value of p is 6.

Question Difficulty:
Hard

Question ID 2937ef4f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: 2937ef4f

Hector used a tool called an auger to remove corn from a storage bin at a constant rate. The bin contained 24,000 bushels of corn when Hector began to use the auger. After 5 hours of using the auger, 19,350 bushels of corn remained in the bin. If the auger continues to remove corn at this rate, what is the total number of hours Hector will have been using the auger when 12,840 bushels of corn remain in the bin?

A. 3

B. 7

C. 8

D. 12

ID: 2937ef4f Answer

Correct Answer:
D

Rationale

Choice D is correct. After using the auger for 5 hours, Hector had removed 24,000 – 19,350 = 4,650 bushels of corn from the storage bin. During the 5-hour period, the auger removed corn from the bin at a constant rate of $\frac{4,650}{5} = 930$ bushels per hour. Assuming the auger continues to remove corn at this rate, after x hours it will have removed 930x bushels of corn. Because the bin contained 24,000 bushels of corn when Hector started using the auger, the equation 24,000 – 930x = 12,840 can be used to find the number of hours, x, Hector will have been using the auger when 12,840 bushels of corn remain in the bin. Subtracting 12,840 from both sides of this equation and adding 930x to both sides of the equation yields 11,160 = 930x. Dividing both sides of this equation by 930 yields x = 12. Therefore, Hector will have been using the auger for 12 hours when 12,840 bushels of corn remain in the storage bin.

Choice A is incorrect. Three hours after Hector began using the auger, 24,000 – 3(930) = 21,210 bushels of corn remained, not 12,840. Choice B is incorrect. Seven hours after Hector began using the auger, 24,000 – 7(930) = 17,490 bushels of corn will remain, not 12,840. Choice C is incorrect. Eight hours after Hector began using the auger, 24,000 – 8(930) = 16,560 bushels of corn will remain, not 12,840.

Question Difficulty:
Hard

Question ID 9bbce683

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 9bbce683

x	y
18	130
23	160
26	178

For line h, the table shows three values of x and their corresponding values of y. Line k is the result of translating line h down 5 units in the *xy*-plane. What is the *x*-intercept of line k?

A. $\left(-\frac{26}{3}, 0\right)$

B. $\left(-\frac{9}{2}, 0\right)$

C. $\left(-\frac{11}{3}, 0\right)$

D. $\left(-\frac{17}{6}, 0\right)$

ID: 9bbce683 Answer

Correct Answer:
D

Rationale

Choice D is correct. The equation of line h can be written in slope-intercept form $y = mx + b$, where m is the slope of the line and $(0, b)$ is the *y*-intercept of the line. It's given that line h contains the points $(18, 130)$, $(23, 160)$, and $(26, 178)$. Therefore, its slope m can be found as $\frac{160-130}{23-18}$, or 6. Substituting 6 for m in the equation $y = mx + b$ yields $y = 6x + b$. Substituting 130 for y and 18 for x in this equation yields $130 = 6(18) + b$, or $130 = 108 + b$. Subtracting 108 from both sides of this equation yields $22 = b$. Substituting 22 for b in $y = 6x + b$ yields $y = 6x + 22$. Since line k is the result of translating line h down 5 units, an equation of line k is $y = 6x + 22 - 5$, or $y = 6x + 17$. Substituting 0 for y in this equation yields $0 = 6x + 17$. Solving this equation for x yields $x = -\frac{17}{6}$. Therefore, the *x*-intercept of line k is $\left(-\frac{17}{6}, 0\right)$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 2b15d65f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 2b15d65f

An economist modeled the demand Q for a certain product as a linear function of the selling price P. The demand was 20,000 units when the selling price was \$40 per unit, and the demand was 15,000 units when the selling price was \$60 per unit. Based on the model, what is the demand, in units, when the selling price is \$55 per unit?

A. 16,250

B. 16,500

C. 16,750

D. 17,500

ID: 2b15d65f Answer

Correct Answer:
A

Rationale

Choice A is correct. Let the economist's model be the linear function $Q = mP + b$, where Q is the demand, P is the selling price, m is the slope of the line, and b is the y-coordinate of the y-intercept of the line in the xy-plane, where $y = Q$. Two pairs of the selling price P and the demand Q are given. Using the coordinate pairs (P, Q), two points that satisfy the function are $(40, 20{,}000)$ and $(60, 15{,}000)$. The slope m of the function can be found using the formula $m = \frac{Q_2 - Q_1}{P_2 - P_1}$. Substituting the given values into this formula yields $m = \frac{15{,}000 - 20{,}000}{60 - 40}$, or $m = -250$. Therefore, $Q = -250P + b$. The value of b can be found by substituting one of the points into the function. Substituting the values of P and Q from the point $(40, 20{,}000)$ yields $20{,}000 = -250(40) + b$, or $20{,}000 = -10{,}000 + b$. Adding 10,000 to both sides of this equation yields $b = 30{,}000$. Therefore, the linear function the economist used as the model is $Q = -250P + 30{,}000$. Substituting 55 for P yields $Q = -250(55) + 30{,}000 = 16{,}250$. It follows that when the selling price is \$55 per unit, the demand is 16,250 units.

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

Question Difficulty:
Hard

Question ID e25f0807

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: e25f0807

x	y
-12	-45
6	45

The table shows two values of x and their corresponding values of y. The graph of the linear equation representing this relationship passes through the point $\left(\frac{1}{4},\ a\right)$. What is the value of a?

ID: e25f0807 Answer

Correct Answer:
16.25, 65/4

Rationale

The correct answer is $\frac{65}{4}$. The linear relationship between x and y can be represented by the equation $y = mx + b$, where m and b are constants. It's given in the table that when $x = -12$, $y = -45$. Substituting -12 for x and -45 for y in the equation $y = mx + b$ yields $-45 = -12m + b$, which can be rewritten as $-45 + 12m = b$. It's also given in the table that when $x = 6$, $y = 45$. Substituting 6 for x and 45 for y in the equation $y = mx + b$ yields $45 = 6m + b$, which can be rewritten as $45 - 6m = b$. Substituting $-45 + 12m$ for b in this equation yields $45 - 6m = -45 + 12m$. Adding $6m$ to both sides of this equation yields $45 = -45 + 18m$. Adding 45 to both sides of this equation yields $90 = 18m$. Dividing both sides of this equation by 18 yields $5 = m$, or $m = 5$. Substituting 5 for m, -12 for x, and -45 for y in the equation $y = mx + b$ yields $-45 = 5(-12) + b$, or $-45 = -60 + b$. Adding 60 to both sides of this equation yields $15 = b$. Therefore, $m = 5$ and $b = 15$. Substituting 5 for m and 15 for b in the equation $y = mx + b$ yields $y = 5x + 15$. Thus, the equation $y = 5x + 15$ represents the linear relationship between x and y. It's also given that the graph of the linear equation representing this relationship passes through the point $\left(\frac{1}{4}, a\right)$. Substituting $\frac{1}{4}$ for x and a for y in the equation $y = 5x + 15$ yields $a = 5\left(\frac{1}{4}\right) + 15$, which is equivalent to $a = \frac{5}{4} + 15$, or $a = \frac{65}{4}$. Note that 65/4 and 16.25 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID be9cb6a2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: be9cb6a2

The cost of renting a backhoe for up to 10 days is $\$270$ for the first day and $\$135$ for each additional day. Which of the following equations gives the cost y, in dollars, of renting the backhoe for x days, where x is a positive integer and $x \leq 10$?

A. $y = 270x - 135$

B. $y = 270x + 135$

C. $y = 135x + 270$

D. $y = 135x + 135$

ID: be9cb6a2 Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that the cost of renting a backhoe for up to 10 days is $\$270$ for the first day and $\$135$ for each additional day. Therefore, the cost y, in dollars, for x days, where $x \leq 10$, is the sum of the cost for the first day, $\$270$, and the cost for the additional $x - 1$ days, $\$135(x - 1)$. It follows that $y = 270 + 135(x - 1)$, which is equivalent to $y = 270 + 135x - 135$, or $y = 135x + 135$.

Choice A is incorrect. This equation represents a situation where the cost of renting a backhoe is $\$135$ for the first day and $\$270$ for each additional day.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID db422e7f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: db422e7f

Line p is defined by $4y + 8x = 6$. Line r is perpendicular to line p in the *xy*-plane. What is the slope of line r?

ID: db422e7f Answer

Correct Answer:

.5, 1/2

Rationale

The correct answer is $\frac{1}{2}$. For an equation in slope-intercept form $y = mx + b$, m represents the slope of the line in the *xy*-plane defined by this equation. It's given that line p is defined by $4y + 8x = 6$. Subtracting $8x$ from both sides of this equation yields $4y = -8x + 6$. Dividing both sides of this equation by 4 yields $y = -\frac{8}{4}x + \frac{6}{4}$, or $y = -2x + \frac{3}{2}$. Thus, the slope of line p is -2. If line r is perpendicular to line p, then the slope of line r is the negative reciprocal of the slope of line p. The negative reciprocal of -2 is $-\frac{1}{(-2)} = \frac{1}{2}$. Note that 1/2 and .5 are examples of ways to enter a correct answer.

Question Difficulty:

Hard

Question ID 45cfb9de

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: 45cfb9de

Adam's school is a 20-minute walk or a 5-minute bus ride away from his house. The bus runs once every 30 minutes, and the number of minutes, w, that Adam waits for the bus varies between 0 and 30. Which of the following inequalities gives the values of w for which it would be faster for Adam to walk to school?

A. $w - 5 < 20$

B. $w - 5 > 20$

C. $w + 5 < 20$

D. $w + 5 > 20$

ID: 45cfb9de Answer

Correct Answer:

D

Rationale

Choice D is correct. It is given that w is the number of minutes that Adam waits for the bus. The total time it takes Adam to get to school on a day he takes the bus is the sum of the minutes, w, he waits for the bus and the 5 minutes the bus ride takes; thus, this time, in minutes, is w + 5. It is also given that the total amount of time it takes Adam to get to school on a day that he walks is 20 minutes. Therefore, w + 5 > 20 gives the values of w for which it would be faster for Adam to walk to school.

Choices A and B are incorrect because w – 5 is not the total length of time for Adam to wait for and then take the bus to school. Choice C is incorrect because the inequality should be true when walking 20 minutes is faster than the time it takes Adam to wait for and ride the bus, not less.

Question Difficulty:

Hard

Question ID f14484a5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: f14484a5

A manufacturing plant makes 10-inch, 9-inch, and 7-inch frying pans. During a certain day, the number of 10-inch frying pans that the manufacturing plant makes is 4 times the number n of 9-inch frying pans it makes, and the number of 7-inch frying pans it makes is 10. During this day, the manufacturing plant makes 100 frying pans total. Which equation represents this situation?

A. $10(4n)+9n+7(10)=100$

B. $10n+9n+7n=100$

C. $4n+10=100$

D. $5n+10=100$

ID: f14484a5 Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that during a certain day, the number of 9-inch frying pans the manufacturing plant makes is n and the number of 7-inch frying pans it makes is 10. It's also given that during this day the number of 10-inch frying pans that the manufacturing plant makes is 4 times the number of 9-inch frying pans, or $4n$. Therefore, the total number of 7-inch, 9-inch, and 10-inch frying pans the manufacturing plant makes is $n+10+4n$, or $5n+10$. It's given that during this day the manufacturing plant makes 100 frying pans total. Thus, the equation $5n+10=100$ represents this situation.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID b7e6394d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: b7e6394d

Alan drives an average of 100 miles each week. His car can travel an average of 25 miles per gallon of gasoline. Alan would like to reduce his weekly expenditure on gasoline by \$5. Assuming gasoline costs \$4 per gallon, which equation can Alan use to determine how many fewer average miles, *m*, he should drive each week?

A. $\frac{25}{4}m = 95$

B. $\frac{25}{4}m = 5$

C. $\frac{4}{25}m = 95$

D. $\frac{4}{25}m = 5$

ID: b7e6394d Answer

Correct Answer:
D

Rationale

Choice D is correct. Since gasoline costs \$4 per gallon, and since Alan's car travels an average of 25 miles per gallon, the expression $\frac{4}{25}$ gives the cost, in dollars per mile, to drive the car. Multiplying $\frac{4}{25}$ by m gives the cost for Alan to drive m miles in his car. Alan wants to reduce his weekly spending by \$5, so setting $\frac{4}{25}$ m equal to 5 gives the number of miles, m, by which he must reduce his driving.

Choices A, B, and C are incorrect. Choices A and B transpose the numerator and the denominator in the fraction. The fraction $\frac{25}{4}$ would result in the unit miles per dollar, but the question requires a unit of dollars per mile. Choices A and C set the expression equal to 95 instead of 5, a mistake that may result from a misconception that Alan wants to reduce his driving by 5 miles each week; instead, the question says he wants to reduce his weekly expenditure by \$5.

Question Difficulty:
Hard

Question ID ee2f611f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: ee2f611f

A local transit company sells a monthly pass for $95 that allows an unlimited number of trips of any length. Tickets for individual trips cost $1.50, $2.50, or $3.50, depending on the length of the trip. What is the minimum number of trips per month for which a monthly pass could cost less than purchasing individual tickets for trips?

ID: ee2f611f Answer

Rationale

The correct answer is 28. The minimum number of individual trips for which the cost of the monthly pass is less than the cost of individual tickets can be found by assuming the maximum cost of the individual tickets, $3.50. If n tickets costing $3.50 each are purchased in one month, the inequality $95 < 3.50n$ represents this situation. Dividing both sides of the inequality by 3.50 yields $27.14 < n$, which is equivalent to $n > 27.14$. Since only a whole number of tickets can be purchased, it follows that 28 is the minimum number of trips.

Question Difficulty:
Hard

Question ID 25e1cfed

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: 25e1cfed

How many solutions does the equation $10(15x - 9) = -15(6 - 10x)$ have?

A. Exactly one

B. Exactly two

C. Infinitely many

D. Zero

ID: 25e1cfed Answer

Correct Answer:
C

Rationale

Choice C is correct. Applying the distributive property to each side of the given equation yields $150x - 90 = -90 + 150x$. Applying the commutative property of addition to the right-hand side of this equation yields $150x - 90 = 150x - 90$. Since the two sides of the equation are equivalent, this equation is true for any value of x. Therefore, the given equation has infinitely many solutions.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID fdee0fbf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: fdee0fbf

In the *xy*-plane, line *k* intersects the *y*-axis at the point $(0, -6)$ and passes through the point $(2, 2)$. If the point $(20, w)$ lies on line *k*, what is the value of *w* ?

ID: fdee0fbf Answer

Rationale

The correct answer is 74. The y-intercept of a line in the xy-plane is the ordered pair (x, y) of the point of intersection of the line with the y-axis. Since line k intersects the y-axis at the point $(0, -6)$, it follows that $(0, -6)$ is the y-intercept of this line. An equation of any line in the xy-plane can be written in the form $y = mx + b$, where m is the slope of the line and b is the y-coordinate of the y-intercept. Therefore, the equation of line k can be written as $y = mx + (-6)$, or $y = mx - 6$. The value of m can be found by substituting the x- and y-coordinates from a point on the line, such as $(2,2)$, for x and y, respectively. This results in $2 = 2m - 6$. Solving this equation for m gives $m = 4$. Therefore, an equation of line k is $y = 4x - 6$. The value of w can be found by substituting the x-coordinate, 20, for x in the equation of line k and solving this equation for y. This gives $y = 4(20) - 6$, or $y = 74$. Since w is the y-coordinate of this point, $w = 74$.

Question Difficulty:
Hard

Question ID f75bd744

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: f75bd744

$$4x - 6y = 10y + 2$$
$$ty = \frac{1}{2} + 2x$$

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

ID: f75bd744 Answer

Correct Answer:

8

Rationale

The correct answer is 8. The given system of equations can be solved using the elimination method. Multiplying both sides of the second equation in the given system by -2 yields $-2ty = -1 - 4x$, or $-1 - 4x = -2ty$. Adding this equation to the first equation in the given system, $4x - 6y = 10y + 2$, yields $(4x - 6y) + (-1 - 4x) = (10y + 2) + (-2ty)$, or $-1 - 6y = 10y - 2ty + 2$. Subtracting $10y$ from both sides of this equation yields $(-1 - 6y) - (10y) = (10y - 2ty + 2) - (10y)$, or $-1 - 16y = -2ty + 2$. If the given system has no solution, then the equation $-1 - 16y = -2ty + 2$ has no solution. If this equation has no solution, the coefficients of y on each side of the equation, -16 and $-2t$, must be equal, which yields the equation $-16 = -2t$. Dividing both sides of this equation by -2 yields $8 = t$. Thus, if the system has no solution, the value of t is 8.

Alternate approach: A system of two linear equations in two variables, x and y, has no solution if the lines represented by the equations in the *xy*-plane are parallel and distinct. Lines represented by equations in the form $Ax + By = C$, where A, B, and C are constant terms, are parallel if the ratio of the *x*-coefficients is equal to the ratio of the *y*-coefficients, and distinct if the ratio of the *x*-coefficients are not equal to the ratio of the constant terms. Subtracting $10y$ from both sides of the first equation in the given system yields $(4x - 6y) - (10y) = (10y + 2) - (10y)$, or $4x - 16y = 2$. Subtracting $2x$ from both sides of the second equation in the given system yields $(ty) - (2x) = \left(\frac{1}{2} + 2x\right) - (2x)$, or $-2x + ty = \frac{1}{2}$. The ratio of the *x*-coefficients for these equations is $-\frac{2}{4}$, or $-\frac{1}{2}$. The ratio of the *y*-coefficients for these equations is $-\frac{t}{16}$. The ratio of the constant terms for these equations is $\frac{1/2}{2}$, or $\frac{1}{4}$. Since the ratio of the *x*-coefficients, $-\frac{1}{2}$, is not equal to the ratio of the constants, $\frac{1}{4}$, the lines represented by the equations are distinct. Setting the ratio of the *x*-coefficients equal to the ratio of the *y*-coefficients yields $-\frac{1}{2} = -\frac{t}{16}$. Multiplying both sides of this equation by -16 yields $\left(-\frac{1}{2}\right)(-16) = \left(-\frac{t}{16}\right)(-16)$, or $t = 8$. Therefore, when $t = 8$, the lines represented by these equations are parallel. Thus, if the system has no solution, the value of t is 8.

Question Difficulty:

Hard

Question ID b3abf40f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: b3abf40f

$$F(x) = \frac{9}{5}(x - 273.15) + 32$$

The function F gives the temperature, in degrees Fahrenheit, that corresponds to a temperature of x kelvins. If a temperature increased by 9.10 kelvins, by how much did the temperature increase, in degrees Fahrenheit?

A. 16.38

B. 48.38

C. 475.29

D. 507.29

ID: b3abf40f Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that the function $F(x) = \frac{9}{5}(x - 273.15) + 32$ gives the temperature, in degrees Fahrenheit, that corresponds to a temperature of x kelvins. A temperature that increased by 9.10 kelvins means that the value of x increased by 9.10 kelvins. It follows that an increase in x by 9.10 increases $F(x)$ by $\frac{9}{5}(9.10)$, or 16.38. Therefore, if a temperature increased by 9.10 kelvins, the temperature increased by 16.38 degrees Fahrenheit.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID e6cb2402

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: e6cb2402

$$3(kx+13)=\frac{48}{17}x+36$$

In the given equation, k is a constant. The equation has no solution. What is the value of k?

ID: e6cb2402 Answer

Correct Answer:

.9411, .9412, 16/17

Rationale

The correct answer is $\frac{16}{17}$. It's given that the equation $3(kx+13)=\frac{48}{17}x+36$ has no solution. A linear equation in the form $ax+b=cx+d$, where a, b, c, and d are constants, has no solution only when the coefficients of x on each side of the equation are equal and the constant terms aren't equal. Dividing both sides of the given equation by 3 yields $kx+13=\frac{48}{51}x+\frac{36}{3}$, or $kx+13=\frac{16}{17}x+12$. Since the coefficients of x on each side of the equation must be equal, it follows that the value of k is $\frac{16}{17}$. Note that 16/17, .9411, .9412, and 0.941 are examples of ways to enter a correct answer.

Question Difficulty:

Hard

Question ID b988eeec

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: b988eeec

The functions f and g are defined as $f(x) = \frac{1}{4}x - 9$ and $g(x) = \frac{3}{4}x + 21$. If the function h is defined as $h(x) = f(x) + g(x)$, what is the *x*-coordinate of the *x*-intercept of the graph of $y = h(x)$ in the *xy*-plane?

ID: b988eeec Answer

Correct Answer:

-12

Rationale

The correct answer is -12. It's given that the functions f and g are defined as $f(x) = \frac{1}{4}x - 9$ and $g(x) = \frac{3}{4}x + 21$. If the function h is defined as $h(x) = f(x) + g(x)$, then substituting $\frac{1}{4}x - 9$ for $f(x)$ and $\frac{3}{4}x + 21$ for $g(x)$ in this function yields $h(x) = \frac{1}{4}x - 9 + \frac{3}{4}x + 21$. This can be rewritten as $h(x) = \frac{4}{4}x + 12$, or $h(x) = x + 12$. The *x*-intercept of a graph in the *xy*-plane is the point on the graph where $y = 0$. The equation representing the graph of $y = h(x)$ is $y = x + 12$. Substituting 0 for y in this equation yields $0 = x + 12$. Subtracting 12 from both sides of this equation yields $-12 = x$, or $x = -12$. Therefore, the *x*-coordinate of the *x*-intercept of the graph of $y = h(x)$ in the *xy*-plane is -12.

Question Difficulty:

Hard

Question ID 70feb725

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: 70feb725

During a month, Morgan ran *r* miles at 5 miles per hour and biked *b* miles at 10 miles per hour. She ran and biked a total of 200 miles that month, and she biked for twice as many hours as she ran. What is the total number of miles that Morgan biked during the month?

A. 80

B. 100

C. 120

D. 160

ID: 70feb725 Answer

Correct Answer:

D

Rationale

Choice D is correct. The number of hours Morgan spent running or biking can be calculated by dividing the distance she traveled during that activity by her speed, in miles per hour, for that activity. So the number of hours she ran can be represented by the expression $\frac{r}{5}$, and the number of hours she biked can be represented by the expression $\frac{b}{10}$. It's given that she biked for twice as many hours as she ran, so this can be represented by the equation $\frac{b}{10} = 2\left(\frac{r}{5}\right)$, which can be rewritten as $b = 4r$. It's also given that she ran r miles and biked b miles, and that she ran and biked a total of 200 miles. This can be represented by the equation $r + b = 200$. Substituting $4r$ for b in this equation yields $r + 4r = 200$, or $5r = 200$. Solving for r yields $r = 40$. Determining the number of miles she biked, b, can be found by substituting 40 for r in $r + b = 200$, which yields $40 + b = 200$. Solving for b yields $b = 160$.

Choices A, B, and C are incorrect because they don't satisfy that Morgan biked for twice as many hours as she ran. In choice A, if she biked 80 miles, then she ran 120 miles, which means she biked for 8 hours and ran for 24 hours. In choice B, if she biked 100 miles, then she ran 100 miles, which means she biked for 10 hours and ran for 20 hours. In choice C, if she biked 120 miles, then she ran for 80 miles, which means she biked for 12 hours and ran for 16 hours.

Question Difficulty:

Hard

Question ID 1a621af4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: 1a621af4

A number x is at most 2 less than 3 times the value of y. If the value of y is -4, what is the greatest possible value of x?

ID: 1a621af4 Answer

Correct Answer:
-14

Rationale

The correct answer is -14. It's given that a number x is at most 2 less than 3 times the value of y. Therefore, x is less than or equal to 2 less than 3 times the value of y. The expression $3y$ represents 3 times the value of y. The expression $3y - 2$ represents 2 less than 3 times the value of y. Therefore, x is less than or equal to $3y - 2$. This can be shown by the inequality $x \leq 3y - 2$. Substituting -4 for y in this inequality yields $x \leq 3(-4) - 2$ or, $x \leq -14$. Therefore, if the value of y is -4, the greatest possible value of x is -14.

Question Difficulty:
Hard

Question ID af2ba762

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: af2ba762

According to data provided by the US Department of Energy, the average price per gallon of regular gasoline in the United States from September 1, 2014, to December 1, 2014, is modeled by the function F defined below, where $F(x)$ is the average price per gallon x months after September 1.

$F(x) = 2.74 - 0.19(x - 3)$

The constant 2.74 in this function estimates which of the following?

A. The average monthly decrease in the price per gallon

B. The difference in the average price per gallon from September 1, 2014, to December 1, 2014

C. The average price per gallon on September 1, 2014

D. The average price per gallon on December 1, 2014

ID: af2ba762 Answer

Correct Answer:

D

Rationale

Choice D is correct. Since 2.74 is a constant term, it represents an actual price of gas rather than a measure of change in gas price. To determine what gas price it represents, find x such that F(x) = 2.74, or 2.74 = 2.74 – 0.19(x – 3). Subtracting 2.74 from both sides gives 0 = –0.19(x – 3). Dividing both sides by –0.19 results in 0 = x – 3, or x = 3. Therefore, the average price of gas is $2.74 per gallon 3 months after September 1, 2014, which is December 1, 2014.

Choice A is incorrect. Since 2.74 is a constant, not a multiple of x, it cannot represent a rate of change in price. Choice B is incorrect. The difference in the average price from September 1, 2014, to December 1, 2014, is F(3) – F(0) = 2.74 – 0.19(3 – 3) – (2.74 – 0.19(0 – 3)) = 2.74 – (2.74 + 0.57) = –0.57, which is not 2.74. Choice C is incorrect. The average price per gallon on September 1, 2014, is F(0) = 2.74 – 0.19(0 – 3) = 2.74 + 0.57 = 3.31, which is not 2.74.

Question Difficulty:

Hard

Question ID b9835972

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: b9835972

In the *xy*-plane, line ℓ passes through the point $(0, 0)$ and is parallel to the line represented by the equation $y = 8x + 2$. If line ℓ also passes through the point $(3, d)$, what is the value of d?

ID: b9835972 Answer

Correct Answer:
24

Rationale

The correct answer is 24. A line in the *xy*-plane can be defined by the equation $y = mx + b$, where m is the slope of the line and b is the *y*-coordinate of the *y*-intercept of the line. It's given that line ℓ passes through the point $(0, 0)$. Therefore, the *y*-coordinate of the *y*-intercept of line ℓ is 0. It's given that line ℓ is parallel to the line represented by the equation $y = 8x + 2$. Since parallel lines have the same slope, it follows that the slope of line ℓ is 8. Therefore, line ℓ can be defined by an equation in the form $y = mx + b$, where $m = 8$ and $b = 0$. Substituting 8 for m and 0 for b in $y = mx + b$ yields the equation $y = 8x + 0$, or $y = 8x$. If line ℓ passes through the point $(3, d)$, then when $x = 3$, $y = d$ for the equation $y = 8x$. Substituting 3 for x and d for y in the equation $y = 8x$ yields $d = 8(3)$, or $d = 24$.

Question Difficulty:
Hard

Question ID e1248a5c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: e1248a5c

In the system of equations below, *a* and *c* are constants.

$$\frac{1}{2}x+\frac{1}{3}y=\frac{1}{6}$$

$$ax+y=c$$

If the system of equations has an infinite number of solutions (x,y), what is the value of *a* ?

A. $-\frac{1}{2}$

B. 0

C. $\frac{1}{2}$

D. $\frac{3}{2}$

ID: e1248a5c Answer

Correct Answer:

D

Rationale

Choice D is correct. A system of two linear equations has infinitely many solutions if one equation is equivalent to the other. This means that when the two equations are written in the same form, each coefficient or constant in one equation is equal to the corresponding coefficient or constant in the other equation multiplied by the same number. The equations in the given system of equations are written in the same form, with x and y on the left-hand side and a constant on the right-hand side of the equation. The coefficient of y in the second equation is equal to the coefficient of y in the first equation multiplied by 3. Therefore, a, the coefficient of x in the second equation, must be equal to 3 times the coefficient of x in the first equation: $a=(\frac{1}{2})(3)$, or $a=\frac{3}{2}$.

Choices A, B, and C are incorrect. When $a=-\frac{1}{2}$, $a=0$, or $a=\frac{1}{2}$, the given system of equations has one solution.

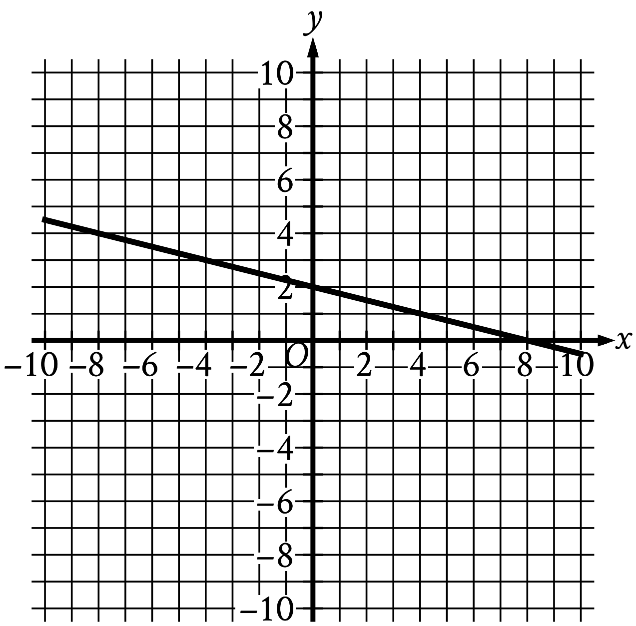
Question Difficulty:

Hard

Question ID 05bb1af9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 05bb1af9



The graph of $y = f(x) + 14$ is shown. Which equation defines function f?

A. $f(x) = -\frac{1}{4}x - 12$

B. $f(x) = -\frac{1}{4}x + 16$

C. $f(x) = -\frac{1}{4}x + 2$

D. $f(x) = -\frac{1}{4}x - 14$

ID: 05bb1af9 Answer

Correct Answer:
A

Rationale

Choice A is correct. An equation for the graph shown can be written in slope-intercept form $y = mx + b$, where m is the slope of the graph and its *y*-intercept is $(0, b)$. Since the *y*-intercept of the graph shown is $(0, 2)$, the value of b is 2. Since the graph also passes through the point $(4, 1)$, the slope can be calculated as $\frac{1-2}{4-0}$, or $-\frac{1}{4}$. Therefore, the value of m is $-\frac{1}{4}$. Substituting $-\frac{1}{4}$ for m and 2 for b in the equation $y = mx + b$ yields $y = -\frac{1}{4}x + 2$. It's given that an equation for the graph shown is $y = f(x) + 14$. Substituting $f(x) + 14$ for y in the equation $y = -\frac{1}{4}x + 2$ yields $f(x) + 14 = -\frac{1}{4}x + 2$. Subtracting 14 from both sides of this equation yields $f(x) = -\frac{1}{4}x - 12$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 52cb8ea4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: 52cb8ea4

$$7x - 5y = 4$$
$$4x - 8y = 9$$

If (x, y) is the solution to the system of equations above, what is the value of $3x + 3y$?

A. -13

B. -5

C. 5

D. 13

ID: 52cb8ea4 Answer

Correct Answer:
B

Rationale

Choice B is correct. Subtracting the second equation, $4x - 8y = 9$, from the first equation, $7x - 5y = 4$, results in $(7x - 5y) - (4x - 8y) = 4 - 9$, or $7x - 5y - 4x + 8y = 5$. Combining like terms on the left-hand side of this equation yields $3x + 3y = -5$.

Choice A is incorrect and may result from miscalculating $4 - 9$ as -13. Choice C is incorrect and may result from miscalculating $4 - 9$ as 5. Choice D is incorrect and may result from adding 9 to 4 instead of subtracting 9 from 4.

Question Difficulty:
Hard

Question ID 0b46bad5

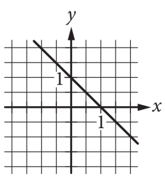
Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 0b46bad5

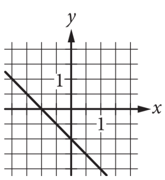
$$ax + by = b$$

In the equation above, *a* and *b* are constants and $0 < a < b$. Which of the following could represent the graph of the equation in the *xy*-plane?

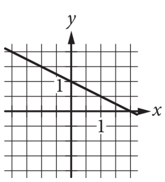
A.



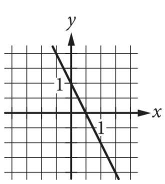
B.



C.



D.



ID: 0b46bad5 Answer

Correct Answer:
C

Rationale

Choice C is correct. The given equation $ax + by = b$ can be rewritten in slope-intercept form, $y = mx + k$, where m represents the slope of the line represented by the equation, and k represents the y-coordinate of the y-intercept of the line. Subtracting ax from both sides of the equation yields $by = -ax + b$, and dividing both sides of this equation by b yields $y = -\frac{a}{b}x + \frac{b}{b}$, or $y = -\frac{a}{b}x + 1$. With the equation now in slope-intercept form, it shows that $k = 1$, which means the y-coordinate of the y-intercept is 1. It's given that a and b are both greater than 0 (positive) and that $a < b$. Since $m = -\frac{a}{b}$, the slope of the line must be a value between -1 and 0. Choice C is the only graph of a line that has a y-value of the y-intercept that is 1 and a slope that is between -1 and 0.

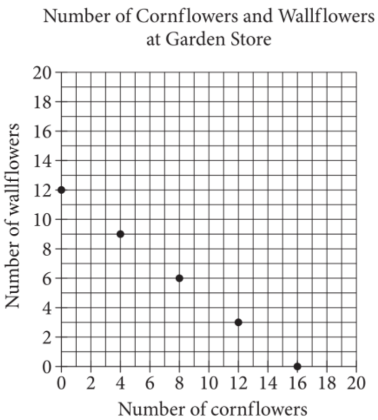
Choices A, B, and D are incorrect because the slopes of the lines in these graphs aren't between -1 and 0.

Question Difficulty:
Hard

Question ID c362c210

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: c362c210



The points plotted in the coordinate plane above represent the possible numbers of wallflowers and cornflowers that someone can buy at the Garden Store in order to spend exactly \$24.00 total on the two types of flowers. The price of each wallflower is the same and the price of each cornflower is the same. What is the price, in dollars, of 1 cornflower?

ID: c362c210 Answer

Rationale

The correct answer is 1.5. The point $(16,0)$ corresponds to the situation where 16 cornflowers and 0 wallflowers are purchased. Since the total spent on the two types of flowers is \$24.00, it follows that the price of 16 cornflowers is \$24.00, and the price of one cornflower is \$1.50. Note that 1.5 and 3/2 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 94b48cbf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 94b48cbf

The graph of $7x + 2y = -31$ in the xy-plane has an x-intercept at $(a, 0)$ and a y-intercept at $(0, b)$, where a and b are constants. What is the value of $\frac{b}{a}$?

A. $-\frac{7}{2}$

B. $-\frac{2}{7}$

C. $\frac{2}{7}$

D. $\frac{7}{2}$

ID: 94b48cbf Answer

Correct Answer:
D

Rationale

Choice D is correct. The *x*-coordinate a of the *x*-intercept $(a, 0)$ can be found by substituting 0 for y in the given equation, which gives $7x + 2(0) = -31$, or $7x = -31$. Dividing both sides of this equation by 7 yields $x = -\frac{31}{7}$. Therefore, the value of a is $-\frac{31}{7}$. The *y*-coordinate b of the *y*-intercept $(0, b)$ can be found by substituting 0 for x in the given equation, which gives $7(0) + 2y = -31$, or $2y = -31$. Dividing both sides of this equation by 2 yields $y = -\frac{31}{2}$. Therefore, the value of b is $-\frac{31}{2}$. It follows that the value of $\frac{b}{a}$ is $\frac{-\frac{31}{2}}{-\frac{31}{7}}$, which is equivalent to $\left(\frac{31}{2}\right)\left(\frac{7}{31}\right)$, or $\frac{7}{2}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 50f4cb9c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 50f4cb9c

x	$f(x)$
1	-64
2	0
3	64

For the linear function f, the table shows three values of x and their corresponding values of $f(x)$. Function f is defined by $f(x) = ax + b$, where a and b are constants. What is the value of $a - b$?

A. -64

B. 62

C. 128

D. 192

ID: 50f4cb9c Answer

Correct Answer:
D

Rationale

Choice D is correct. The table gives that $f(x) = 0$ when $x = 2$. Substituting 0 for $f(x)$ and 2 for x into the equation $f(x) = ax + b$ yields $0 = 2a + b$. Subtracting $2a$ from both sides of this equation yields $b = -2a$. The table gives that $f(x) = -64$ when $x = 1$. Substituting $-2a$ for b, -64 for $f(x)$, and 1 for x into the equation $f(x) = ax + b$ yields $-64 = a(1) + (-2a)$. Combining like terms yields $-64 = -a$, or $a = 64$. Since $b = -2a$, substituting 64 for a into this equation gives $b = (-2)(64)$, which yields $b = -128$. Thus, the value of $a - b$ can be written as $64 - (-128)$, which is 192.

Choice A is incorrect. This is the value of $a + b$, not $a - b$.

Choice B is incorrect. This is the value of $a - 2$, not $a - b$.

Choice C is incorrect. This is the value of $2a$, not $a - b$.

Question Difficulty:
Hard

Question ID 16889ef3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 16889ef3

Oil and gas production in a certain area dropped from 4 million barrels in 2000 to 1.9 million barrels in 2013. Assuming that the oil and gas production decreased at a constant rate, which of the following linear functions f best models the production, in millions of barrels, t years after the year 2000?

A. $f(t) = \frac{21}{130}t + 4$

B. $f(t) = \frac{19}{130}t + 4$

C. $f(t) = -\frac{21}{130}t + 4$

D. $f(t) = -\frac{19}{130}t + 4$

ID: 16889ef3 Answer

Correct Answer:
C

Rationale

Choice C is correct. It is assumed that the oil and gas production decreased at a constant rate. Therefore, the function f that best models the production t years after the year 2000 can be written as a linear function, $f(t) = mt + b$, where m is the rate of change of the oil and gas production and b is the oil and gas production, in millions of barrels, in the year 2000. Since there were 4 million barrels of oil and gas produced in 2000, $b = 4$. The rate of change, m, can be calculated as $\frac{4-1.9}{0-13} = -\frac{2.1}{13}$, which is equivalent to $-\frac{21}{130}$, the rate of change in choice C.

Choices A and B are incorrect because each of these functions has a positive rate of change. Since the oil and gas production decreased over time, the rate of change must be negative. Choice D is incorrect. This model may result from misinterpreting 1.9 million barrels as the amount by which the production decreased.

Question Difficulty:
Hard

Question ID d7bf55e1

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: d7bf55e1

A movie theater sells two types of tickets, adult tickets for \$12 and child tickets for \$8. If the theater sold 30 tickets for a total of \$300, how much, in dollars, was spent on adult tickets? (Disregard the \$ sign when gridding your answer.)

ID: d7bf55e1 Answer

Rationale

The correct answer is 180. Let a be the number of adult tickets sold and c be the number of child tickets sold. Since the theater sold a total of 30 tickets, $a + c = 30$. The price per adult ticket is \$12, and the price per child ticket is \$8. Since the theater received a total of \$300 for the 30 tickets sold, it follows that $12a + 8c = 300$. To eliminate c, the first equation can be multiplied by 8 and then subtracted from the second equation:

$$\begin{array}{r} 12a+8c = 300 \\ -8a-8c = -240 \\ \hline 4a+0c=60 \end{array}$$

Because the question asks for the amount spent on adult tickets, which is 12a dollars, the resulting equation can be multiplied by 3 to give $3(4a) = 3(60) = 180$. Therefore, \$180 was spent on adult tickets.

Alternate approach: If all the 30 tickets sold were child tickets, their total price would be $30(\$8) = \$240$. Since the actual total price of the 30 tickets was \$300, the extra \$60 indicates that a certain number of adult tickets, a, were sold. Since the price of each adult ticket is \$4 more than each child ticket, $4a = 60$, and it follows that $12a = 180$.

Question Difficulty:
Hard

Question ID 771bd0ca

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: 771bd0ca

$$5(t+3)-7(t+3)=38$$

What value of t is the solution to the given equation?

ID: 771bd0ca Answer

Correct Answer:

-22

Rationale

The correct answer is -22. The given equation can be rewritten as $-2(t+3)=38$. Dividing both sides of this equation by -2 yields $t+3=-19$. Subtracting 3 from both sides of this equation yields $t=-22$. Therefore, -22 is the value of t that is the solution to the given equation.

Question Difficulty:

Hard

Question ID a309803e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: a309803e

One gallon of paint will cover 220 square feet of a surface. A room has a total wall area of w square feet. Which equation represents the total amount of paint P, in gallons, needed to paint the walls of the room twice?

A. $P = \frac{w}{110}$

B. $P = 440w$

C. $P = \frac{w}{220}$

D. $P = 220w$

ID: a309803e Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that w represents the total wall area, in square feet. Since the walls of the room will be painted twice, the amount of paint, in gallons, needs to cover $2w$ square feet. It's also given that one gallon of paint will cover 220 square feet. Dividing the total area, in square feet, of the surface to be painted by the number of square feet covered by one gallon of paint gives the number of gallons of paint that will be needed. Dividing $2w$ by 220 yields $\frac{2w}{220}$, or $\frac{w}{110}$. Therefore, the equation that represents the total amount of paint P, in gallons, needed to paint the walls of the room twice is $P = \frac{w}{110}$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from finding the amount of paint needed to paint the walls once rather than twice.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 55ea82f3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: 55ea82f3

A team hosting an event to raise money for new uniforms plans to sell at least 140 tickets before this event and at least 220 tickets during this event to raise a total of at least $\$5,820$ from all tickets sold. The price of a ticket during this event is $\$3$ less than the price of a ticket before this event. Which inequality represents this situation, where x is the price, in dollars, of a ticket sold during this event?

A. $140(x+3)+220x \leq 5{,}820$

B. $140(x+3)+220x \geq 5{,}820$

C. $140(x-3)+220x \leq 5{,}820$

D. $140(x-3)+220x \geq 5{,}820$

ID: 55ea82f3 Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that a team plans to sell at least 140 tickets before an event and at least 220 tickets during the event to raise a total of at least $\$5,820$ from all tickets sold. It's also given that the price of a ticket during the event is $\$3$ less than the price of a ticket before the event and that x represents the price, in dollars, of a ticket sold during the event. It follows that $x+3$ represents the price, in dollars, of a ticket sold before the event. The expression $140(x+3)$ represents the planned revenue, in dollars, from the tickets sold before the event, and the expression $220x$ represents the planned revenue, in dollars, from the tickets sold during the event. Thus, the expression $140(x+3)+220x$ represents the planned revenue, in dollars, from all tickets sold. Since the team plans to raise a total of at least $\$5,820$ from all tickets sold, the total revenue must be at least $\$5,820$. Therefore, the inequality $140(x+3)+220x \geq 5{,}820$ represents this situation.

Choice A is incorrect. This inequality represents a situation in which the team raises a total of at most $\$5,820$ from all tickets sold.

Choice C is incorrect. This inequality represents a situation in which the price of a ticket before the event is $\$3$ less, rather than $\$3$ more, than the price of a ticket during the event and the team raises a total of at most $\$5,820$ from all tickets sold.

Choice D is incorrect. This inequality represents a situation in which the price of a ticket before the event is $\$3$ less, rather than $\$3$ more, than the price of a ticket during the event.

Question Difficulty:
Hard

Question ID 98d3393a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 98d3393a

Line ℓ in the *xy*-plane is perpendicular to the line with equation $x = 2$. What is the slope of line ℓ?

A. 0

B. $-\frac{1}{2}$

C. -2

D. The slope of line ℓ is undefined.

ID: 98d3393a Answer

Correct Answer:
A

Rationale

Choice A is correct. It is given that line ℓ is perpendicular to a line whose equation is x = 2. A line whose equation is a constant value of x is vertical, so ℓ must therefore be horizontal. Horizontal lines have a slope of 0, so ℓ has a slope of 0.

Choice B is incorrect. A line with slope $-\frac{1}{2}$ is perpendicular to a line with slope 2. However, the line with equation x = 2 is vertical and has undefined slope (not slope of 2). Choice C is incorrect. A line with slope −2 is perpendicular to a line with slope $\frac{1}{2}$. However, the line with equation x = 2 has undefined slope (not slope of $\frac{1}{2}$). Choice D is incorrect; this is the slope of the line x = 2 itself, not the slope of a line perpendicular to it.

Question Difficulty:
Hard

Question ID 0b0fa68b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 0b0fa68b

For the function f, $f(cx) = x - 8$ for all values of x, where c is a positive constant. If $f(2) = 35$, what is the value of c?

ID: 0b0fa68b Answer

Correct Answer:
.0465, 2/43

Rationale

The correct answer is $\frac{2}{43}$. It's given that $f(cx) = x - 8$ for all values of x, where c is a positive constant, and $f(2) = 35$. Therefore, for the given function f, $cx = 2$. Dividing both sides of this equation by c yields $x = \frac{2}{c}$. Substituting $\frac{2}{c}$ for x in the equation $f(cx) = x - 8$ yields $f\left(\frac{2c}{c}\right) = \frac{2}{c} - 8$, or $f(2) = \frac{2}{c} - 8$. Since it's given that $f(2) = 35$, substituting 35 for $f(2)$ yields $35 = \frac{2}{c} - 8$. Adding 8 to both sides of this equation yields $43 = \frac{2}{c}$. Multiplying both sides of this equation by c yields $43c = 2$. Dividing both sides of this equation by 43 yields $c = \frac{2}{43}$. Note that 2/43, .0465, 0.046, and 0.047 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 6989c80a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 6989c80a

$$F(x) = \frac{9}{5}(x - 273.15) + 32$$

The function F gives the temperature, in degrees Fahrenheit, that corresponds to a temperature of x kelvins. If a temperature increased by 2.10 kelvins, by how much did the temperature increase, in degrees Fahrenheit?

A. 3.78

B. 35.78

C. 487.89

D. 519.89

ID: 6989c80a Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that the function $F(x) = \frac{9}{5}(x - 273.15) + 32$ gives the temperature, in degrees Fahrenheit, that corresponds to a temperature of x kelvins. A temperature that increased by 2.10 kelvins means that the value of x increased by 2.10 kelvins. It follows that an increase in x by 2.10 increases $F(x)$ by $\frac{9}{5}(2.10)$, or 3.78. Therefore, if a temperature increased by 2.10 kelvins, the temperature increased by 3.78 degrees Fahrenheit.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID e8f9e117

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: e8f9e117

$$I = \frac{V}{R}$$

The formula above is Ohm's law for an electric circuit with current *I*, in amperes, potential difference *V*, in volts, and resistance *R*, in ohms. A circuit has a resistance of 500 ohms, and its potential difference will be generated by *n* six-volt batteries that produce a total potential difference of $6n$ volts. If the circuit is to have a current of no more than 0.25 ampere, what is the greatest number, *n*, of six-volt batteries that can be used?

ID: e8f9e117 Answer

Rationale

The correct answer is 20. For the given circuit, the resistance R is 500 ohms, and the total potential difference V generated by n batteries is $6n$ volts. It's also given that the circuit is to have a current of no more than 0.25 ampere, which can be expressed as $I < 0.25$. Since Ohm's law says that $I = \frac{V}{R}$, the given values for V and R can be substituted for I in this inequality, which yields $\frac{6n}{500} < 0.25$. Multiplying both sides of this inequality by 500 yields $6n < 125$, and dividing both sides of this inequality by 6 yields $n < 20.833$. Since the number of batteries must be a whole number less than 20.833, the greatest number of batteries that can be used in this circuit is 20.

Question Difficulty:
Hard

Question ID a7e2859a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: a7e2859a

The cost of renting a large canopy tent for up to 10 days is $\$430$ for the first day and $\$215$ for each additional day. Which of the following equations gives the cost y, in dollars, of renting the tent for x days, where x is a positive integer and $x \leq 10$?

A. $y = 215x + 215$

B. $y = 430x - 215$

C. $y = 430x + 215$

D. $y = 215x + 430$

ID: a7e2859a Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that the cost of renting a large canopy tent is $\$430$ for the first day and $\$215$ for each additional day for up to 10 days. For x days of renting the tent, the cost includes $\$430$ for the first day and $\$215$ for each of the $(x - 1)$ additional days. It follows that the cost y, in dollars, of renting the tent can be expressed as $y = 430 + 215(x - 1)$, which is equivalent to $y = 430 + 215x - 215$, or $y = 215x + 215$. Therefore, the equation $y = 215x + 215$ gives the cost of renting the tent for x days, where x is a positive integer and $x \leq 10$.

Choice B is incorrect. This equation represents a situation where the cost of renting the tent for the first day is $\$215$, not $\$430$, and the cost for each additional day is $\$430$, not $\$215$.

Choice C is incorrect. This equation represents a situation where the cost of renting the tent for the first day is $\$645$, not $\$430$, and the cost for each additional day is $\$430$, not $\$215$.

Choice D is incorrect. This equation represents a situation where the cost of renting the tent for the first day is $\$645$, not $\$430$.

Question Difficulty:
Hard

Question ID f718c9cf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: f718c9cf

$$5x + 14y = 45$$
$$10x + 7y = 27$$

The solution to the given system of equations is (x, y). What is the value of xy?

ID: f718c9cf Answer

Correct Answer:
1.8, 9/5

Rationale

The correct answer is $\frac{9}{5}$. Multiplying the first equation in the given system by 2 yields $10x + 28y = 90$. Subtracting the second equation in the given system, $10x + 7y = 27$, from $10x + 28y = 90$ yields $(10x + 28y) - (10x + 7y) = 90 - 27$, which is equivalent to $10x + 28y - 10x - 7y = 63$, or $21y = 63$. Dividing both sides of this equation by 21 yields $y = 3$. The value of x can be found by substituting 3 for y in either of the two given equations. Substituting 3 for y in the equation $10x + 7y = 27$ yields $10x + 7(3) = 27$, or $10x + 21 = 27$. Subtracting 21 from both sides of this equation yields $10x = 6$. Dividing both sides of this equation by 10 yields $x = \frac{6}{10}$, or $x = \frac{3}{5}$. Therefore, the value of xy is $\left(\frac{3}{5}\right)(3)$, or $\frac{9}{5}$. Note that 9/5 and 1.8 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 466b87e3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: 466b87e3

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

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

ID: 466b87e3 Answer

Rationale

The correct answer is $\frac{1}{2}$. 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 $\frac{1}{2}$. Note that 1/2 and .5 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID aee9fd2d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: aee9fd2d

If $\frac{x+6}{3} = \frac{x+6}{13}$, the value of $x + 6$ is between which of the following pairs of values?

A. -7 and -3

B. -2 and 2

C. 2 and 7

D. 8 and 13

ID: aee9fd2d Answer

Correct Answer:
B

Rationale

Choice B is correct. Multiplying both sides of the given equation by $(3)(13)$, or 39, yields $(39)\left(\frac{x+6}{3}\right) = (39)\left(\frac{x+6}{13}\right)$, or $13(x+6) = 3(x+6)$. Subtracting $3(x+6)$ from both sides of this equation yields $10(x+6) = 0$. Dividing both sides of this equation by 10 yields $x + 6 = 0$. Therefore, if $\frac{x+6}{3} = \frac{x+6}{13}$, then the value of $x + 6$ is 0. It follows that of the given choices, the value of $x + 6$ is between -2 and 2.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 0366d965

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 0366d965

x	y
3	7
k	11
12	n

The table above shows the coordinates of three points on a line in the *xy*-plane, where *k* and *n* are constants. If the slope of the line is 2, what is the value of $k+n$?

ID: 0366d965 Answer

Rationale

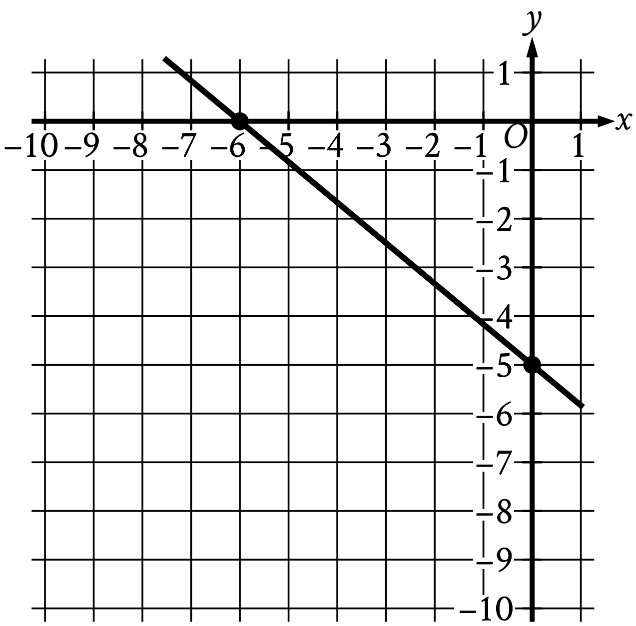
The correct answer is 30. The slope of a line can be found by using the slope formula, $\frac{y_2-y_1}{x_2-x_1}$. It's given that the slope of the line is 2; therefore, $\frac{y_2-y_1}{x_2-x_1}=2$. According to the table, the points $(3,7)$ and $(k,11)$ lie on the line. Substituting the coordinates of these points into the equation gives $\frac{11-7}{k-3}=2$. Multiplying both sides of this equation by $k-3$ gives $11-7=2(k-3)$, or $11-7=2k-6$. Solving for k gives $k=5$. According to the table, the points $(3,7)$ and $(12,n)$ also lie on the line. Substituting the coordinates of these points into $\frac{y_2-y_1}{x_2-x_1}=2$ gives $\frac{n-7}{12-3}=2$. Solving for n gives $n=25$. Therefore, $k+n=5+25$, or 30.

Question Difficulty:
Hard

Question ID 6d8ad460

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 6d8ad460



Line k is shown in the *xy*-plane. Line j (not shown) is perpendicular to line k. What is the slope of line j?

ID: 6d8ad460 Answer

Correct Answer:

1.2, 6/5

Rationale

The correct answer is $\frac{6}{5}$. It's given that line j is perpendicular to line k in the *xy*-plane. This means that the slope of line j is the opposite reciprocal of the slope of line k. For a line that passes through the points (x_1, y_1) and (x_2, y_2) in the *xy*-plane, the slope of the line can be calculated as $\frac{y_2-y_1}{x_2-x_1}$. It's shown that line k passes through the points $(-6, 0)$ and $(0, -5)$ in the *xy*-plane. Substituting -6 for x_1, 0 for y_1, 0 for x_2, and -5 for y_2 in $\frac{y_2-y_1}{x_2-x_1}$ yields $\frac{-5-0}{0-(-6)}$, or $-\frac{5}{6}$. The opposite reciprocal of $-\frac{5}{6}$ is $\frac{6}{5}$. Therefore, the slope of line j is $\frac{6}{5}$. Note that 6/5 and 1.2 are examples of ways to enter a correct answer.

Question Difficulty:

Hard

Question ID 963da34c

Assessment	Test	Math	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: 963da34c

A shipping service restricts the dimensions of the boxes it will ship for a certain type of service. The restriction states that for boxes shaped like rectangular prisms, the sum of the perimeter of the base of the box and the height of the box cannot exceed 130 inches. The perimeter of the base is determined using the width and length of the box. If a box has a height of 60 inches and its length is 2.5 times the width, which inequality shows the allowable width *x*, in inches, of the box?

A. $0 < x \leq 10$

B. $0 < x \leq 11\frac{2}{3}$

C. $0 < x \leq 17\frac{1}{2}$

D. $0 < x \leq 20$

ID: 963da34c Answer

Correct Answer:

A

Rationale

Choice A is correct. If x is the width, in inches, of the box, then the length of the box is 2.5x inches. It follows that the perimeter of the base is $2(2.5x + x)$, or 7x inches. The height of the box is given to be 60 inches. According to the restriction, the sum of the perimeter of the base and the height of the box should not exceed 130 inches. Algebraically, this can be represented by $7x + 60 \leq 130$, or $7x \leq 70$. Dividing both sides of the inequality by 7 gives $x \leq 10$. Since x represents the width of the box, x must also be a positive number. Therefore, the inequality $0 < x \leq 10$ represents all the allowable values of x that satisfy the given conditions.

Choices B, C, and D are incorrect and may result from calculation errors or misreading the given information.

Question Difficulty:

Hard

Question ID e2e3942f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: e2e3942f

$$y = 2x + 1$$
$$y = ax - 8$$

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

A. $-\frac{1}{2}$

B. 0

C. 1

D. 2

ID: e2e3942f Answer

Correct Answer:
D

Rationale

Choice D is correct. A system of two linear equations has no solution when the graphs of the equations have the same slope and different y-coordinates of the y-intercepts. Each of the given equations is written in the slope-intercept form of a linear equation, $y = mx + b$, 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-coordinates of the y-intercepts are different: 1 and -8. Thus, if the system of equations has no solution, the slopes of the two linear equations must be the same. The slope of the first linear equation is 2. Therefore, for the system of equations to have no solution, the value of a must be 2.

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

Question Difficulty:
Hard

Question ID 2d54c272

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: 2d54c272

$$5G + 45R = 380$$

At a school fair, students can win colored tokens that are worth a different number of points depending on the color. One student won G green tokens and R red tokens worth a total of 380 points. The given equation represents this situation. How many more points is a red token worth than a green token?

ID: 2d54c272 Answer

Correct Answer:
40

Rationale

The correct answer is 40. It's given that $5G + 45R = 380$, where G is the number of green tokens and R is the number of red tokens won by one student and these tokens are worth a total of 380 points. Since the equation represents the situation where the student won points with green tokens and red tokens for a total of 380 points, each term on the left-hand side of the equation represents the number of points won for one of the colors. Since the coefficient of G in the given equation is 5, a green token must be worth 5 points. Similarly, since the coefficient of R in the given equation is 45, a red token must be worth 45 points. Therefore, a red token is worth $45 - 5$ points, or 40 points, more than a green token.

Question Difficulty:
Hard

Question ID 1e0a46e4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: 1e0a46e4

Which system of linear equations has no solution?

A. $-2x + 3y = -9$
$2x - 3y = 9$

B. $2x - 3y = 9$
$3x + 4y = 10$

C. $2x - 3y = 9$
$-6x + 9y = -27$

D. $-2x + 3y = 9$
$4x - 6y = 18$

ID: 1e0a46e4 Answer

Correct Answer:
D

Rationale

Choice D is correct. A system of linear equations can be solved by the elimination method. Multiplying the equation $-2x + 3y = 9$ by 2 yields $-4x + 6y = 18$. Adding this equation to the equation $4x - 6y = 18$ yields $0 = 36$, which has no solution. It follows that the system of linear equations consisting of $-2x + 3y = 9$ and $4x - 6y = 18$ has no solution.

Choice A is incorrect. This system of linear equations has infinitely many solutions, rather than no solution.

Choice B is incorrect. This system of linear equations has one solution, rather than no solution.

Choice C is incorrect. This system of linear equations has infinitely many solutions, rather than no solution.

Question Difficulty:
Hard

Question ID 1e11190a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: 1e11190a

Store A sells raspberries for $\$5.50$ per pint and blackberries for $\$3.00$ per pint. Store B sells raspberries for $\$6.50$ per pint and blackberries for $\$8.00$ per pint. A certain purchase of raspberries and blackberries would cost $\$37.00$ at Store A or $\$66.00$ at Store B. How many pints of blackberries are in this purchase?

A. 4

B. 5

C. 8

D. 12

ID: 1e11190a Answer

Correct Answer:
B

Rationale

Choice C is correct. It's given that store A sells raspberries for $\$5.50$ per pint and blackberries for $\$3.00$ per pint, and a certain purchase of raspberries and blackberries at store A would cost $\$37.00$. It's also given that store B sells raspberries for $\$6.50$ per pint and blackberries for $\$8.00$ per pint, and this purchase of raspberries and blackberries at store B would cost $\$66.00$. Let r represent the number of pints of raspberries and b represent the number of pints of blackberries in this purchase. The equation $5.50r + 3.00b = 37.00$ represents this purchase of raspberries and blackberries from store A and the equation $6.50r + 8.00b = 66.00$ represents this purchase of raspberries and blackberries from store B. Solving the system of equations by elimination gives the value of r and the value of b that make the system of equations true. Multiplying both sides of the equation for store A by 6.5 yields $(5.50r)(6.5) + (3.00b)(6.5) = (37.00)(6.5)$, or $35.75r + 19.5b = 240.5$. Multiplying both sides of the equation for store B by 5.5 yields $(6.50r)(5.5) + (8.00b)(5.5) = (66.00)(5.5)$, or $35.75r + 44b = 363$. Subtracting both sides of the equation for store A, $35.75r + 19.5b = 240.5$, from the corresponding sides of the equation for store B, $35.75r + 44b = 363$, yields $(35.75r - 35.75r) + (44b - 19.5b) = (363 - 240.5)$, or $24.5b = 122.5$. Dividing both sides of this equationby 24.5 yields $b = 5$. Thus, 5 pints of blackberries are in this purchase.

Choices A and B are incorrect and may result from conceptual or calculation errors. Choice D is incorrect. This is the number of pints of raspberries, not blackberries, in the purchase.

Question Difficulty:
Hard

Question ID 78391fcc

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 78391fcc

x	-11	-10	-9	-8
$f(x)$	21	18	15	12

The table above shows some values of x and their corresponding values $f(x)$ for the linear function f. What is the x-intercept of the graph of $y=f(x)$ in the xy-plane?

A. $(-3,0)$

B. $(-4,0)$

C. $(-9,0)$

D. $(-12,0)$

ID: 78391fcc Answer

Correct Answer:

B

Rationale

Choice B is correct. The equation of a linear function can be written in the form $y=mx+b$, where $y=f(x)$, m is the slope of the graph of $y=f(x)$, and b is the y-coordinate of the y-intercept of the graph. The value of m can be found using the slope formula, $m=\frac{y_2-y_1}{x_2-x_1}$. According to the table, the points $(-11,21)$ and $(-10,18)$ lie on the graph of $y=f(x)$. Using these two points in the slope formula yields $m=\frac{18-21}{-10+11}$, or -3. Substituting -3 for m in the slope-intercept form of the equation yields $y=-3x+b$. The value of b can be found by substituting values from the table and solving; for example, substituting the coordinates of the point $(-11,21)$ into the equation $y=-3x+b$ gives $21=-3(-11)+b$, which yields $b=-12$. This means the function given by the table can be represented by the equation $y=-3x-12$. The value of the x-intercept of the graph of $y=f(x)$ can be determined by finding the value of x when $y=0$. Substituting $y=0$ into $y=-3x-12$ yields $0=-3x-12$, or $x=-4$. This corresponds to the point $(-4,0)$.

Choice A is incorrect and may result from substituting the value of the slope for the x-coordinate of the x-intercept. Choice C is incorrect and may result from a calculation error. Choice D is incorrect and may result from substituting the y-coordinate of the y-intercept for the x-coordinate of the x-intercept.

Question Difficulty:

Hard

Question ID 68c5c81a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: 68c5c81a

$$11x + 14y \leq 115$$

Anthony will spend at most $\$115$ to purchase x small cheese pizzas and y large cheese pizzas for a team dinner. The given inequality represents this situation. Which of the following is the best interpretation of $14y$ in this context?

A. The amount, in dollars, Anthony will spend on each large cheese pizza

B. The amount, in dollars, Anthony will spend on each small cheese pizza

C. The total amount, in dollars, Anthony will spend on large cheese pizzas

D. The total amount, in dollars, Anthony will spend on small cheese pizzas

ID: 68c5c81a Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that Anthony will spend at most $\$115$ to purchase x small cheese pizzas and y large cheese pizzas. In the inequality $11x + 14y \leq 115$, y represents the number of large cheese pizzas that Anthony will purchase. This means the coefficient 14 represents the amount, in dollars, Anthony will spend on each large cheese pizza. Therefore, the best interpretation of $14y$ in this context is the total amount, in dollars, Anthony will spend on large cheese pizzas.

Choice A is incorrect. This is the best interpretation of 14, not $14y$.

Choice B is incorrect. This is the best interpretation of 11, not $14y$.

Choice D is incorrect. This is the best interpretation of $11x$, not $14y$.

Question Difficulty:
Hard

Question ID b8e73b5b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: b8e73b5b

Ken is working this summer as part of a crew on a farm. He earned $8 per hour for the first 10 hours he worked this week. Because of his performance, his crew leader raised his salary to $10 per hour for the rest of the week. Ken saves 90% of his earnings from each week. What is the least number of hours he must work the rest of the week to save at least $270 for the week?

A. 38

B. 33

C. 22

D. 16

ID: b8e73b5b Answer

Correct Answer:
C

Rationale

Choice C is correct. Ken earned $8 per hour for the first 10 hours he worked, so he earned a total of $80 for the first 10 hours he worked. For the rest of the week, Ken was paid at the rate of $10 per hour. Let x be the number of hours he will work for the rest of the week. The total of Ken's earnings, in dollars, for the week will be $10x+80$. He saves 90% of his earnings each week, so this week he will save $0.9(10x+80)$ dollars. The inequality $0.9(10x+80)\geq 270$ represents the condition that he will save at least $270 for the week. Factoring 10 out of the expression $10x+80$ gives $10(x+8)$. The product of 10 and 0.9 is 9, so the inequality can be rewritten as $9(x+8)\geq 270$. Dividing both sides of this inequality by 9 yields $x+8\geq 30$, so $x\geq 22$. Therefore, the least number of hours Ken must work the rest of the week to save at least $270 for the week is 22.

Choices A and B are incorrect because Ken can save $270 by working fewer hours than 38 or 33 for the rest of the week. Choice D is incorrect. If Ken worked 16 hours for the rest of the week, his total earnings for the week will be $\$80+\$160=\$240$, which is less than $270. Since he saves only 90% of his earnings each week, he would save even less than $240 for the week.

Question Difficulty:
Hard

Question ID 830120b0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear inequalities in one or two variables	

ID: 830120b0

$$y > 2x - 1$$
$$2x > 5$$

Which of the following consists of the y-coordinates of all the points that satisfy the system of inequalities above?

A. $y > 6$

B. $y > 4$

C. $y > \frac{5}{2}$

D. $y > \frac{3}{2}$

ID: 830120b0 Answer

Correct Answer:
B

Rationale

Choice B is correct. Subtracting the same number from each side of an inequality gives an equivalent inequality. Hence, subtracting 1 from each side of the inequality $2x > 5$ gives $2x - 1 > 4$. So the given system of inequalities is equivalent to the system of inequalities $y > 2x - 1$ and $2x - 1 > 4$, which can be rewritten as $y > 2x - 1 > 4$. Using the transitive property of inequalities, it follows that $y > 4$.

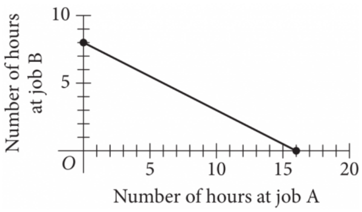
Choice A is incorrect because there are points with a y-coordinate less than 6 that satisfy the given system of inequalities. For example, $(3, 5.5)$ satisfies both inequalities. Choice C is incorrect. This may result from solving the inequality $2x > 5$ for x, then replacing x with y. Choice D is incorrect because this inequality allows y-values that are not the y-coordinate of any point that satisfies both inequalities. For example, $y = 2$ is contained in the set $y > \frac{3}{2}$; however, if 2 is substituted into the first inequality for y, the result is $x < \frac{3}{2}$. This cannot be true because the second inequality gives $x > \frac{5}{2}$.

Question Difficulty:
Hard

Question ID c4ea43ef

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: c4ea43ef



To earn money for college, Avery works two part-time jobs: A and B. She earns \$10 per hour working at job A and \$20 per hour working at job B. In one week, Avery earned a total of s dollars for working at the two part-time jobs. The graph above represents all possible combinations of numbers of hours Avery could have worked at the two jobs to earn s dollars. What is the value of s ?

A. 128

B. 160

C. 200

D. 320

ID: c4ea43ef Answer

Correct Answer:
B

Rationale

Choice B is correct. Avery earns \$10 per hour working at job A. Therefore, if she works a hours at job A, she will earn $10a$ dollars. Avery earns \$20 per hour working at job B. Therefore, if she works b hours at job B, she will earn $20b$ dollars. The graph shown represents all possible combinations of the number of hours Avery could have worked at the two jobs to earn s dollars. Therefore, if she worked a hours at job A, worked b hours at job B, and earned s dollars from both jobs, the following equation represents the graph: $10a+20b=s$, where s is a constant. Identifying any point (a,b) from the graph and substituting the values of the coordinates for a and b, respectively, in this equation yield the value of s. For example, the point $(16,0)$, where $a=16$ and $b=0$, lies on the graph. Substituting 16 for a and 0 for b in the equation $10a+20b=s$ yields $10(16)+20(0)=s$, or $160=s$. Similarly, the point $(0,8)$, where $a=0$ and $b=8$, lies on the graph. Substituting 0 for a and 8 for b in the equation $10a+20b=s$ yields $10(0)+20(8)=s$, or $160=s$.

Choices A, C, and D are incorrect. If the value of s is 128, 200, or 320, then no points (a,b) on the graph will satisfy this equation. For example, if the value of s is 128 (choice A), then the equation $10a+20b=s$ becomes $10a+20b=128$. The point $(16,0)$, where $a=16$ and $b=0$, lies on the graph. However, substituting 16 for a and 0 for b in $10a+20b=s$ yields $10(16)+20(0)=128$, or $160=128$, which is false. Therefore, $(16,0)$ doesn't satisfy the equation, and so the value of s can't be

128. Similarly, if $s = 200$ (choice C) or $s = 320$ (choice D), then substituting 16 for a and 0 for b yields $160 = 200$ and $160 = 320$, respectively, which are both false.

Question Difficulty:
Hard

Question ID fb5e7f59

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: fb5e7f59

$$-x - wy = -337$$
$$2x - wy = 47$$

In the given system of equations, w is a constant. In the *xy*-plane, the graphs of these equations intersect at the point $(q, 19)$, where q is a constant. What is the value of w?

ID: fb5e7f59 Answer

Correct Answer:
11

Rationale

The correct answer is 11. It's given that the graphs of the equations in the given system intersect at the point $(q, 19)$, where q is a constant. Therefore, the coordinates of this point must satisfy both equations. Substituting the point $(q, 19)$ into the first equation, $-x - wy = -337$, yields $-q - w(19) = -337$. Adding $19w$ to both sides of this equation yields $-q = -337 + 19w$, which is equivalent to $q = 337 - 19w$. Substituting the point $(q, 19)$ into the second equation yields $2q - w(19) = 47$. Substituting $337 - 19w$ in place of q in the equation $2q - w(19) = 47$ yields $2(337 - 19w) - 19w = 47$. Applying the distributive property to the left-hand side of this equation yields $674 - 38w - 19w = 47$. Combining like terms on the left-hand side of this equation yields $674 - 57w = 47$. Subtracting 674 from both sides of this equation yields $-57w = -627$. Dividing both sides of this equation by -57 yields $w = 11$.

Question Difficulty:
Hard

Question ID cb58833c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: cb58833c

The line with the equation $\frac{4}{5}x + \frac{1}{3}y = 1$ is graphed in the *xy*-plane. What is the *x*-coordinate of the *x*-intercept of the line?

ID: cb58833c Answer

Rationale

The correct answer is 1.25. The y-coordinate of the x-intercept is 0, so 0 can be substituted for y, giving $\frac{4}{5}x + \frac{1}{3}(0) = 1$. This simplifies to $\frac{4}{5}x = 1$. Multiplying both sides of $\frac{4}{5}x = 1$ by 5 gives $4x = 5$. Dividing both sides of $4x = 5$ by 4 gives $x = \frac{5}{4}$, which is equivalent to 1.25. Note that 1.25 and 5/4 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 567ac7ab

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Systems of two linear equations in two variables	

ID: 567ac7ab

One of the two equations in a linear system is $2x + 6y = 10$. The system has no solution. Which of the following could be the other equation in the system?

A. $x + 3y = 5$

B. $x + 3y = -20$

C. $6x - 2y = 0$

D. $6x + 2y = 10$

ID: 567ac7ab Answer

Correct Answer:
B

Rationale

Choice B is correct. A system of two linear equations written in standard form has no solution when the equations are distinct and the ratio of the x-coefficient to the y-coefficient for one equation is equivalent to the ratio of the x-coefficient to the y-coefficient for the other equation. This ratio for the given equation is 2 to 6, or 1 to 3. Only choice B is an equation that isn't equivalent to the given equation and whose ratio of the x-coefficient to the y-coefficient is 1 to 3.

Choice A is incorrect. Multiplying each of the terms in this equation by 2 yields an equation that is equivalent to the given equation. This system would have infinitely many solutions. Choices C and D are incorrect. The ratio of the x-coefficient to the y-coefficient in $6x - 2y = 0$ (choice C) is -6 to 2, or -3 to 1. This ratio in $6x + 2y = 10$ (choice D) is 6 to 2, or 3 to 1. Since neither of these ratios is equivalent to that for the given equation, these systems would have exactly one solution.

Question Difficulty:
Hard

Question ID daad7c32

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: daad7c32

An object hangs from a spring. The formula $\ell = 30 + 2w$ relates the length ℓ, in centimeters, of the spring to the weight *w*, in newtons, of the object. Which of the following describes the meaning of the 2 in this context?

A. The length, in centimeters, of the spring with no weight attached

B. The weight, in newtons, of an object that will stretch the spring 30 centimeters

C. The increase in the weight, in newtons, of the object for each one-centimeter increase in the length of the spring

D. The increase in the length, in centimeters, of the spring for each one-newton increase in the weight of the object

ID: daad7c32 Answer

Correct Answer:
D

Rationale

Choice D is correct. The value 2 is multiplied by w, the weight of the object. When the weight is 0, the length is 30 + 2(0) = 30 centimeters. If the weight increases by w newtons, the length increases by 2w centimeters, or 2 centimeters for each one-newton increase in weight.

Choice A is incorrect because this describes the value 30. Choice B is incorrect because 30 represents the length of the spring before it has been stretched. Choice C is incorrect because this describes the value w.

Question Difficulty:
Hard

Question ID 3f8a701b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: 3f8a701b

The equation $9x+5=a(x+b)$, where *a* and *b* are constants, has no solutions. Which of the following must be true?

I. $a=9$

II. $b=5$

III. $b \neq \frac{5}{9}$

A. None

B. I only

C. I and II only

D. I and III only

ID: 3f8a701b Answer

Correct Answer:

D

Rationale

Choice D is correct. For a linear equation in a form $ax+b=cx+d$ to have no solutions, the x-terms must have equal coefficients and the remaining terms must not be equal. Expanding the right-hand side of the given equation yields $9x+5=ax+ab$. Inspecting the x-terms, 9 must equal a, so statement I must be true. Inspecting the remaining terms, 5 can't equal $9b$. Dividing both of these quantities by 9 yields that b can't equal $\frac{5}{9}$. Therefore, statement III must be true. Since b can have any value other than $\frac{5}{9}$, statement II may or may not be true.

Choice A is incorrect. For the given equation to have no solution, both $a=9$ and $b \neq \frac{5}{9}$ must be true. Choice B is incorrect because it must also be true that $b \neq \frac{5}{9}$. Choice C is incorrect because when $a=9$, there are many values of b that lead to an equation having no solution. That is, b might be 5, but b isn't required to be 5.

Question Difficulty:

Hard

Question ID 023c0a8d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 023c0a8d

For the function *f*, if $f(3x) = x - 6$ for all values of *x*, what is the value of $f(6)$?

A. -6

B. -4

C. 0

D. 2

ID: 023c0a8d Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that $f(3x) = x - 6$ for all values of x. If $3x = 6$, then $f(3x)$ will equal $f(6)$. Dividing both sides of $3x = 6$ by 3 gives $x = 2$. Therefore, substituting 2 for x in the given equation yields $f(3 \times 2) = 2 - 6$, which can be rewritten as $f(6) = -4$.

Choice A is incorrect. This is the value of the constant in the given equation for f. Choice C is incorrect and may result from substituting $x = 6$, rather than $x = 2$, into the given equation. Choice D is incorrect. This is the value of x that yields $f(6)$ for the left-hand side of the given equation; it's not the value of $f(6)$.

Question Difficulty:
Hard

Question ID a7a14e87

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: a7a14e87

In the *xy*-plane, line *k* is defined by $x + y = 0$. Line *j* is perpendicular to line *k*, and the *y*-intercept of line *j* is $(0, 3)$. Which of the following is an equation of line *j* ?

A. $x + y = 3$

B. $x + y = -3$

C. $x - y = 3$

D. $x - y = -3$

ID: a7a14e87 Answer

Correct Answer:
D

Rationale

Choice D is correct. It’s given that line j is perpendicular to line k and that line k is defined by the equation $x + y = 0$. This equation can be rewritten in slope-intercept form, $y = mx + b$, where m represents the slope of the line and b represents the y-coordinate of the y-intercept of the line, by subtracting x from both sides of the equation, which yields $y = -x$. Thus, the slope of line k is -1. Since line j and line k are perpendicular, their slopes are opposite reciprocals of each other. Thus, the slope of line j is 1. It’s given that the y-intercept of line j is $(0, 3)$. Therefore, the equation for line j in slope-intercept form is $y = x + 3$, which can be rewritten as $x - y = -3$.

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

Question Difficulty:
Hard

Question ID 429fb7c0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: 429fb7c0

What value of t is the solution to the equation $0.8t - 0.46 = 8(t - 0.001) + 1.9$?

ID: 429fb7c0 Answer

Correct Answer:
-.3266, -.3267, -49/150

Rationale

The correct answer is $-.3267$. Applying the distributive property to the right-hand side of the given equation yields $0.8t - 0.46 = 8t - 0.008 + 1.9$, or $0.8t - 0.46 = 8t + 1.892$. Subtracting $0.8t$ from both sides of this equation yields $-0.46 = 7.2t + 1.892$. Subtracting 1.892 from both sides of this equation yields $-2.352 = 7.2t$. Dividing both sides of this equation by 7.2 yields $\frac{-2.352}{7.2} = t$. Therefore, the value of t is approximately -0.32667. Note that -.3267, -.3266, -0.326, and -0.327 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID f5ff91b2

Assessment	Test	Math	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: f5ff91b2

If $\frac{x-5}{7} = \frac{x-5}{9}$, the value of $x - 5$ is between which of the following pairs of values?

A. -9 and -7

B. -3 and 3

C. 4.5 and 5.5

D. 6.75 and 9.25

ID: f5ff91b2 Answer

Correct Answer:
B

Rationale

Choice B is correct. Multiplying both sides of the given equation by $(7)(9)$, or 63, yields $(63)\left(\frac{x-5}{7}\right) = (63)\left(\frac{x-5}{9}\right)$, or $9(x-5) = 7(x-5)$. Subtracting $7(x-5)$ from both sides of this equation yields $2(x-5) = 0$. Dividing both sides of this equation by 2 yields $x - 5 = 0$. Therefore, if $\frac{x-5}{7} = \frac{x-5}{9}$, then the value of $x - 5$ is 0. It follows that of the given choices, the value of $x - 5$ is between -3 and 3.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID a1fd2304

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in two variables	

ID: a1fd2304

How many liters of a 25% saline solution must be added to 3 liters of a 10% saline solution to obtain a 15% saline solution?

ID: a1fd2304 Answer

Rationale

The correct answer is 1.5. The total amount, in liters, of a saline solution can be expressed as the liters of each type of saline solution multiplied by the percent concentration of the saline solution. This gives $3(0.10)$, $x(0.25)$, and $(x+3)(0.15)$, where x is the amount, in liters, of 25% saline solution and 10%, 15%, and 25% are represented as 0.10, 0.15, and 0.25, respectively. Thus, the equation $3(0.10)+0.25x=0.15(x+3)$ must be true. Multiplying 3 by 0.10 and distributing 0.15 to $(x+3)$ yields $0.30+0.25x=0.15x+0.45$. Subtracting 0.15x and 0.30 from each side of the equation gives $0.10x=0.15$. Dividing each side of the equation by 0.10 yields $x=1.5$. Note that 1.5 and 3/2 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 628300a9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear equations in one variable	

ID: 628300a9

A science teacher is preparing the 5 stations of a science laboratory. Each station will have either Experiment A materials or Experiment B materials, but not both. Experiment A requires 6 teaspoons of salt, and Experiment B requires 4 teaspoons of salt. If x is the number of stations that will be set up for Experiment A and the remaining stations will be set up for Experiment B, which of the following expressions represents the total number of teaspoons of salt required?

A. $5x$

B. $10x$

C. $2x+20$

D. $10x+20$

ID: 628300a9 Answer

Correct Answer:

C

Rationale

Choice C is correct. It is given that x represents the number of stations that will be set up for Experiment A and that there will be 5 stations total, so it follows that $5 - x$ is the number of stations that will be set up for Experiment B. It is also given that Experiment A requires 6 teaspoons of salt and that Experiment B requires 4 teaspoons of salt, so the total number of teaspoons of salt required is $6x + 4(5 - x)$, which simplifies to $2x + 20$.

Choices A, B, and D are incorrect and may be the result of not understanding the description of the context.

Question Difficulty:

Hard

Question ID 0bd33265

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: 0bd33265

The equation $h = \frac{9(v-273.15)}{5} + 32$ gives the corresponding temperature h, in degrees Fahrenheit, of any substance that has a temperature of v kelvins, where $v > 0$. If a substance has a temperature of 467.33 degrees Fahrenheit, what is the corresponding temperature, in kelvins, of this substance?

ID: 0bd33265 Answer

Correct Answer:

515

Rationale

The correct answer is 515. It's given that the equation $h = \frac{9(v-273.15)}{5} + 32$ gives the corresponding temperature h, in degrees Fahrenheit, of any substance that has a temperature of v kelvins, where $v > 0$. Substituting 467.33 for h in the given equation yields $467.33 = \frac{9(v-273.15)}{5} + 32$. Subtracting 32 from both sides of this equation yields $435.33 = \frac{9(v-273.15)}{5}$. Multiplying both sides of this equation by 5 yields $2{,}176.65 = 9(v - 273.15)$. Dividing both sides of this equation by 9 yields $241.85 = v - 273.15$. Adding 273.15 to both sides of this equation yields $515 = v$. Therefore, if a substance has a temperature of 467.33 degrees Fahrenheit, the corresponding temperature, in kelvins, of this substance is 515.

Question Difficulty:

Hard

Question ID bbf9e5ce

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	

ID: bbf9e5ce

For groups of 25 or more people, a museum charges $\$21$ per person for the first 25 people and $\$14$ for each additional person. Which function f gives the total charge, in dollars, for a tour group with n people, where $n \geq 25$?

A. $f(n) = 14n + 175$

B. $f(n) = 14n + 525$

C. $f(n) = 35n - 350$

D. $f(n) = 14n + 21$

ID: bbf9e5ce Answer

Correct Answer:
A

Rationale

Choice A is correct. A tour group with n people, where $n \geq 25$, can be split into two subgroups: the first 25 people and the additional $n - 25$ people. Since the museum charges $\$21$ per person for the first 25 people and $\$14$ for each additional person, the charge for the first 25 people is $\$21(25)$ and the charge for the additional $n - 25$ people is $\$14(n - 25)$. Therefore, the total charge, in dollars, is given by the function $f(n) = 21(25) + 14(n - 25)$, or $f(n) = 14n + 175$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 128c75e2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 128c75e2

The function g is defined by $g(x) = \frac{|x|}{a} - 14$, where $a < 0$. What is the product of $g(15a)$ and $g(7a)$?

ID: 128c75e2 Answer

Correct Answer:
609

Rationale

The correct answer is 609. It's given that the function g is defined by $g(x) = \frac{|x|}{a} - 14$, where $a < 0$. Substituting $15a$ for x in function g yields $g(15a) = \frac{|15a|}{a} - 14$. This function can be rewritten as $g(15a) = \frac{15|a|}{a} - 14$, or $g(15a) = 15\left(\frac{|a|}{a}\right) - 14$. Since $a < 0$, it follows that $\frac{|a|}{a} = -1$. Substituting -1 for $\frac{|a|}{a}$ in $g(15a) = 15\left(\frac{|a|}{a}\right) - 14$ yields $g(15a) = 15(-1) - 14$, or $g(15a) = -29$. Similarly, substituting $7a$ for x in function g yields $g(7a) = \frac{|7a|}{a} - 14$. This function can be rewritten as $g(7a) = \frac{7|a|}{a} - 14$, or $g(7a) = 7\left(\frac{|a|}{a}\right) - 14$. Since $a < 0$, it again follows that $\frac{|a|}{a} = -1$. Substituting -1 for $\frac{|a|}{a}$ in $g(7a) = 7\left(\frac{|a|}{a}\right) - 14$ yields $g(7a) = 7(-1) - 14$, or $g(7a) = -21$. Therefore, $g(15a) = -29$ and $g(7a) = -21$. Thus, the product of $g(15a)$ and $g(7a)$ is $(-29)(-21)$, or 609.

Question Difficulty:
Hard

Question ID 91e7ea5e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 91e7ea5e

$h(x) = 2(x - 4)^2 - 32$

The quadratic function h is defined as shown. In the xy-plane, the graph of $y = h(x)$ intersects the x-axis at the points $(0,0)$and $(t,0)$, where t is a constant. What is the value of t ?

A. 1

B. 2

C. 4

D. 8

ID: 91e7ea5e Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that the graph of $y = h(x)$ intersects the x-axis at $(0,0)$ and $(t,0)$, where t is a constant. Since this graph intersects the x-axis when $y = 0$ or when $h(x) = 0$, it follows that $h(0) = 0$ and $h(t) = 0$. If $h(t) = 0$, then $0 = 2(t - 4)^2 - 32$. Adding 32 to both sides of this equation yields $32 = 2(t - 4)^2$. Dividing both sides of this equation by 2 yields $16 = (t - 4)^2$. Taking the square root of both sides of this equation yields $4 = t - 4$. Adding 4 to both sides of this equation yields $8 = t$. Therefore, the value of t is 8.

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

Question Difficulty:
Hard

Question ID 3a9d60b2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 3a9d60b2

$$2|4-x|+3|4-x|=25$$

What is the positive solution to the given equation?

ID: 3a9d60b2 Answer

Correct Answer:

9

Rationale

The correct answer is 9. The given equation can be rewritten as $5|4-x|=25$. Dividing each side of this equation by 5 yields $|4-x|=5$. By the definition of absolute value, if $|4-x|=5$, then $4-x=5$ or $4-x=-5$. Subtracting 4 from each side of the equation $4-x=5$ yields $-x=1$. Dividing each side of this equation by -1 yields $x=-1$. Similarly, subtracting 4 from each side of the equation $4-x=-5$ yields $-x=-9$. Dividing each side of this equation by -1 yields $x=9$. Therefore, since the two solutions to the given equation are -1 and 9, the positive solution to the given equation is 9.

Question Difficulty:

Hard

Question ID ebed7dc6

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: ebed7dc6

An auditorium has seats for $1{,}800$ people. Tickets to attend a show at the auditorium currently cost $\$4.00$. For each $\$1.00$ increase to the ticket price, 100 fewer tickets will be sold. This situation can be modeled by the equation $y = -100x^2 + 1{,}400x + 7{,}200$, where x represents the increase in ticket price, in dollars, and y represents the revenue, in dollars, from ticket sales. If this equation is graphed in the *xy*-plane, at what value of x is the maximum of the graph?

A. 4

B. 7

C. 14

D. 18

ID: ebed7dc6 Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that the situation can be modeled by the equation $y = -100x^2 + 1{,}400x + 7{,}200$, where x represents the increase in ticket price, in dollars, and y represents the revenue, in dollars, from ticket sales. Since the coefficient of the x^2 term is negative, the graph of this equation in the *xy*-plane opens downward and reaches its maximum value at its vertex. If a quadratic equation in the form $y = ax^2 + bx + c$, where a, b, and c are constants, is graphed in the *xy*-plane, the *x*-coordinate of the vertex is equal to $-\frac{b}{2a}$. For the equation $y = -100x^2 + 1{,}400x + 7{,}200$, $a = -100$, $b = 1{,}400$, and $c = 7{,}200$. It follows that the *x*-coordinate of the vertex is $-\frac{1{,}400}{2(-100)}$, or 7. Therefore, if the given equation is graphed in the *xy*-plane, the maximum of the graph occurs at an *x*-value of 7.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID fc3d783a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: fc3d783a

In the xy-plane, a line with equation $2y = 4.5$ intersects a parabola at exactly one point. If the parabola has equation $y = -4x^2 + bx$, where b is a positive constant, what is the value of b?

ID: fc3d783a Answer

Correct Answer:

6

Rationale

The correct answer is 6. It's given that a line with equation $2y = 4.5$ intersects a parabola with equation $y = -4x^2 + bx$, where b is a positive constant, at exactly one point in the *xy*-plane. It follows that the system of equations consisting of $2y = 4.5$ and $y = -4x^2 + bx$ has exactly one solution. Dividing both sides of the equation of the line by 2 yields $y = 2.25$. Substituting 2.25 for y in the equation of the parabola yields $2.25 = -4x^2 + bx$. Adding $4x^2$ and subtracting bx from both sides of this equation yields $4x^2 - bx + 2.25 = 0$. A quadratic equation in the form of $ax^2 + bx + c = 0$, where a, b, and c are constants, has exactly one solution when the discriminant, $b^2 - 4ac$, is equal to zero. Substituting 4 for a and 2.25 for c in the expression $b^2 - 4ac$ and setting this expression equal to 0 yields $b^2 - 4(4)(2.25) = 0$, or $b^2 - 36 = 0$. Adding 36 to each side of this equation yields $b^2 = 36$. Taking the square root of each side of this equation yields $b = \pm 6$. It's given that b is positive, so the value of b is 6.

Question Difficulty:

Hard

Question ID a9084ca4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: a9084ca4

$$f(x) = 9{,}000(0.66)^x$$

The given function f models the number of advertisements a company sent to its clients each year, where x represents the number of years since 1997, and $0 \leq x \leq 5$. If $y = f(x)$ is graphed in the *xy*-plane, which of the following is the best interpretation of the *y*-intercept of the graph in this context?

A. The minimum estimated number of advertisements the company sent to its clients during the 5 years was $1{,}708$.

B. The minimum estimated number of advertisements the company sent to its clients during the 5 years was $9{,}000$.

C. The estimated number of advertisements the company sent to its clients in 1997 was $1{,}708$.

D. The estimated number of advertisements the company sent to its clients in 1997 was $9{,}000$.

ID: a9084ca4 Answer

Correct Answer:

D

Rationale

Choice D is correct. The *y*-intercept of a graph in the *xy*-plane is the point where $x = 0$. For the given function f, the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane can be found by substituting 0 for x in the equation $y = 9{,}000(0.66)^x$, which gives $y = 9{,}000(0.66)^0$. This is equivalent to $y = 9{,}000(1)$, or $y = 9{,}000$. Therefore, the *y*-intercept of the graph of $y = f(x)$ is $(0, 9{,}000)$. It's given that the function f models the number of advertisements a company sent to its clients each year. Therefore, $f(x)$ represents the estimated number of advertisements the company sent to its clients each year. It's also given that x represents the number of years since 1997. Therefore, $x = 0$ represents 0 years since 1997, or 1997. Thus, the best interpretation of the *y*-intercept of the graph of $y = f(x)$ is that the estimated number of advertisements the company sent to its clients in 1997 was $9{,}000$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:

Hard

Question ID 4661e2a9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 4661e2a9

$x - y = 1$
$x + y = x^2 - 3$

Which ordered pair is a solution to the system of equations above?

A. $(1+\sqrt{3}, \sqrt{3})$

B. $(\sqrt{3}, -\sqrt{3})$

C. $(1+\sqrt{5}, \sqrt{5})$

D. $(\sqrt{5}, -1+\sqrt{5})$

ID: 4661e2a9 Answer

Correct Answer:
A

Rationale

Choice A is correct. The solution to the given system of equations can be found by solving the first equation for x, which gives $x = y + 1$, and substituting that value of x into the second equation which gives $y + 1 + y = (y+1)^2 - 3$. Rewriting this equation by adding like terms and expanding $(y+1)^2$ gives $2y + 1 = y^2 + 2y - 2$. Subtracting $2y$ from both sides of this equation gives $1 = y^2 - 2$. Adding to 2 to both sides of this equation gives $3 = y^2$. Therefore, it follows that $y = \pm\sqrt{3}$. Substituting $\sqrt{3}$ for y in the first equation yields $x - \sqrt{3} = 1$. Adding $\sqrt{3}$ to both sides of this equation yields $x = 1 + \sqrt{3}$. Therefore, the ordered pair $(1+\sqrt{3}, \sqrt{3})$ is a solution to the given system of equations.

Choice B is incorrect. Substituting $\sqrt{3}$ for x and $-\sqrt{3}$ for y in the first equation yields $\sqrt{3} - (-\sqrt{3}) = 1$, or $2\sqrt{3} = 1$, which isn't a true statement. Choice C is incorrect. Substituting $1 + \sqrt{5}$ for x and $\sqrt{5}$ for y in the second equation yields $(1+\sqrt{5}) + \sqrt{5} = (1+\sqrt{5})^2 - 3$, or $1 + 2\sqrt{5} = 2\sqrt{5} + 3$, which isn't a true statement. Choice D is incorrect. Substituting $\sqrt{5}$ for x and $(-1+\sqrt{5})$ for y in the second equation yields $\sqrt{5} + (-1+\sqrt{5}) = (\sqrt{5})^2 - 3$, or $2\sqrt{5} - 1 = 2$, which isn't a true statement.

Question Difficulty:

Hard

Question ID 371cbf6b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 371cbf6b

$$(ax+3)(5x^2-bx+4)=20x^3-9x^2-2x+12$$

The equation above is true for all *x*, where *a* and *b* are constants. What is the value of *ab* ?

A. 18

B. 20

C. 24

D. 40

ID: 371cbf6b Answer

Correct Answer:

C

Rationale

Choice C is correct. If the equation is true for all x, then the expressions on both sides of the equation will be equivalent. Multiplying the polynomials on the left-hand side of the equation gives $5ax^3-abx^2+4ax+15x^2-3bx+12$. On the right-hand side of the equation, the only x^2-term is $-9x^2$. Since the expressions on both sides of the equation are equivalent, it follows that $-abx^2+15x^2=-9x^2$, which can be rewritten as $(-ab+15)x^2=-9x^2$. Therefore, $-ab+15=-9$, which gives $ab=24$.

Choice A is incorrect. If $ab=18$, then the coefficient of x^2 on the left-hand side of the equation would be $-18+15=-3$, which doesn't equal the coefficient of x^2, -9, on the right-hand side. Choice B is incorrect. If $ab=20$, then the coefficient of x^2 on the left-hand side of the equation would be $-20+15=-5$, which doesn't equal the coefficient of x^2, -9, on the right-hand side. Choice D is incorrect. If $ab=40$, then the coefficient of x^2 on the left-hand side of the equation would be $-40+15=-25$, which doesn't equal the coefficient of x^2, -9, on the right-hand side.

Question Difficulty:

Hard

Question ID c3b116d7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: c3b116d7

Which of the following expressions is(are) a factor of $3x^2 + 20x - 63$?

I. $x - 9$

II. $3x - 7$

A. I only

B. II only

C. I and II

D. Neither I nor II

ID: c3b116d7 Answer

Correct Answer:

B

Rationale

Choice B is correct. The given expression can be factored by first finding two values whose sum is 20 and whose product is $3(-63)$, or -189. Those two values are 27 and -7. It follows that the given expression can be rewritten as $3x^2 + 27x - 7x - 63$. Since the first two terms of this expression have a common factor of $3x$ and the last two terms of this expression have a common factor of -7, this expression can be rewritten as $3x(x + 9) - 7(x + 9)$. Since the two terms of this expression have a common factor of $(x + 9)$, it can be rewritten as $(3x - 7)(x + 9)$. Therefore, expression II, $3x - 7$, is a factor of $3x^2 + 20x - 63$, but expression I, $x - 9$, is not a factor of $3x^2 + 20x - 63$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:

Hard

Question ID 40c09d66

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 40c09d66

If $\frac{\sqrt{x^5}}{\sqrt[3]{x^4}} = x^{\frac{a}{b}}$ for all positive values of x, what is the value of $\frac{a}{b}$?

ID: 40c09d66 Answer

Rationale

The correct answer is $\frac{7}{6}$. The value of $\frac{a}{b}$ can be found by first rewriting the left-hand side of the given equation as $\frac{x^{\frac{5}{2}}}{x^{\frac{4}{3}}}$. Using the properties of exponents, this expression can be rewritten as $x^{\left(\frac{5}{2}-\frac{4}{3}\right)}$. This expression can be rewritten by subtracting the fractions in the exponent, which yields $x^{\frac{7}{6}}$. Thus, $\frac{a}{b}$ is $\frac{7}{6}$. Note that 7/6, 1.166, and 1.167 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID b8f13a3a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: b8f13a3a

Function f is defined by $f(x) = -a^x + b$, where a and b are constants. In the *xy*-plane, the graph of $y = f(x) - 12$ has a *y*-intercept at $\left(0, -\frac{75}{7}\right)$. The product of a and b is $\frac{320}{7}$. What is the value of a?

ID: b8f13a3a Answer

Correct Answer:
20

Rationale

The correct answer is 20. It's given that $f(x) = -a^x + b$. Substituting $-a^x + b$ for $f(x)$ in the equation $y = f(x) - 12$ yields $y = -a^x + b - 12$. It's given that the *y*-intercept of the graph of $y = f(x) - 12$ is $\left(0, -\frac{75}{7}\right)$. Substituting 0 for x and $-\frac{75}{7}$ for y in the equation $y = -a^x + b - 12$ yields $-\frac{75}{7} = -a^0 + b - 12$, which is equivalent to $-\frac{75}{7} = -1 + b - 12$, or $-\frac{75}{7} = b - 13$. Adding 13 to both sides of this equation yields $\frac{16}{7} = b$. It's given that the product of a and b is $\frac{320}{7}$, or $ab = \frac{320}{7}$. Substituting $\frac{16}{7}$ for b in this equation yields $(a)\left(\frac{16}{7}\right) = \frac{320}{7}$. Dividing both sides of this equation by $\frac{16}{7}$ yields $a = 20$.

Question Difficulty:
Hard

Question ID f65288e8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: f65288e8

$$\frac{1}{x^2+10x+25}=4$$

If x is a solution to the given equation, which of the following is a possible value of $x+5$?

A. $\frac{1}{2}$

B. $\frac{5}{2}$

C. $\frac{9}{2}$

D. $\frac{11}{2}$

ID: f65288e8 Answer

Correct Answer:
A

Rationale

Choice A is correct. The given equation can be rewritten as $\frac{1}{(x+5)^2}=4$. Multiplying both sides of this equation by $(x+5)^2$ yields $1=4(x+5)^2$. Dividing both sides of this equation by 4 yields $\frac{1}{4}=(x+5)^2$. Taking the square root of both sides of this equation yields $\frac{1}{2}=x+5$ or $-\frac{1}{2}=x+5$. Therefore, a possible value of $x+5$ is $\frac{1}{2}$.

Choices B, C, and D are incorrect and may result from computational or conceptual errors.

Question Difficulty:
Hard

Question ID f2f3fa00

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: f2f3fa00

During a 5-second time interval, the average acceleration a, in meters per second squared, of an object with an initial velocity of 12 meters per second is defined by the equation $a = \frac{v_f - 12}{5}$, where v_f is the final velocity of the object in meters per second. If the equation is rewritten in the form $v_f = xa + y$, where x and y are constants, what is the value of x ?

ID: f2f3fa00 Answer

Rationale

The correct answer is 5. The given equation can be rewritten in the form $v_f = xa + y$, like so:

$$a = \frac{v_f - 12}{5}$$

$$v_f - 12 = 5a$$

$$v_f = 5a + 12$$

It follows that the value of x is 5 and the value of y is 12.

Question Difficulty:
Hard

Question ID 9654add7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 9654add7

$f(x) = -500x^2 + 25{,}000x$

The revenue $f(x)$, in dollars, that a company receives from sales of a product is given by the function f above, where x is the unit price, in dollars, of the product. The graph of $y = f(x)$ in the *xy*-plane intersects the *x*-axis at 0 and *a*. What does *a* represent?

A. The revenue, in dollars, when the unit price of the product is $0

B. The unit price, in dollars, of the product that will result in maximum revenue

C. The unit price, in dollars, of the product that will result in a revenue of $0

D. The maximum revenue, in dollars, that the company can make

ID: 9654add7 Answer

Correct Answer:

C

Rationale

Choice C is correct. By definition, the y-value when a function intersects the x-axis is 0. It's given that the graph of the function intersects the x-axis at 0 and a, that x is the unit price, in dollars, of a product, and that $f(x)$, where $y = f(x)$, is the revenue, in dollars, that a company receives from the sales of the product. Since the value of a occurs when $y = 0$, a is the unit price, in dollars, of the product that will result in a revenue of $0.

Choice A is incorrect. The revenue, in dollars, when the unit price of the product is $0 is represented by $f(x)$, when $x = 0$. Choice B is incorrect. The unit price, in dollars, of the product that will result in maximum revenue is represented by the x-coordinate of the maximum of f. Choice D is incorrect. The maximum revenue, in dollars, that the company can make is represented by the y-coordinate of the maximum of f.

Question Difficulty:

Hard

Question ID 34847f8a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 34847f8a

$$\frac{2}{x-2}+\frac{3}{x+5}=\frac{rx+t}{(x-2)(x+5)}$$

The equation above is true for all $x>2$, where *r* and *t* are positive constants. What is the value of *rt* ?

A. -20

B. 15

C. 20

D. 60

ID: 34847f8a Answer

Correct Answer:
C

Rationale

Choice C is correct. To express the sum of the two rational expressions on the left-hand side of the equation as the single rational expression on the right-hand side of the equation, the expressions on the left-hand side must have the same denominator. Multiplying the first expression by $\frac{x+5}{x-5}$ results in $\frac{2(x+5)}{(x-2)(x+5)}$, and multiplying the second expression by $\frac{x-2}{x-2}$ results in $\frac{3(x-2)}{(x-2)(x+5)}$, so the given equation can be rewritten as $\frac{2(x+5)}{(x-2)(x+5)}+\frac{3(x-2)}{(x-2)(x+5)}=\frac{rx+t}{(x-2)(x+5)}$, or $\frac{2x+10}{(x-2)(x+5)}+\frac{3x-6}{(x-2)(x+5)}=\frac{rx+t}{(x-2)(x+5)}$. Since the two rational expressions on the left-hand side of the equation have the same denominator as the rational expression on the right-hand side of the equation, it follows that $(2x+10)+(3x-6)=rx+t$. Combining like terms on the left-hand side yields $5x+4=rx+t$, so it follows that $r=5$ and $t=4$. Therefore, the value of rt is $(5)(4)=20$.

Choice A is incorrect and may result from an error when determining the sign of either r or t. Choice B is incorrect and may result from not distributing the 2 and 3 to their respective terms in $\frac{2(x+5)}{(x-2)(x+5)}+\frac{3(x-2)}{(x-2)(x+5)}=\frac{rx+t}{(x-2)(x+5)}$. Choice D is incorrect and may result from a calculation error.

Question Difficulty:
Hard

Question ID 263f9937

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 263f9937

Growth of a Culture of Bacteria

Day	Number of bacteria per milliliter at end of day
1	2.5×10^5
2	5.0×10^5
3	1.0×10^6

A culture of bacteria is growing at an exponential rate, as shown in the table above. At this rate, on which day would the number of bacteria per milliliter reach 5.12×10^8?

A. Day 5

B. Day 9

C. Day 11

D. Day 12

ID: 263f9937 Answer

Correct Answer:
D

Rationale

Choice D is correct. The number of bacteria per milliliter is doubling each day. For example, from day 1 to day 2, the number of bacteria increased from 2.5×10^5 to 5.0×10^5. At the end of day 3 there are 10^6 bacteria per milliliter. At the end of day 4, there will be $10^6 \times 2$ bacteria per milliliter. At the end of day 5, there will be $(10^6 \times 2) \times 2$, or $10^6 \times (2^2)$ bacteria per milliliter, and so on. At the end of day d, the number of bacteria will be $10^6 \times (2^{d-3})$. If the number of bacteria per milliliter will reach 5.12×10^8 at the end of day d, then the equation $10^6 \times (2^{d-3}) = 5.12 \times 10^8$ must hold. Since 5.12×10^8 can be rewritten as 512×10^6, the equation is equivalent to $2^{d-3} = 512$. Rewriting 512 as 2^9 gives $d - 3 = 9$, so $d = 12$. The number of bacteria per milliliter would reach 5.12×10^8 at the end of day 12.

Choices A, B, and C are incorrect. Given the growth rate of the bacteria, the number of bacteria will not reach 5.12×10^8 per milliliter by the end of any of these days.

Question Difficulty:
Hard

Question ID 137cc6fd

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 137cc6fd

$$\sqrt[5]{70n}\left(\sqrt[6]{70n}\right)^2$$

For what value of x is the given expression equivalent to $(70n)^{30x}$, where $n > 1$?

ID: 137cc6fd Answer

Correct Answer:
.0177, .0178, 4/225

Rationale

The correct answer is $\frac{4}{225}$. An expression of the form $\sqrt[k]{a}$, where k is an integer greater than 1 and $a \geq 0$, is equivalent to $a^{\frac{1}{k}}$. Therefore, the given expression, where $n > 1$, is equivalent to $(70n)^{\frac{1}{5}}\left((70n)^{\frac{1}{6}}\right)^2$. Applying properties of exponents, this expression can be rewritten as $(70n)^{\frac{1}{5}}(70n)^{\frac{1}{6}\cdot 2}$, or $(70n)^{\frac{1}{5}}(70n)^{\frac{1}{3}}$, which can be rewritten as $(70n)^{\frac{1}{5}+\frac{1}{3}}$, or $(70n)^{\frac{8}{15}}$. It's given that the expression $\sqrt[5]{70n}\left(\sqrt[6]{70n}\right)^2$ is equivalent to $(70n)^{30x}$, where $n > 1$. It follows that $(70n)^{\frac{8}{15}}$ is equivalent to $(70n)^{30x}$. Therefore, $\frac{8}{15} = 30x$. Dividing both sides of this equation by 30 yields $\frac{8}{450} = x$, or $\frac{4}{225} = x$. Thus, the value of x for which the given expression is equivalent to $(70n)^{30x}$, where $n > 1$, is $\frac{4}{225}$. Note that 4/225, .0177, .0178, 0.017, and 0.018 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 6ce95fc8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 6ce95fc8

$$2x^2 - 2 = 2x + 3$$

Which of the following is a solution to the equation above?

A. 2

B. $1 - \sqrt{11}$

C. $\frac{1}{2} + \sqrt{11}$

D. $\frac{1 + \sqrt{11}}{2}$

ID: 6ce95fc8 Answer

Correct Answer:

D

Rationale

Choice D is correct. A quadratic equation in the form $ax^2 + bx + c = 0$, where a, b, and c are constants, can be solved using the quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Subtracting $2x + 3$ from both sides of the given equation yields $2x^2 - 2x - 5 = 0$. Applying the quadratic formula, where $a = 2$, $b = -2$, and $c = -5$, yields $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(2)(-5)}}{2(2)}$. This can be rewritten as $x = \frac{2 \pm \sqrt{44}}{4}$. Since $\sqrt{44} = \sqrt{2^2(11)}$, or $2\sqrt{11}$, the equation can be rewritten as $x = \frac{2 \pm 2\sqrt{11}}{4}$. Dividing 2 from both the numerator and denominator yields $\frac{1 + \sqrt{11}}{2}$ or $\frac{1 - \sqrt{11}}{2}$. Of these two solutions, only $\frac{1 + \sqrt{11}}{2}$ is present among the choices. Thus, the correct choice is D.

Choice A is incorrect and may result from a computational or conceptual error. Choice B is incorrect and may result from using $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{a}$ instead of $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ as the quadratic formula. Choice C is incorrect and may result from rewriting $\sqrt{44}$ as $4\sqrt{11}$ instead of $2\sqrt{11}$.

Question Difficulty:
Hard

Question ID 4dd4efcf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 4dd4efcf

$$f(x) = ax^2 + 4x + c$$

In the given quadratic function, a and c are constants. The graph of $y = f(x)$ in the *xy*-plane is a parabola that opens upward and has a vertex at the point (h, k), where h and k are constants. If $k < 0$ and $f(-9) = f(3)$, which of the following must be true?

I. $c < 0$

II. $a \geq 1$

A. I only

B. II only

C. I and II

D. Neither I nor II

ID: 4dd4efcf Answer

Correct Answer:

D

Rationale

Choice D is correct. It's given that the graph of $y = f(x)$ in the *xy*-plane is a parabola with vertex (h, k). If $f(-9) = f(3)$, then for the graph of $y = f(x)$, the point with an *x*-coordinate of -9 and the point with an *x*-coordinate of 3 have the same *y*-coordinate. In the *xy*-plane, a parabola is a symmetric graph such that when two points have the same *y*-coordinate, these points are equidistant from the vertex, and the *x*-coordinate of the vertex is halfway between the *x*-coordinates of these two points. Therefore, for the graph of $y = f(x)$, the points with *x*-coordinates -9 and 3 are equidistant from the vertex, (h, k), and h is halfway between -9 and 3. The value that is halfway between -9 and 3 is $\frac{-9+3}{2}$, or -3. Therefore, $h = -3$. The equation defining f can also be written in vertex form, $f(x) = a(x-h)^2 + k$. Substituting -3 for h in this equation yields $f(x) = a(x-(-3))^2 + k$, or $f(x) = a(x+3)^2 + k$. This equation is equivalent to $f(x) = a\left(x^2 + 6x + 9\right) + k$, or $f(x) = ax^2 + 6ax + 9a + k$. Since $f(x) = ax^2 + 4x + c$, it follows that $6a = 4$ and $9a + k = c$. Dividing both sides of the equation $6a = 4$ by 6 yields $a = \frac{4}{6}$, or $a = \frac{2}{3}$. Since $\frac{2}{3} < 1$, it's not true that $a \geq 1$. Therefore, statement II isn't true. Substituting $\frac{2}{3}$ for a in the equation $9a + k = c$ yields $9\left(\frac{2}{3}\right) + k = c$, or $6 + k = c$. Subtracting 6 from both sides of this equation yields $k = c - 6$. If $k < 0$, then $c - 6 < 0$, or $c < 6$. Since c could be any value less than 6, it's not necessarily true that $c < 0$. Therefore, statement I isn't necessarily true. Thus, neither I nor II must be true.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:

Hard

Question ID f5aa5040

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: f5aa5040

In the *xy*-plane, a line with equation $2y = c$ for some constant c intersects a parabola at exactly one point. If the parabola has equation $y = -2x^2 + 9x$, what is the value of c?

ID: f5aa5040 Answer

Correct Answer:
20.25, 81/4

Rationale

The correct answer is $\frac{81}{4}$. The given linear equation is $2y = c$. Dividing both sides of this equation by 2 yields $y = \frac{c}{2}$. Substituting $\frac{c}{2}$ for y in the equation of the parabola yields $\frac{c}{2} = -2x^2 + 9x$. Adding $2x^2$ and $-9x$ to both sides of this equation yields $2x^2 - 9x + \frac{c}{2} = 0$. Since it's given that the line and the parabola intersect at exactly one point, the equation $2x^2 - 9x + \frac{c}{2} = 0$ must have exactly one solution. An equation of the form $Ax^2 + Bx + C = 0$, where A, B, and C are constants, has exactly one solution when the discriminant, $B^2 - 4AC$, is equal to 0. In the equation $2x^2 - 9x + \frac{c}{2} = 0$, where $A = 2$, $B = -9$, and $C = \frac{c}{2}$, the discriminant is $(-9)^2 - 4(2)\left(\frac{c}{2}\right)$. Setting the discriminant equal to 0 yields $(-9)^2 - 4(2)\left(\frac{c}{2}\right) = 0$, or $81 - 4c = 0$. Adding $4c$ to both sides of this equation yields $81 = 4c$. Dividing both sides of this equation by 4 yields $c = \frac{81}{4}$. Note that 81/4 and 20.25 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID ea6d05bb

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: ea6d05bb

The expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a, b, and c are constants. What is the value of b?

ID: ea6d05bb Answer

Correct Answer:

-419

Rationale

The correct answer is -419. It's given that the expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a, b, and c are constants. Applying the distributive property to the given expression, $(3x - 23)(19x + 6)$, yields $(3x)(19x) + (3x)(6) - (23)(19x) - (23)(6)$, which can be rewritten as $57x^2 + 18x - 437x - 138$. Combining like terms yields $57x^2 - 419x - 138$. Since this expression is equivalent to $ax^2 + bx + c$, it follows that the value of b is -419.

Question Difficulty:

Hard

Question ID 722de804

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 722de804

$$(x-47)^2 = 1$$

What is the sum of the solutions to the given equation?

ID: 722de804 Answer

Correct Answer:
94

Rationale

The correct answer is 94. Taking the square root of each side of the given equation yields $x - 47 = 1$ or $x - 47 = -1$. Adding 47 to both sides of the equation $x - 47 = 1$ yields $x = 48$. Adding 47 to both sides of the equation $x - 47 = -1$ yields $x = 46$. Therefore, the sum of the solutions to the given equation is $48 + 46$, or 94.

Question Difficulty:
Hard

Question ID 433184f1

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 433184f1

Which expression is equivalent to $\frac{4}{4x-5} - \frac{1}{x+1}$?

A. $\frac{1}{(x+1)(4x-5)}$

B. $\frac{3}{3x-6}$

C. $-\frac{1}{(x+1)(4x-5)}$

D. $\frac{9}{(x+1)(4x-5)}$

ID: 433184f1 Answer

Correct Answer:
D

Rationale

Choice D is correct. The expression $\frac{4}{4x-5} - \frac{1}{x+1}$ can be rewritten as $\frac{4}{4x-5} + \frac{(-1)}{x+1}$. To add the two terms of this expression, the terms can be rewritten with a common denominator. Since $\frac{x+1}{x+1} = 1$, the expression $\frac{4}{4x-5}$ can be rewritten as $\frac{(x+1)(4)}{(x+1)(4x-5)}$. Since $\frac{4x-5}{4x-5} = 1$, the expression $\frac{-1}{x+1}$ can be rewritten as $\frac{(4x-5)(-1)}{(4x-5)(x+1)}$. Therefore, the expression $\frac{4}{4x-5} + \frac{(-1)}{x+1}$ can be rewritten as $\frac{(x+1)(4)}{(x+1)(4x-5)} + \frac{(4x-5)(-1)}{(4x-5)(x+1)}$, which is equivalent to $\frac{(x+1)(4)+(4x-5)(-1)}{(x+1)(4x-5)}$. Applying the distributive property to each term of the numerator yields $\frac{(4x+4)+(-4x+5)}{(x+1)(4x-5)}$, or $\frac{(4x+(-4x))+(4+5)}{(x+1)(4x-5)}$. Adding like terms in the numerator yields $\frac{9}{(x+1)(4x-5)}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID d8789a4c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: d8789a4c

$$\frac{x^2 - c}{x - b}$$

In the expression above, b and c are positive integers. If the expression is equivalent to $x + b$ and $x \neq b$, which of the following could be the value of c ?

A. 4

B. 6

C. 8

D. 10

ID: d8789a4c Answer

Correct Answer:
A

Rationale

Choice A is correct. If the given expression is equivalent to $x + b$, then $\frac{x^2 - c}{x - b} = x + b$, where x isn't equal to b. Multiplying both sides of this equation by $x - b$ yields $x^2 - c = (x + b)(x - b)$. Since the right-hand side of this equation is in factored form for the difference of squares, the value of c must be a perfect square. Only choice A gives a perfect square for the value of c.

Choices B, C, and D are incorrect. None of these values of c produces a difference of squares. For example, when 6 is substituted for c in the given expression, the result is $\frac{x^2 - 6}{x - b}$. The expression $x^2 - 6$ can't be factored with integer values, and therefore $\frac{x^2 - 6}{x - b}$ isn't equivalent to $x + b$.

Question Difficulty:
Hard

Question ID 35e05e19

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 35e05e19

A park ranger hung squirrel houses each in the shape of a right rectangular prism for fox squirrels. Each house has a height of 11 inches. The length of each house's base is x inches, which is 1 inch more than the width of the house's base. Which function V gives the volume of each house, in cubic inches, in terms of the length of the house's base?

A. $V(x) = 11x(x-1)$

B. $V(x) = 11x(x+1)$

C. $V(x) = x(x+11)(x-1)$

D. $V(x) = x(x+11)(x+1)$

ID: 35e05e19 Answer

Correct Answer:
A

Rationale

Choice A is correct. The volume of a prism is equal to the area of its base times its height. It's given that the length of each house's base is x inches and that this length is 1 inch more than the width, in inches, of the house's base. It follows that the width, in inches, of the house's base is $x-1$. The area of a rectangle is the product of its length and its width. Therefore, the area of the base of the house is $x(x-1)$ square inches. It's given that the height of each house is 11 inches. Therefore, the function V that gives the volume of each house, in cubic inches, in terms of the length of the house's base x is $V(x) = x(x-1)11$, or $V(x) = 11x(x-1)$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 18e35375

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 18e35375

$$f(x) = (x - 14)(x + 19)$$

The function f is defined by the given equation. For what value of x does $f(x)$ reach its minimum?

A. -266

B. -19

C. $-\frac{33}{2}$

D. $-\frac{5}{2}$

ID: 18e35375 Answer

Correct Answer:

D

Rationale

Choice D is correct. It's given that $f(x) = (x - 14)(x + 19)$, which can be rewritten as $f(x) = x^2 + 5x - 266$. Since the coefficient of the x^2-term is positive, the graph of $y = f(x)$ in the *xy*-plane opens upward and reaches its minimum value at its vertex. The *x*-coordinate of the vertex is the value of x such that $f(x)$ reaches its minimum. For an equation in the form $f(x) = ax^2 + bx + c$, where a, b, and c are constants, the *x*-coordinate of the vertex is $-\frac{b}{2a}$. For the equation $f(x) = x^2 + 5x - 266$, $a = 1$, $b = 5$, and $c = -266$. It follows that the *x*-coordinate of the vertex is $-\frac{5}{2(1)}$, or $-\frac{5}{2}$. Therefore, $f(x)$ reaches its minimum when the value of x is $-\frac{5}{2}$.

Alternate approach: The value of x for the vertex of a parabola is the *x*-value of the midpoint between the two *x*-intercepts of the parabola. Since it's given that $f(x) = (x - 14)(x + 19)$, it follows that the two *x*-intercepts of the graph of $y = f(x)$ in the *xy*-plane occur when $x = 14$ and $x = -19$, or at the points $(14, 0)$ and $(-19, 0)$. The midpoint between two points, (x_1, y_1) and (x_2, y_2), is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$. Therefore, the midpoint between $(14, 0)$ and $(-19, 0)$ is $\left(\frac{14+(-19)}{2}, \frac{0+0}{2}\right)$, or $\left(-\frac{5}{2}, 0\right)$. It follows that $f(x)$ reaches its minimum when the value of x is $-\frac{5}{2}$.

Choice A is incorrect. This is the *y*-coordinate of the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane.

Choice B is incorrect. This is one of the *x*-coordinates of the *x*-intercepts of the graph of $y = f(x)$ in the *xy*-plane.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:

Hard

Question ID 7bd10ef3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 7bd10ef3

$$2x^2 - 4x = t$$

In the equation above, t is a constant. If the equation has no real solutions, which of the following could be the value of t ?

A. -3

B. -1

C. 1

D. 3

ID: 7bd10ef3 Answer

Correct Answer:

A

Rationale

Choice A is correct. The number of solutions to any quadratic equation in the form $ax^2 + bx + c = 0$, where a, b, and c are constants, can be found by evaluating the expression $b^2 - 4ac$, which is called the discriminant. If the value of $b^2 - 4ac$ is a positive number, then there will be exactly two real solutions to the equation. If the value of $b^2 - 4ac$ is zero, then there will be exactly one real solution to the equation. Finally, if the value of $b^2 - 4ac$ is negative, then there will be no real solutions to the equation.

The given equation $2x^2 - 4x = t$ is a quadratic equation in one variable, where t is a constant. Subtracting t from both sides of the equation gives $2x^2 - 4x - t = 0$. In this form, $a = 2$, $b = -4$, and $c = -t$. The values of t for which the equation has no real solutions are the same values of t for which the discriminant of this equation is a negative value. The discriminant is equal to $(-4)^2 - 4(2)(-t)$; therefore, $(-4)^2 - 4(2)(-t) < 0$. Simplifying the left side of the inequality gives $16 + 8t < 0$. Subtracting 16 from both sides of the inequality and then dividing both sides by 8 gives $t < -2$. Of the values given in the options, -3 is the only value that is less than -2. Therefore, choice A must be the correct answer.

Choices B, C, and D are incorrect and may result from a misconception about how to use the discriminant to determine the number of solutions of a quadratic equation in one variable.

Question Difficulty:
Hard

Question ID 88a0c425

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 88a0c425

$$-2x^2 + 20x + c = 0$$

In the given equation, c is a constant. The equation has exactly one solution. What is the value of c?

A. -68

B. -50

C. -32

D. 0

ID: 88a0c425 Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that the equation $-2x^2 + 20x + c = 0$, where c is a constant, has exactly one solution. A quadratic equation of the form $ax^2 + bx + c = 0$ has exactly one solution if and only if its discriminant, $b^2 - 4ac$, is equal to zero. It follows that for the given equation, $a = -2$ and $b = 20$. Substituting -2 for a and 20 for b in $b^2 - 4ac$ yields $20^2 - 4\left(-2\right)\left(c\right)$, or $400 + 8c$. Since the discriminant must equal zero, it follows that $400 + 8c = 0$. Subtracting 400 from both sides of this equation yields $8c = -400$. Dividing each side of this equation by 8 yields $c = -50$. Therefore, the value of c is -50.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 8462b105

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 8462b105

The function f gives the product of a number, x, and a number that is 91 more than x. Which equation defines f?

A. $f(x) = x^2 + x + 91$

B. $f(x) = x^2 + 91$

C. $f(x) = x^2 + 91x$

D. $f(x) = x^2 + 91x + 91$

ID: 8462b105 Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that the function f gives the product of a number, x, and a number that is 91 more than x. A number that is 91 more than x can be represented by the expression $x + 91$. Therefore, f can be defined by the equation $f(x) = x(x + 91)$, or $f\left(x\right) = x^2 + 91x$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID ce579859

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: ce579859

A model estimates that at the end of each year from 2015 to 2020, the number of squirrels in a population was 150% more than the number of squirrels in the population at the end of the previous year. The model estimates that at the end of 2016, there were 180 squirrels in the population. Which of the following equations represents this model, where n is the estimated number of squirrels in the population t years after the end of 2015 and $t \leq 5$?

A. $n = 72(1.5)^t$

B. $n = 72(2.5)^t$

C. $n = 180(1.5)^t$

D. $n = 180(2.5)^t$

ID: ce579859 Answer

Correct Answer:
B

Rationale

Choice B is correct. Since the model estimates that the number of squirrels in the population increased by a fixed percentage, 150%, each year, the model can be represented by an exponential equation of the form $n = a\left(1 + \frac{p}{100}\right)^t$, where a is the estimated number of squirrels in the population at the end of 2015, and the model estimates that at the end of each year, the number is $p\%$ more than the number at the end of the previous year. Since the model estimates that at the end of each year, the number was 150% more than the number at the end of the previous year, $p = 150$. Substituting 150 for p in the equation $n = a\left(1 + \frac{p}{100}\right)^t$ yields $n = a\left(1 + \frac{150}{100}\right)^t$, which is equivalent to $n = a(1 + 1.5)^t$, or $n = a(2.5)^t$. It's given that the estimated number of squirrels at the end of 2016 was 180. This means that when $t = 1$, $n = 180$. Substituting 1 for t and 180 for n in the equation $n = a(2.5)^t$ yields $180 = a(2.5)^1$, or $180 = 2.5a$. Dividing each side of this equation by 2.5 yields $72 = a$. Substituting 72 for a in the equation $n = a(2.5)^t$ yields $n = 72(2.5)^t$.

Choice A is incorrect. This equation represents a model where at the end of each year, the estimated number of squirrels was 150% of, not 150% more than, the estimated number at the end of the previous year.

Choice C is incorrect. This equation represents a model where at the end of each year, the estimated number of squirrels was 150% of, not 150% more than, the estimated number at the end of the previous year, and the estimated number of squirrels at the end of 2015, not the end of 2016, was 180.

Choice D is incorrect. This equation represents a model where the estimated number of squirrels at the end of 2015, not the end of 2016, was 180.

Question Difficulty:
Hard

Question ID 5355c0ef

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 5355c0ef

$$0.36x^2 + 0.63x + 1.17$$

The given expression can be rewritten as $a\left(4x^2 + 7x + 13\right)$, where a is a constant. What is the value of a?

ID: 5355c0ef Answer

Correct Answer:

.09, 9/100

Rationale

The correct answer is $.09$. It's given that the expression $0.36x^2 + 0.63x + 1.17$ can be rewritten as $a\left(4x^2 + 7x + 13\right)$. Applying the distributive property to the expression $a\left(4x^2 + 7x + 13\right)$ yields $4ax^2 + 7ax + 13a$. Therefore, $0.36x^2 + 0.63x + 1.17$ can be rewritten as $4ax^2 + 7ax + 13a$. It follows that in the expressions $0.36x^2 + 0.63x + 1.17$ and $4ax^2 + 7ax + 13a$, the coefficients of x^2 are equivalent, the coefficients of x are equivalent, and the constant terms are equivalent. Therefore, $0.36 = 4a$, $0.63 = 7a$, and $1.17 = 13a$. Solving any of these equations for a yields the value of a. Dividing both sides of the equation $0.36 = 4a$ by 4 yields $0.09 = a$. Therefore, the value of a is 0.09. Note that .09 and 9/100 are examples of ways to enter a correct answer.

Question Difficulty:

Hard

Question ID c81b6c57

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: c81b6c57

In the expression $3(2x^2 + px + 8) - 16x(p + 4)$, p is a constant. This expression is equivalent to the expression $6x^2 - 155x + 24$. What is the value of p ?

A. -3

B. 7

C. 13

D. 155

ID: c81b6c57 Answer

Correct Answer:

B

Rationale

Choice B is correct. Using the distributive property, the first given expression can be rewritten as $6x^2 + 3px + 24 - 16px - 64x + 24$, and then rewritten as $6x^2 + (3p - 16p - 64)x + 24$. Since the expression $6x^2 + (3p - 16p - 64)x + 24$ is equivalent to $6x^2 - 155x + 24$, the coefficients of the x terms from each expression are equivalent to each other; thus $3p - 16p - 64 = -155$. Combining like terms gives $-13p - 64 = -155$. Adding 64 to both sides of the equation gives $-13p = -71$. Dividing both sides of the equation by -13 yields $p = 7$.

Choice A is incorrect. If $p = -3$, then the first expression would be equivalent to $6x^2 - 25x + 24$. Choice C is incorrect. If $p = 13$, then the first expression would be equivalent to $6x^2 - 233x + 24$. Choice D is incorrect. If $p = 155$, then the first expression would be equivalent to $6x^2 - 2{,}079x + 24$.

Question Difficulty:

Hard

Question ID d139cf4b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: d139cf4b

$$f(t) = 55t - 2t^2$$

The function f is defined by the given equation. The function g is defined by $g(t) = f(t) + 3$. Which expression represents the maximum value of $g(t)$?

A. $3 + \left(\frac{55}{2}\right)^2$

B. $3 + 2\left(\frac{55}{4}\right)^2$

C. $3 - 2\left(\frac{55}{4}\right)^2$

D. $3 - \left(\frac{55}{2}\right)^2$

ID: d139cf4b Answer

Correct Answer:

B

Rationale

Choice B is correct. It's given that function g is defined by $g(t) = f(t) + 3$ and that $f(t) = 55t - 2t^2$. Substituting $55t - 2t^2$ for $f(t)$ in $g(t) = f(t) + 3$ yields $g(t) = 55t - 2t^2 + 3$, or $g(t) = -2t^2 + 55t + 3$. The maximum value of $g(t)$ can be found by completing the square to rewrite the equation defining g in the form $g(t) = a(t-h)^2 + k$, where the maximum value of the function is k, which occurs when $t = h$, and a is a negative constant. The equation $g(t) = -2t^2 + 55t + 3$ is equivalent to $g(t) = -2\left(t^2 - \frac{55}{2}t\right) + 3$, which can be rewritten as $g(t) = -2\left(t^2 - \frac{55}{2}t + \left(\frac{55}{4}\right)^2\right) + 3 + 2\left(\frac{55}{4}\right)^2$, or $g(t) = -2\left(t - \frac{55}{4}\right)^2 + 3 + 2\left(\frac{55}{4}\right)^2$. This equation is in the form $g(t) = a(t-h)^2 + k$, where $a = -2$, $h = \frac{55}{4}$, and $k = 3 + 2\left(\frac{55}{4}\right)^2$. Thus, the maximum value of $g(t)$ is $3 + 2\left(\frac{55}{4}\right)^2$.

Alternate approach: Since the function f is a quadratic function, the maximum value of $f(t)$ occurs at the value of t that's halfway between the two zeros of the function. The zeros of function f can be found by substituting 0 for $f(t)$ in the equation defining f, which yields $0 = 55t - 2t^2$. This equation can be rewritten as $0 = t(55 - 2t)$. By the zero product property, it follows that $t = 0$ or $55 - 2t = 0$. Subtracting 55 from each side of the equation $55 - 2t = 0$ yields $-2t = -55$. Dividing each side of this equation by -2 yields $t = \frac{55}{2}$. Therefore, the zeros of function f are 0 and $\frac{55}{2}$. The value that's halfway between 0 and $\frac{55}{2}$ can be found by calculating the average of 0 and $\frac{55}{2}$, which is $\frac{0+\frac{55}{2}}{2}$, or $\frac{55}{4}$. It follows that the maximum of function f occurs when $t = \frac{55}{4}$. Substituting $\frac{55}{4}$ for t in the equation defining function f yields $f\left(\frac{55}{4}\right) = 55\left(\frac{55}{4}\right) - 2\left(\frac{55}{4}\right)^2$, which is equivalent to $f\left(\frac{55}{4}\right) = \frac{55^2}{4} - 2\left(\frac{55^2}{4^2}\right)$. Multiplying $\frac{55^2}{4}$ by $\frac{4}{4}$ in this equation to get a common denominator yields $f\left(\frac{55}{4}\right) = 4\left(\frac{55^2}{4^2}\right) - 2\left(\frac{55^2}{4^2}\right)$, or $f\left(\frac{55}{4}\right) = 2\left(\frac{55^2}{4^2}\right)$, which is equivalent to $f\left(\frac{55}{4}\right) = 2\left(\frac{55}{4}\right)^2$. Thus, the maximum value of $f(t)$ is $2\left(\frac{55}{4}\right)^2$. Since the equation defining $g(t)$ is $g(t) = f(t) + 3$, the maximum value of $g(t)$ is 3 greater than the maximum value of $f(t)$. It follows that the maximum value of $g(t)$ is $3 + 2\left(\frac{55}{4}\right)^2$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 66bce0c1

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 66bce0c1

$$\sqrt{2x+6}+4=x+3$$

What is the solution set of the equation above?

A. $\{-1\}$

B. $\{5\}$

C. $\{-1, 5\}$

D. $\{0, -1, 5\}$

ID: 66bce0c1 Answer

Correct Answer:
B

Rationale

Choice B is correct. Subtracting 4 from both sides of $\sqrt{2x+6}+4=x+3$ isolates the radical expression on the left side of the equation as follows: $\sqrt{2x+6}=x-1$. Squaring both sides of $\sqrt{2x+6}=x-1$ yields $2x+6=x^2-2x+1$. This equation can be rewritten as a quadratic equation in standard form: $x^2-4x-5=0$. One way to solve this quadratic equation is to factor the expression x^2-4x-5 by identifying two numbers with a sum of -4 and a product of -5. These numbers are -5 and 1. So the quadratic equation can be factored as $(x-5)(x+1)=0$. It follows that 5 and -1 are the solutions to the quadratic equation. However, the solutions must be verified by checking whether 5 and -1 satisfy the original equation, $\sqrt{2x+6}+4=x+3$. When $x=-1$, the original equation gives $\sqrt{2(-1)+6}+4=(-1)+3$, or $6=2$, which is false. Therefore, -1 does not satisfy the original equation. When $x=5$, the original equation gives $\sqrt{2(5)+6}+4=5+3$, or $8=8$, which is true. Therefore, $x=5$ is the only solution to the original equation, and so the solution set is $\{5\}$.

Choices A, C, and D are incorrect because each of these sets contains at least one value that results in a false statement when substituted into the given equation. For instance, in choice D, when 0 is substituted for x into the given equation, the result is $\sqrt{2(0)+6}+4=(0)+3$, or $\sqrt{6}+4=3$. This is not a true statement, so 0 is not a solution to the given equation.

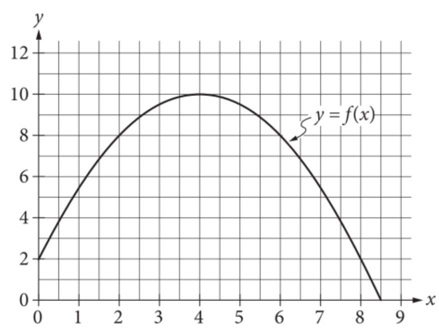
Question Difficulty:

Hard

Question ID 97e50fa2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 97e50fa2



The graph of the function *f*, defined by $f(x) = -\frac{1}{2}(x-4)^2 + 10$, is shown in the *xy*-plane above. If the function *g* (not shown) is defined by $g(x) = -x + 10$, what is one possible value of *a* such that $f(a) = g(a)$?

ID: 97e50fa2 Answer

Rationale

The correct answer is either 2 or 8. Substituting $x = a$ in the definitions for f and g gives $f(a) = -\frac{1}{2}(a-4)^2 + 10$ and $g(a) = -a + 10$, respectively. If $f(a) = g(a)$, then $-\frac{1}{2}(a-4)^2 + 10 = -a + 10$. Subtracting 10 from both sides of this equation gives $-\frac{1}{2}(a-4)^2 = -a$. Multiplying both sides by -2 gives $(a-4)^2 = 2a$. Expanding $(a-4)^2$ gives $a^2 - 8a + 16 = 2a$. Combining the like terms on one side of the equation gives $a^2 - 10a + 16 = 0$. One way to solve this equation is to factor $a^2 - 10a + 16$ by identifying two numbers with a sum of -10 and a product of 16. These numbers are -2 and -8, so the quadratic equation can be factored as $(a-2)(a-8) = 0$. Therefore, the possible values of a are either 2 or 8. Note that 2 and 8 are examples of ways to enter a correct answer.

Alternate approach: Graphically, the condition $f(a) = g(a)$ implies the graphs of the functions $y = f(x)$ and $y = g(x)$ intersect at $x = a$. The graph $y = f(x)$ is given, and the graph of $y = g(x)$ may be sketched as a line with y-intercept 10 and a slope of -1 (taking care to note the different scales on each axis). These two graphs intersect at $x = 2$ and $x = 8$.

Question Difficulty:
Hard

Question ID 9afe2370

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 9afe2370

The population P of a certain city y years after the last census is modeled by the equation below, where r is a constant and P_0 is the population when $y = 0$.

$$P = P_0(1+r)^y$$

If during this time the population of the city decreases by a fixed percent each year, which of the following must be true?

A. $r < -1$

B. $-1 < r < 0$

C. $0 < r < 1$

D. $r > 1$

ID: 9afe2370 Answer

Correct Answer:
B

Rationale

Choice B is correct. The term (1 + r) represents a percent change. Since the population is decreasing, the percent change must be between 0% and 100%. When the percent change is expressed as a decimal rather than as a percent, the percentage change must be between 0 and 1. Because (1 + r) represents percent change, this can be expressed as 0 < 1 + r < 1. Subtracting 1 from all three terms of this compound inequality results in −1 < r < 0.

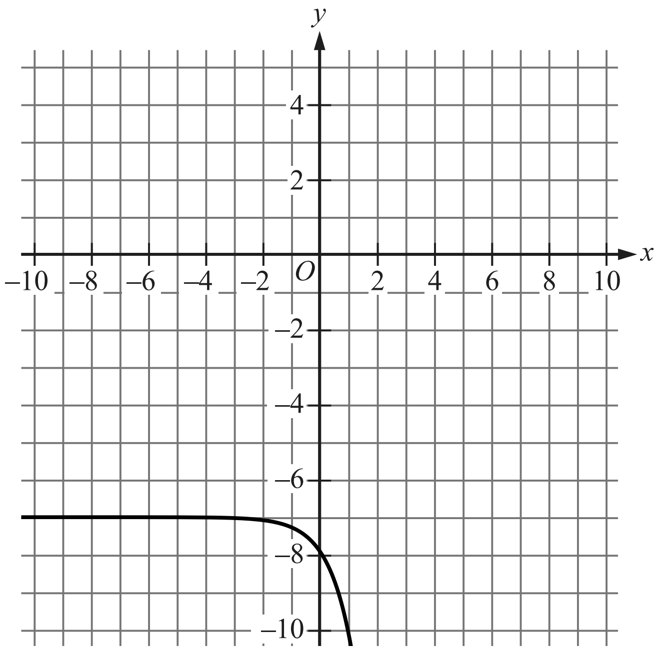
Choice A is incorrect. If r < −1, then after 1 year, the population P would be a negative value, which is not possible. Choices C and D are incorrect. For any value of r > 0, 1 + r > 1, and the exponential function models growth for positive values of the exponent. This contradicts the given information that the population is decreasing.

Question Difficulty:
Hard

Question ID df71424b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: df71424b



The graph of $y = f(x)$ is shown, where $f(x) = ab^x + c$, and a, b, and c are constants. For how many values of x does $f(x) = 0$?

A. Three

B. Two

C. One

D. Zero

ID: df71424b Answer

Correct Answer:

D

Rationale

Choice D is correct. Each point (x, y) on the graph of $y = f(x)$ in the *xy*-plane gives a value of x and its corresponding value of $f(x)$, or y. For any value of x for which $f(x) = 0$, there is a corresponding point on the graph of $y = f(x)$ with a *y*-coordinate of 0. A point with a *y*-coordinate of 0 is a point where the graph intersects the *x*-axis. It's given that $f(x) = ab^x + c$, where a, b, and c are constants. In the *xy*-plane, the graph of an equation of this form will lie entirely either above or below the horizontal line defined by $y = c$. The part of the graph of $y = f(x)$ shown lies entirely below the horizontal line defined by $y = -7$, and thus the entire graph of $y = f(x)$ must lie below the line defined by $y = -7$. It follows that the graph of $y = f(x)$ will never intersect the *x*-axis. Therefore, there are zero values of *x* for which $f(x) = 0$.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice C is incorrect and may result from conceptual errors.

Question Difficulty:
Hard

Question ID 3d12b1e0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 3d12b1e0

$$-16x^2 - 8x + c = 0$$

In the given equation, c is a constant. The equation has exactly one solution. What is the value of c?

ID: 3d12b1e0 Answer

Correct Answer:

-1

Rationale

The correct answer is -1. A quadratic equation in the form $ax^2 + bx + c = 0$, where a, b, and c are constants, has exactly one solution when its discriminant, $b^2 - 4ac$, is equal to 0. In the given equation, $-16x^2 - 8x + c = 0$, $a = -16$ and $b = -8$. Substituting -16 for a and -8 for b in $b^2 - 4ac$ yields $(-8)^2 - 4(-16)(c)$, or $64 + 64c$. Since the given equation has exactly one solution, $64 + 64c = 0$. Subtracting 64 from both sides of this equation yields $64c = -64$. Dividing both sides of this equation by 64 yields $c = -1$. Therefore, the value of c is -1.

Question Difficulty:

Hard

Question ID 2c88af4d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 2c88af4d

The expression $\frac{x^{-2}y^{\frac{1}{2}}}{x^{\frac{1}{3}}y^{-1}}$, where $x > 1$ and $y > 1$, is equivalent to which of the following?

A. $\frac{\sqrt{y}}{\sqrt[3]{x^2}}$

B. $\frac{y\sqrt{y}}{\sqrt[3]{x^2}}$

C. $\frac{y\sqrt{y}}{x\sqrt{x}}$

D. $\frac{y\sqrt{y}}{x^2\sqrt[3]{x}}$

ID: 2c88af4d Answer

Correct Answer:

D

Rationale

Choice D is correct. For $x > 1$ and $y > 1$, $x^{\frac{1}{3}}$ and $y^{\frac{1}{2}}$ are equivalent to $\sqrt[3]{x}$ and $\sqrt{y}$, respectively. Also, x^{-2} and y^{-1} are equivalent to $\frac{1}{x^2}$ and $\frac{1}{y}$, respectively. Therefore, the given expression can be rewritten as $\frac{y\sqrt{y}}{x^2\sqrt[3]{x}}$.

Choices A, B, and C are incorrect because these choices are not equivalent to the given expression for $x > 1$ and $y > 1$.

For example, for $x = 2$ and $y = 2$, the value of the given expression is $2^{-\frac{5}{6}}$; the values of the choices, however, are $2^{-\frac{1}{3}}$, $2^{\frac{5}{6}}$, and 1, respectively.

Question Difficulty:

Hard

Question ID 71014fb1

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 71014fb1

$$(x-1)^2 = -4$$

How many distinct real solutions does the given equation have?

A. Exactly one

B. Exactly two

C. Infinitely many

D. Zero

ID: 71014fb1 Answer

Correct Answer:
D

Rationale

Choice D is correct. Any quantity that is positive or negative in value has a positive value when squared. Therefore, the left-hand side of the given equation is either positive or zero for any value of x. Since the right-hand side of the given equation is negative, there is no value of x for which the given equation is true. Thus, the number of distinct real solutions for the given equation is zero.

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

Question Difficulty:
Hard

Question ID 22fd3e1f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 22fd3e1f

$$f(x) = x^3 - 9x$$
$$g(x) = x^2 - 2x - 3$$

Which of the following expressions is equivalent to $\frac{f(x)}{g(x)}$, for $x > 3$?

A. $\frac{1}{x+1}$

B. $\frac{x+3}{x+1}$

C. $\frac{x(x-3)}{x+1}$

D. $\frac{x(x+3)}{x+1}$

ID: 22fd3e1f Answer

Correct Answer:

D

Rationale

Choice D is correct. Since $x^3 - 9x = x(x+3)(x-3)$ and $x^2 - 2x - 3 = (x+1)(x-3)$, the fraction $\frac{f(x)}{g(x)}$ can be written as $\frac{x(x+3)(x-3)}{(x+1)(x-3)}$. It is given that $x > 3$, so the common factor $x - 3$ is not equal to 0. Therefore, the fraction can be further simplified to $\frac{x(x+3)}{x+1}$.

Choice A is incorrect. The expression $\frac{1}{x+1}$ is not equivalent to $\frac{f(x)}{g(x)}$ because at $x = 0$, $\frac{1}{x+1}$ as a value of 1 and $\frac{f(x)}{g(x)}$ has a value of 0.

Choice B is incorrect and results from omitting the factor x in the factorization of $f(x)$. Choice C is incorrect and may result from incorrectly factoring $g(x)$ as $(x+1)(x+3)$ instead of $(x+1)(x-3)$.

Question Difficulty:
Hard

Question ID a0b4103e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: a0b4103e

The expression $\frac{1}{3}x^2-2$ can be rewritten as $\frac{1}{3}(x-k)(x+k)$, where k is a positive constant. What is the value of k ?

A. 2

B. 6

C. $\sqrt{2}$

D. $\sqrt{6}$

ID: a0b4103e Answer

Correct Answer:
D

Rationale

Choice D is correct. Factoring out the coefficient $\frac{1}{3}$, the given expression can be rewritten as $\frac{1}{3}(x^2-6)$. The expression x^2-6 can be approached as a difference of squares and rewritten as $(x-\sqrt{6})(x+\sqrt{6})$. Therefore, k must be $\sqrt{6}$.

Choice A is incorrect. If k were 2, then the expression given would be rewritten as $\frac{1}{3}(x-2)(x+2)$, which is equivalent to $\frac{1}{3}x^2-\frac{4}{3}$, not $\frac{1}{3}x^2-2$.

Choice B is incorrect. This may result from incorrectly factoring the expression and finding $(x-6)(x+6)$ as the factored form of the expression. Choice C is incorrect. This may result from incorrectly distributing the $\frac{1}{3}$ and rewriting the expression as $\frac{1}{3}(x^2-2)$.

Question Difficulty:
Hard

Question ID e9349667

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: e9349667

$$y = x^2 + 2x + 1$$
$$x + y + 1 = 0$$

If (x_1, y_1) and (x_2, y_2) are the two solutions to the system of equations above, what is the value of $y_1 + y_2$?

A. -3

B. -2

C. -1

D. 1

ID: e9349667 Answer

Correct Answer:
D

Rationale

Choice D is correct. The system of equations can be solved using the substitution method. Solving the second equation for y gives $y = -x - 1$. Substituting the expression $-x - 1$ for y into the first equation gives $-x - 1 = x^2 + 2x + 1$. Adding $x + 1$ to both sides of the equation yields $x^2 + 3x + 2 = 0$. The left-hand side of the equation can be factored by finding two numbers whose sum is 3 and whose product is 2, which gives $(x + 2)(x + 1) = 0$. Setting each factor equal to 0 yields $x + 2 = 0$ and $x + 1 = 0$, and solving for x yields $x = -2$ or $x = -1$. These values of x can be substituted for x in the equation $y = -x - 1$ to find the corresponding y-values: $y = -(-2) - 1 = 2 - 1 = 1$ and $y = -(-1) - 1 = 1 - 1 = 0$. It follows that $(-2, 1)$ and $(-1, 0)$ are the solutions to the given system of equations. Therefore, $(x_1, y_1) = (-2, 1)$, $(x_2, y_2) = (-1, 0)$, and $y_1 + y_2 = 1 + 0 = 1$.

Choice A is incorrect. The solutions to the system of equations are $(x_1, y_1) = (-2, 1)$ and $(x_2, y_2) = (-1, 0)$. Therefore, -3 is the sum of the x-coordinates of the solutions, not the sum of the y-coordinates of the solutions. Choices B and C are incorrect and may be the result of computation or substitution errors.

Question Difficulty:
Hard

Question ID b03adde3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: b03adde3

If $u-3=\frac{6}{t-2}$, what is t in terms of u ?

A. $t=\frac{1}{u}$

B. $t=\frac{2u+9}{u}$

C. $t=\frac{1}{u-3}$

D. $t=\frac{2u}{u-3}$

ID: b03adde3 Answer

Correct Answer:

D

Rationale

Choice D is correct. Multiplying both sides of the given equation by $t-2$ yields $(t-2)(u-3)=6$. Dividing both sides of this equation by $u-3$ yields $t-2=\frac{6}{u-3}$. Adding 2 to both sides of this equation yields $t=\frac{6}{u-3}+2$, which can be rewritten as $t=\frac{6}{u-3}+\frac{2(u-3)}{u-3}$. Since the fractions on the right-hand side of this equation have a common denominator, adding the fractions yields $t=\frac{6+2(u-3)}{u-3}$. Applying the distributive property to the numerator on the right-hand side of this equation yields $t=\frac{6+2u-6}{u-3}$, which is equivalent to $t=\frac{2u}{u-3}$.

Choices A, B, and C are incorrect and may result from various misconceptions or miscalculations.

Question Difficulty:

Hard

Question ID 7dbd46d9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 7dbd46d9

$$8x + y = -11$$
$$2x^2 = y + 341$$

The graphs of the equations in the given system of equations intersect at the point (x, y) in the xy-plane. What is a possible value of x?

A. -15

B. -11

C. 2

D. 8

ID: 7dbd46d9 Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that the graphs of the equations in the given system of equations intersect at the point (x, y). Therefore, this intersection point is a solution to the given system. The solution can be found by isolating y in each equation. The given equation $8x + y = -11$ can be rewritten to isolate y by subtracting $8x$ from both sides of the equation, which gives $y = -8x - 11$. The given equation $2x^2 = y + 341$ can be rewritten to isolate y by subtracting 341 from both sides of the equation, which gives $2x^2 - 341 = y$. With each equation solved for y, the value of y from one equation can be substituted into the other, which gives $2x^2 - 341 = -8x - 11$. Adding $8x$ and 11 to both sides of this equation results in $2x^2 + 8x - 330 = 0$. Dividing both sides of this equation by 2 results in $x^2 + 4x - 165 = 0$. This equation can be rewritten by factoring the left-hand side, which yields $(x + 15)(x - 11) = 0$. By the zero-product property, if $(x + 15)(x - 11) = 0$, then $(x + 15) = 0$, or $(x - 11) = 0$. It follows that $x = -15$, or $x = 11$. Since only -15 is given as a choice, a possible value of x is -15.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 0121a235

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 0121a235

x	$p(x)$
-2	5
-1	0
0	-3
1	-1
2	0

The table above gives selected values of a polynomial function p. Based on the values in the table, which of the following must be a factor of p ?

A. $(x-3)$

B. $(x+3)$

C. $(x-1)(x+2)$

D. $(x+1)(x-2)$

ID: 0121a235 Answer

Correct Answer:
D

Rationale

Choice D is correct. According to the table, when x is -1 or 2, $p(x)=0$. Therefore, two x-intercepts of the graph of p are $(-1,0)$ and $(2,0)$. Since $(-1,0)$ and $(2,0)$ are x-intercepts, it follows that $(x+1)$ and $(x-2)$ are factors of the polynomial equation. This is because when $x=-1$, the value of $x+1$ is 0. Similarly, when $x=2$, the value of $x-2$ is 0. Therefore, the product $(x+1)(x-2)$ is a factor of the polynomial function p.

Choice A is incorrect. The factor $x-3$ corresponds to an x-intercept of $(3,0)$, which isn't present in the table. Choice B is incorrect. The factor $x+3$ corresponds to an x-intercept of $(-3,0)$, which isn't present in the table. Choice C is incorrect. The factors $x-1$ and $x+2$ correspond to x-intercepts $(1,0)$ and $(-2,0)$, respectively, which aren't present in the table.

Question Difficulty:
Hard

Question ID bba18ecb

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: bba18ecb

When the quadratic function f is graphed in the *xy*-plane, where $y = f(x)$, its vertex is $(-3, 6)$. One of the *x*-intercepts of this graph is $\left(-\frac{17}{4}, 0\right)$. What is the other *x*-intercept of the graph?

A. $\left(-\frac{29}{4}, 0\right)$

B. $\left(-\frac{7}{4}, 0\right)$

C. $\left(\frac{5}{4}, 0\right)$

D. $\left(\frac{17}{4}, 0\right)$

ID: bba18ecb Answer

Correct Answer:
B

Rationale

Choice B is correct. Since the line of symmetry for the graph of a quadratic function contains the vertex of the graph, the *x*-coordinate of the vertex of the graph of $y = f(x)$ is the *x*-coordinate of the midpoint of its two *x*-intercepts. The midpoint of two points with *x*-coordinates x_1 and x_2 has *x*-coordinate x_m, where $x_m = \frac{x_1+x_2}{2}$. It's given that the vertex is $(-3, 6)$ and one of the *x*-intercepts is $\left(-\frac{17}{4}, 0\right)$. Substituting -3 for x_m and $-\frac{17}{4}$ for x_1 in the equation $x_m = \frac{x_1+x_2}{2}$ yields $-3 = \frac{-\frac{17}{4}+x_2}{2}$. Multiplying each side of this equation by 2 yields $-6 = -\frac{17}{4} + x_2$. Adding $\frac{17}{4}$ to each side of this equation yields $-\frac{7}{4} = x_2$. Therefore, the other *x*-intercept is $\left(-\frac{7}{4}, 0\right)$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 668f1863

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 668f1863

Function f is a quadratic function where $f(-20) = 0$ and $f(-4) = 0$. The graph of $y = f(x)$ in the *xy*-plane has a vertex at $(r, -64)$. What is the value of r?

ID: 668f1863 Answer

Correct Answer:
-12

Rationale

The correct answer is -12. It's given that function f is a quadratic function where $f(-20) = 0$ and $f(-4) = 0$. It follows that the graph of $y = f(x)$ in the *xy*-plane passes through the points $(-20, 0)$ and $(-4, 0)$. When the graph of a quadratic function contains two points $(a, 0)$ and $(b, 0)$, the *x*-coordinate of the vertex of the graph is the average of a and b. Therefore, the *x*-coordinate of the vertex of the graph of $y = f(x)$ is $\frac{-20+(-4)}{2}$, or -12. It's given that the graph of $y = f(x)$ in the *xy*-plane has a vertex at $(r, -64)$. It follows that the value of r is -12.

Question Difficulty:
Hard

Question ID 70753f99

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 70753f99

The function *f* is defined by $f(x) = (x+3)(x+1)$. The graph of *f* in the *xy*-plane is a parabola. Which of the following intervals contains the *x*-coordinate of the vertex of the graph of *f* ?

A. $-4 < x < -3$

B. $-3 < x < 1$

C. $1 < x < 3$

D. $3 < x < 4$

ID: 70753f99 Answer

Correct Answer:
B

Rationale

Choice B is correct. The graph of a quadratic function in the xy-plane is a parabola. The axis of symmetry of the parabola passes through the vertex of the parabola. Therefore, the vertex of the parabola and the midpoint of the segment between the two x-intercepts of the graph have the same x-coordinate. Since $f(-3) = f(-1) = 0$, the x-coordinate of the vertex is $\frac{(-3)+(-1)}{2} = -2$. Of the shown intervals, only the interval in choice B contains –2. Choices A, C, and D are incorrect and may result from either calculation errors or misidentification of the graph's x-intercepts.

Question Difficulty:
Hard

Question ID 58dcc59f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 58dcc59f

A landscaper is designing a rectangular garden. The length of the garden is to be 5 feet longer than the width. If the area of the garden will be 104 square feet, what will be the length, in feet, of the garden?

ID: 58dcc59f Answer

Rationale

The correct answer is 13. Let w represent the width of the rectangular garden, in feet. Since the length of the garden will be 5 feet longer than the width of the garden, the length of the garden will be $w+5$ feet. Thus the area of the garden will be $w(w+5)$. It is also given that the area of the garden will be 104 square feet. Therefore, $w(w+5)=104$, which is equivalent to $w^2+5w-104=0$. Factoring this equation results in $(w+13)(w-8)=0$. Therefore, $w=8$ and $w=-13$. Because width cannot be negative, the width of the garden must be 8 feet. This means the length of the garden must be $8+5=13$ feet.

Question Difficulty:
Hard

Question ID 30281058

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 30281058

In the *xy*-plane, the graph of $y = x^2 - 9$ intersects line *p* at $(1, a)$ and $(5, b)$, where *a* and *b* are constants. What is the slope of line *p* ?

A. 6

B. 2

C. -2

D. -6

ID: 30281058 Answer

Correct Answer:

A

Rationale

Choice A is correct. It's given that the graph of $y = x^2 - 9$ and line p intersect at $(1, a)$ and $(5, b)$. Therefore, the value of y when $x = 1$ is the value of a, and the value of y when $x = 5$ is the value of b. Substituting 1 for x in the given equation yields $y = (1)^2 - 9$, or $y = -8$. Similarly, substituting 5 for x in the given equation yields $y = (5)^2 - 9$, or $y = 16$. Therefore, the intersection points are $(1, -8)$ and $(5, 16)$. The slope of line p is the ratio of the change in y to the change in x between these two points: $\frac{16 - (-8)}{5 - 1} = \frac{24}{4}$, or 6.

Choices B, C, and D are incorrect and may result from conceptual or calculation errors in determining the values of a, b, or the slope of line p.

Question Difficulty:

Hard

Question ID 84dd43f8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 84dd43f8

For the function f, $f(0) = 86$, and for each increase in x by 1, the value of $f(x)$ decreases by 80%. What is the value of $f(2)$?

ID: 84dd43f8 Answer

Correct Answer:
3.44, 86/25

Rationale

The correct answer is 3.44. It's given that $f(0) = 86$ and that for each increase in x by 1, the value of $f(x)$ decreases by 80%. Because the output of the function decreases by a constant percentage for each 1-unit increase in the value of x, this relationship can be represented by an exponential function of the form $f(x) = a(b)^x$, where a represents the initial value of the function and b represents the rate of decay,
expressed as a decimal. Because $f(0) = 86$, the value of a must be 86. Because the value of $f(x)$ decreases by 80% for each 1-unit increase in x, the value of b must be $(1 - 0.80)$, or 0.2. Therefore, the function f can be defined by $f(x) = 86(0.2)^x$. Substituting 2 for x in this function yields $f(2) = 86(0.2)^2$, which is equivalent to $f(2) = 86(0.04)$, or $f(2) = 3.44$. Either 3.44 or $86/25$ may be entered as the correct answer.

Alternate approach: It's given that $f(0) = 86$ and that for each increase in x by 1, the value of $f(x)$ decreases by 80%. Therefore, when $x = 1$, the value of $f(x)$ is $(100 - 80)\%$, or 20%, of 86, which can be expressed as $(0.20)(86)$. Since $(0.20)(86) = 17.2$, the value of $f(1)$ is 17.2. Similarly, when $x = 2$, the value of $f(x)$ is 20% of 17.2, which can be expressed as $(0.20)(17.2)$. Since $(0.20)(17.2) = 3.44$, the value of $f(2)$ is 3.44. Either 3.44 or $86/25$ may be entered as the correct answer.

Question Difficulty:
Hard

Question ID 59d1f4b5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 59d1f4b5

$M = 1{,}800(1.02)^t$

The equation above models the number of members, *M*, of a gym *t* years after the gym opens. Of the following, which equation models the number of members of the gym *q* quarter years after the gym opens?

A. $M = 1{,}800(1.02)^{\frac{q}{4}}$

B. $M = 1{,}800(1.02)^{4q}$

C. $M = 1{,}800(1.005)^{4q}$

D. $M = 1{,}800(1.082)^{q}$

ID: 59d1f4b5 Answer

Correct Answer:
A

Rationale

Choice A is correct. In 1 year, there are 4 quarter years, so the number of quarter years, q, is 4 times the number of years, t ; that is, $q = 4t$. This is equivalent to $t = \frac{q}{4}$, and substituting this into the expression for M in terms of t gives $M = 1{,}800(1.02)^{\frac{q}{4}}$.

Choices B and D are incorrect and may be the result of incorrectly using $t = 4q$ instead of $q = 4t$. (Choices B and D are nearly the same since 1.02^{4q} is equivalent to $(1.02^4)^q$, which is approximately 1.082^q.) Choice C is incorrect and may be the result of incorrectly using $t = 4q$ and unnecessarily dividing 0.02 by 4.

Question Difficulty:
Hard

Question ID 5910bfff

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 5910bfff

$$D = T - \frac{9}{25}(100 - H)$$

The formula above can be used to approximate the dew point *D*, in degrees Fahrenheit, given the temperature *T*, in degrees Fahrenheit, and the relative humidity of *H* percent, where $H > 50$. Which of the following expresses the relative humidity in terms of the temperature and the dew point?

A. $H = \frac{25}{9}(D - T) + 100$

B. $H = \frac{25}{9}(D - T) - 100$

C. $H = \frac{25}{9}(D + T) + 100$

D. $H = \frac{25}{9}(D + T) - 100$

ID: 5910bfff Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that $D = T - \frac{9}{25}(100 - H)$. Solving this formula for H expresses the relative humidity in terms of the temperature and the dew point. Subtracting T from both sides of this equation yields $D - T = -\frac{9}{25}(100 - H)$. Multiplying both sides by $-\frac{25}{9}$ yields $-\frac{25}{9}(D - T) = 100 - H$. Subtracting 100 from both sides yields $-\frac{25}{9}(D - T) - 100 = -H$. Multiplying both sides by -1 results in the formula $\frac{25}{9}(D - T) + 100 = H$.

Choices B, C, and D are incorrect and may result from errors made when rewriting the given formula.

Question Difficulty:
Hard

Question ID ad038c19

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: ad038c19

Which of the following is equivalent to $\left(a+\frac{b}{2}\right)^2$?

A. $a^2+\frac{b^2}{2}$

B. $a^2+\frac{b^2}{4}$

C. $a^2+\frac{ab}{2}+\frac{b^2}{2}$

D. $a^2+ab+\frac{b^2}{4}$

ID: ad038c19 Answer

Correct Answer:
D

Rationale

Choice D is correct. The expression $\left(a+\frac{b}{2}\right)^2$ can be rewritten as $\left(a+\frac{b}{2}\right)\left(a+\frac{b}{2}\right)$. Using the distributive property, the expression yields $\left(a+\frac{b}{2}\right)\left(a+\frac{b}{2}\right)=a^2+\frac{ab}{2}+\frac{ab}{2}+\frac{b^2}{4}$. Combining like terms gives $a^2+ab+\frac{b^2}{4}$.

Choices A, B, and C are incorrect and may result from errors using the distributive property on the given expression or combining like terms.

Question Difficulty:
Hard

Question ID 635f54ee

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 635f54ee

The surface area of a cube is $6\left(\frac{a}{4}\right)^2$, where *a* is a positive constant. Which of the following gives the perimeter of one face of the cube?

A. $\frac{a}{4}$

B. a

C. $4a$

D. $6a$

ID: 635f54ee Answer

Correct Answer:
B

Rationale

Choice B is correct. A cube has 6 faces of equal area, so if the total surface area of a cube is $6\left(\frac{a}{4}\right)^2$, then the area of one face is $\left(\frac{a}{4}\right)^2$. Likewise, the area of one face of a cube is the square of one of its edges; therefore, if the area of one face is $\left(\frac{a}{4}\right)^2$, then the length of one edge of the cube is $\frac{a}{4}$. Since the perimeter of one face of a cube is four times the length of one edge, the perimeter is $4\left(\frac{a}{4}\right) = a$.

Choice A is incorrect because if the perimeter of one face of the cube is $\frac{a}{4}$, then the total surface area of the cube is $6\left(\frac{\frac{a}{4}}{4}\right)^2 = 6\left(\frac{a}{16}\right)^2$, which is not $6\left(\frac{a}{4}\right)^2$. Choice C is incorrect because if the perimeter of one face of the cube is 4a, then the total surface area of the cube is $6\left(\frac{4a}{4}\right)^2 = 6a^2$, which is not $6\left(\frac{a}{4}\right)^2$. Choice D is incorrect because if the perimeter of one face of the cube is 6a, then the total surface area of the cube is $6\left(\frac{6a}{4}\right)^2 = 6\left(\frac{3a}{2}\right)^2$, which is not $6\left(\frac{a}{4}\right)^2$.

Question Difficulty:
Hard

Question ID 1697ffcf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 1697ffcf

In the *xy*-plane, the graph of $y = 3x^2 - 14x$ intersects the graph of $y = x$ at the points $(0, 0)$ and (a, a). What is the value of *a* ?

ID: 1697ffcf Answer

Rationale

The correct answer is 5. The intersection points of the graphs of $y = 3x^2 - 14x$ and $y = x$ can be found by solving the system consisting of these two equations. To solve the system, substitute x for y in the first equation. This gives $x = 3x^2 - 14x$. Subtracting x from both sides of the equation gives $0 = 3x^2 - 15x$. Factoring $3x$ out of each term on the left-hand side of the equation gives $0 = 3x(x - 5)$. Therefore, the possible values for x are 0 and 5. Since $y = x$, the two intersection points are $(0,0)$ and $(5,5)$. Therefore, $a = 5$.

Question Difficulty:
Hard

Question ID 42f8e4b4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 42f8e4b4

One of the factors of $2x^3 + 42x^2 + 208x$ is $x + b$, where b is a positive constant. What is the smallest possible value of b?

ID: 42f8e4b4 Answer

Correct Answer:

8

Rationale

The correct answer is 8. Since each term of the given expression, $2x^3 + 42x^2 + 208x$, has a factor of $2x$, the expression can be rewritten as $2x\left(x^2\right) + 2x(21x) + 2x(104)$, or $2x\left(x^2 + 21x + 104\right)$. Since the values 8 and 13 have a sum of 21 and a product of 104, the expression $x^2 + 21x + 104$ can be factored as $(x+8)(x+13)$. Therefore, the given expression can be factored as $2x(x+8)(x+13)$. It follows that the factors of the given expression are 2, x, $x+8$, and $x+13$. Of these factors, only $x+8$ and $x+13$ are of the form $x+b$, where b is a positive constant. Therefore, the possible values of b are 8 and 13. Thus, the smallest possible value of b is 8.

Question Difficulty:

Hard

Question ID de39858a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: de39858a

The function h is defined by $h(x) = a^x + b$, where a and b are positive constants. The graph of $y = h(x)$ in the xy-plane passes through the points $(0, 10)$ and $(-2, \frac{325}{36})$. What is the value of ab?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 54

D. 60

ID: de39858a Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that the function h is defined by $h(x) = a^x + b$ and that the graph of $y = h(x)$ in the *xy*-plane passes through the points $(0, 10)$ and $\left(-2, \frac{325}{36}\right)$. Substituting 0 for x and 10 for $h(x)$ in the equation $h(x) = a^x + b$ yields $10 = a^0 + b$, or $10 = 1 + b$. Subtracting 1 from both sides of this equation yields $9 = b$. Substituting -2 for x and $\frac{325}{36}$ for $h(x)$ in the equation $h(x) = a^x + 9$ yields $\frac{325}{36} = a^{-2} + 9$. Subtracting 9 from both sides of this equation yields $\frac{1}{36} = a^{-2}$, which can be rewritten as $a^2 = 36$. Taking the square root of both sides of this equation yields $a = 6$ and $a = -6$, but because it's given that a is a positive constant, a must equal 6. Because the value of a is 6 and the value of b is 9, the value of ab is $(6)(9)$, or 54.

Choice A is incorrect and may result from finding the value of $a^{-2}b$ rather than the value of ab.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from correctly finding the value of a as 6, but multiplying it by the *y*-value in the first ordered pair rather than by the value of b.

Question Difficulty:
Hard

Question ID 1178f2df

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 1178f2df

x	y
21	-8
23	8
25	-8

The table shows three values of x and their corresponding values of y, where $y = f(x) + 4$ and f is a quadratic function. What is the *y*-coordinate of the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane?

ID: 1178f2df Answer

Correct Answer:
-2112

Rationale

The correct answer is $-2{,}112$. It's given that f is a quadratic function. It follows that f can be defined by an equation of the form $f(x) = a(x-h)^2 + k$, where a, h, and k are constants. It's also given that the table shows three values of x and their corresponding values of y, where $y = f(x) + 4$. Substituting $a(x-h)^2 + k$ for $f(x)$ in this equation yields $y = a(x-h)^2 + k + 4$. This equation represents a quadratic relationship between x and y, where $k + 4$ is either the maximum or the minimum value of y, which occurs when $x = h$. For quadratic relationships between x and y, the maximum or minimum value of y occurs at the value of x halfway between any two values of x that have the same corresponding value of y. The table shows that *x*-values of 21 and 25 correspond to the same *y*-value, -8. Since 23 is halfway between 21 and 25, the maximum or minimum value of y occurs at an *x*-value of 23. The table shows that when $x = 23$, $y = 8$. It follows that $h = 23$ and $k + 4 = 8$. Subtracting 4 from both sides of the equation $k + 4 = 8$ yields $k = 4$. Substituting 23 for h and 4 for k in the equation $y = a(x-h)^2 + k + 4$ yields $y = a(x-23)^2 + 4 + 4$, or $y = a(x-23)^2 + 8$. The value of a can be found by substituting any *x*-value and its corresponding *y*-value for x and y, respectively, in this equation. Substituting 25 for x and -8 for y in this equation yields $-8 = a(25-23)^2 + 8$, or $-8 = a(2)^2 + 8$. Subtracting 8 from both sides of this equation yields $-16 = a(2)^2$, or $-16 = 4a$. Dividing both sides of this equation by 4 yields $-4 = a$. Substituting -4 for a, 23 for h, and 4 for k in the equation $f(x) = a(x-h)^2 + k$ yields $f(x) = -4(x-23)^2 + 4$. The *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane is the point on the graph where $x = 0$. Substituting 0 for x in the equation $f(x) = -4(x-23)^2 + 4$ yields $f(0) = -4(0-23)^2 + 4$, or $f(0) = -4(-23)^2 + 4$. This is equivalent to $f(0) = -2{,}112$, so the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane is $(0, -2{,}112)$. Thus, the *y*-coordinate of the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane is $-2{,}112$.

Question Difficulty:
Hard

Question ID 84e8cc72

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 84e8cc72

A quadratic function models the height, in feet, of an object above the ground in terms of the time, in seconds, after the object is launched off an elevated surface. The model indicates the object has an initial height of 10 feet above the ground and reaches its maximum height of $1{,}034$ feet above the ground 8 seconds after being launched. Based on the model, what is the height, in feet, of the object above the ground 10 seconds after being launched?

A. 234

B. 778

C. 970

D. $1{,}014$

ID: 84e8cc72 Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that a quadratic function models the height, in feet, of an object above the ground in terms of the time, in seconds, after the object is launched off an elevated surface. This quadratic function can be defined by an equation of the form $f(x) = a(x - h)^2 + k$, where $f(x)$ is the height of the object x seconds after it was launched, and a, h, and k are constants such that the function reaches its maximum value, k, when $x = h$. Since the model indicates the object reaches its maximum height of $1{,}034$ feet above the ground 8 seconds after being launched, $f(x)$ reaches its maximum value, $1{,}034$, when $x = 8$. Therefore, $k = 1{,}034$ and $h = 8$. Substituting 8 for h and $1{,}034$ for k in the function $f(x) = a(x - h)^2 + k$ yields $f(x) = a(x - 8)^2 + 1{,}034$. Since the model indicates the object has an initial height of 10 feet above the ground, the value of $f(x)$ is 10 when $x = 0$. Substituting 0 for x and 10 for $f(x)$ in the equation $f(x) = a(x - 8)^2 + 1{,}034$ yields $10 = a(0 - 8)^2 + 1{,}034$, or $10 = 64a + 1{,}034$. Subtracting $1{,}034$ from both sides of this equation yields $64a = -1{,}024$. Dividing both sides of this equation by 64 yields $a = -16$. Therefore, the model can be represented by the equation $f(x) = -16(x - 8)^2 + 1{,}034$. Substituting 10 for x in this equation yields $f(10) = -16(10 - 8)^2 + 1{,}034$, or $f(10) = 970$. Therefore, based on the model, 10 seconds after being launched, the height of the object above the ground is 970 feet.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 12e7faf8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 12e7faf8

The equation $\frac{x^2+6x-7}{x+7}=ax+d$ is true for all $x \neq -7$, where a and d are integers. What is the value of $a+d$?

A. -6

B. -1

C. 0

D. 1

ID: 12e7faf8 Answer

Correct Answer:
C

Rationale

Choice C is correct. Since the expression x^2+6x-7 can be factored as $(x+7)(x-1)$, the given equation can be rewritten as $\frac{(x+7)(x-1)}{x+7}=ax+d$. Since $x \neq -7$, $x+7$ is also not equal to 0, so both the numerator and denominator of $\frac{(x+7)(x-1)}{x+7}$ can be divided by $x+7$. This gives $x-1=ax+d$. Equating the coefficient of x on each side of the equation gives $a=1$. Equating the constant terms gives $d=-1$. The sum is $1+(-1)=0$.

Choice A is incorrect and may result from incorrectly simplifying the equation. Choices B and D are incorrect. They are the values of d and a, respectively, not $a+d$.

Question Difficulty:
Hard

Question ID 89fc23af

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 89fc23af

Which of the following expressions is equivalent to $\frac{x^2-2x-5}{x-3}$?

A. $x - 5 - \frac{20}{x-3}$

B. $x - 5 - \frac{10}{x-3}$

C. $x + 1 - \frac{8}{x-3}$

D. $x + 1 - \frac{2}{x-3}$

ID: 89fc23af Answer

Correct Answer:
D

Rationale

Choice D is correct. The numerator of the given expression can be rewritten in terms of the denominator, $x - 3$, as follows: $x^2-2x-5=x^2-3x+x-3-2$, which is equivalent to $x(x-3)+(x-3)-2$. So the given expression is equivalent to $\frac{x(x-3)+(x-3)-2}{x-3}=\frac{x(x-3)}{x-3}+\frac{x-3}{x-3}-\frac{2}{x-3}$. Since the given expression is defined for $x \neq 3$, the expression can be rewritten as $x+1-\frac{2}{x-3}$.

Long division can also be used as an alternate approach. Choices A, B, and C are incorrect and may result from errors made when dividing the two polynomials or making use of structure.

Question Difficulty:
Hard

Question ID 911c415b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: 911c415b

$$(7532+100y^2)+10(10y^2-110)$$

The expression above can be written in the form ay^2+b , where *a* and *b* are constants. What is the value of $a+b$?

ID: 911c415b Answer

Rationale

The correct answer is 6632. Applying the distributive property to the expression yields $(7532+100y^2)+(100y^2-1100)$. Then adding together $7532+100y^2$ and $100y^2-1100$ and collecting like terms results in $200y^2+6432$. This is written in the form ay^2+b, where $a=200$ and $b=6432$. Therefore $a+b=200+6432=6632$.

Question Difficulty:
Hard

Question ID f89e1d6f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: f89e1d6f

If $a = c + d$, which of the following is equivalent to the expression $x^2 - c^2 - 2cd - d^2$?

A. $(x + a)^2$

B. $(x - a)^2$

C. $(x + a)(x - a)$

D. $x^2 - ax - a^2$

ID: f89e1d6f Answer

Correct Answer:
C

Rationale

Choice C is correct. Factoring −1 from the second, third, and fourth terms gives $x^2 - c^2 - 2cd - d^2 = x^2 - (c^2 + 2cd + d^2)$. The expression $c^2 + 2cd + d^2$ is the expanded form of a perfect square: $c^2 + 2cd + d^2 = (c + d)^2$. Therefore, $x^2 - (c^2 + 2cd + d^2) = x^2 - (c + d)^2$. Since $a = c + d$, $x^2 - (c + d)^2 = x^2 - a^2$. Finally, because $x^2 - a^2$ is the difference of squares, it can be expanded as $x^2 - a^2 = (x + a)(x - a)$.

Choices A and B are incorrect and may be the result of making an error in factoring the difference of squares $x^2 - a^2$. Choice D is incorrect and may be the result of incorrectly combining terms.

Question Difficulty:
Hard

Question ID 2c5c22d0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 2c5c22d0

$$y = x^2 + 3x - 7$$
$$y - 5x + 8 = 0$$

How many solutions are there to the system of equations above?

A. There are exactly 4 solutions.

B. There are exactly 2 solutions.

C. There is exactly 1 solution.

D. There are no solutions.

ID: 2c5c22d0 Answer

Correct Answer:
C

Rationale

Choice C is correct. The second equation of the system can be rewritten as $y = 5x - 8$. Substituting $5x - 8$ for y in the first equation gives $5x - 8 = x^2 + 3x - 7$. This equation can be solved as shown below:

$$x^2 + 3x - 7 - 5x + 8 = 0$$

$$x^2 - 2x + 1 = 0$$

$$(x - 1)^2 = 0$$

$$x = 1$$

Substituting 1 for x in the equation $y = 5x - 8$ gives $y = -3$. Therefore, $(1, -3)$ is the only solution to the system of equations.

Choice A is incorrect. In the xy-plane, a parabola and a line can intersect at no more than two points. Since the graph of the first equation is a parabola and the graph of the second equation is a line, the system cannot have more than 2 solutions. Choice B is incorrect. There is a single ordered pair (x, y) that satisfies both equations of the system. Choice D is incorrect because the ordered pair $(1, -3)$ satisfies both equations of the system.

Question Difficulty:
Hard

Question ID fc3dfa26

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: fc3dfa26

$$\frac{4x^2}{x^2-9} - \frac{2x}{x+3} = \frac{1}{x-3}$$

What value of *x* satisfies the equation above?

A. -3

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. 3

ID: fc3dfa26 Answer

Correct Answer:
C

Rationale

Choice C is correct. Each fraction in the given equation can be expressed with the common denominator x^2-9. Multiplying $\frac{2x}{x+3}$ by $\frac{x-3}{x-3}$ yields $\frac{2x^2-6x}{x^2-9}$, and multiplying $\frac{1}{x-3}$ by $\frac{x+3}{x+3}$ yields $\frac{x+3}{x^2-9}$. Therefore, the given equation can be written as $\frac{4x^2}{x^2-9} - \frac{2x^2-6x}{x^2-9} = \frac{x+3}{x^2-9}$. Multiplying each fraction by the denominator results in the equation $4x^2-(2x^2-6x)=x+3$, or $2x^2+6x=x+3$. This equation can be solved by setting a quadratic expression equal to 0, then solving for x. Subtracting $x+3$ from both sides of this equation yields $2x^2+5x-3=0$. The expression $2x^2+5x-3$ can be factored, resulting in the equation $(2x-1)(x+3)=0$. By the zero product property, $2x-1=0$ or $x+3=0$. To solve for x in $2x-1=0$, 1 can be added to both sides of the equation, resulting in $2x=1$. Dividing both sides of this equation by 2 results in $x=\frac{1}{2}$. Solving for x in $x+3=0$ yields $x=-3$. However, this value of x would result in the second fraction of the original equation having a denominator of 0. Therefore, $x=-3$ is an extraneous solution. Thus, the only value of x that satisfies the given equation is $x=\frac{1}{2}$.

Choice A is incorrect and may result from solving $x+3=0$ but not realizing that this solution is extraneous because it would result in a denominator of 0 in the second fraction. Choice B is incorrect and may result from a sign error when solving $2x-1=0$ for x. Choice D is incorrect and may result from a calculation error.

Question Difficulty:
Hard

Question ID 6d9e01a2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 6d9e01a2

$$f(x) = 4x^2 - 50x + 126$$

The given equation defines the function f. For what value of x does $f(x)$ reach its minimum?

ID: 6d9e01a2 Answer

Correct Answer:
25/4, 6.25

Rationale

The correct answer is $\frac{25}{4}$. The given equation can be rewritten in the form $f(x) = a(x-h)^2 + k$, where a, h, and k are constants. When $a > 0$, h is the value of x for which $f(x)$ reaches its minimum. The given equation can be rewritten as $f(x) = 4\left(x^2 - \frac{50}{4}x\right) + 126$, which is equivalent to $f(x) = 4\left(x^2 - \frac{50}{4}x + \left(\frac{50}{8}\right)^2 - \left(\frac{50}{8}\right)^2\right) + 126$. This equation can be rewritten as $f(x) = 4\left(\left(x - \frac{50}{8}\right)^2 - \left(\frac{50}{8}\right)^2\right) + 126$, or $f(x) = 4\left(x - \frac{50}{8}\right)^2 - 4\left(\frac{50}{8}\right)^2 + 126$, which is equivalent to $f(x) = 4\left(x - \frac{25}{4}\right)^2 - \frac{121}{4}$. Therefore, $h = \frac{25}{4}$, so the value of x for which $f(x)$ reaches its minimum is $\frac{25}{4}$. Note that 25/4 and 6.25 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 9f2ecade

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 9f2ecade

$$h(x) = x^3 + ax^2 + bx + c$$

The function *h* is defined above, where *a*, *b*, and *c* are integer constants. If the zeros of the function are -5, 6, and 7, what is the value of *c* ?

ID: 9f2ecade Answer

Rationale

The correct answer is 210. Since -5, 6, and 7 are zeros of the function, the function can be rewritten as $h(x) = (x+5)(x-6)(x-7)$. Expanding the function yields $h(x) = x^3 - 8x^2 - 23x + 210$. Thus, $a = -8$, $b = -23$, and $c = 210$. Therefore, the value of c is 210.

Question Difficulty:
Hard

Question ID 6011a3f8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 6011a3f8

$$64x^2 + bx + 25 = 0$$

In the given equation, b is a constant. For which of the following values of b will the equation have more than one real solution?

A. -91

B. -80

C. 5

D. 40

ID: 6011a3f8 Answer

Correct Answer:
A

Rationale

Choice A is correct. A quadratic equation of the form $ax^2 + bx + c = 0$, where a, b, and c are constants, has either no real solutions, exactly one real solution, or exactly two real solutions. That is, for the given equation to have more than one real solution, it must have exactly two real solutions. When the value of the discriminant, or $b^2 - 4ac$, is greater than 0, the given equation has exactly two real solutions. In the given equation, $64x^2 + bx + 25 = 0$, $a = 64$ and $c = 25$. Therefore, the given equation has exactly two real solutions when $(b)^2 - 4(64)(25) > 0$, or $b^2 - 6{,}400 > 0$. Adding $6{,}400$ to both sides of this inequality yields $b^2 > 6{,}400$. Taking the square root of both sides of $b^2 > 6{,}400$ yields two possible inequalities: $b < -80$ or $b > 80$. Of the choices, only choice A satisfies $b < -80$ or $b > 80$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID e117d3b8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Equivalent expressions	

ID: e117d3b8

If a and c are positive numbers, which of the following is equivalent to $\sqrt{(a+c)^3} \cdot \sqrt{a+c}$?

A. $a+c$

B. a^2+c^2

C. $a^2+2ac+c^2$

D. a^2c^2

ID: e117d3b8 Answer

Correct Answer:

C

Rationale

Choice C is correct. Using the property that $\sqrt{x}\sqrt{y}=\sqrt{xy}$ for positive numbers x and y, with x = $(a + c)^3$ and y = a + c, it follows that $\sqrt{(a+c)^3} \cdot \sqrt{a+c} = \sqrt{(a+c)^4}$. By rewriting $(a + c)^4$ as $((a + c)^2)^2$, it is possible to simplify the square root expression as follows: $\sqrt{((a+c)^2)^2} = (a+c)^2 = a^2+2ac+c^2$.

Choice A is incorrect and may be the result of $\sqrt{(a+c)^3} \div \sqrt{(a+c)}$. Choice B is incorrect and may be the result of incorrectly rewriting $(a + c)^2$ as $a^2 + c^2$. Choice D is incorrect and may be the result of incorrectly applying properties of exponents.

Question Difficulty:

Hard

Question ID 1fe10d97

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 1fe10d97

$$p(t) = 90{,}000(1.06)^t$$

The given function p models the population of Lowell t years after a census. Which of the following functions best models the population of Lowell m months after the census?

A. $r(m) = \frac{90{,}000}{12}(1.06)^m$

B. $r(m) = 90{,}000\left(\frac{1.06}{12}\right)^m$

C. $r(m) = 90{,}000\left(\frac{1.06}{12}\right)^{\frac{m}{12}}$

D. $r(m) = 90{,}000(1.06)^{\frac{m}{12}}$

ID: 1fe10d97 Answer

Correct Answer:

D

Rationale

Choice D is correct. It's given that the function p models the population of Lowell t years after a census. Since there are 12 months in a year, m months after the census is equivalent to $\frac{m}{12}$ years after the census. Substituting $\frac{m}{12}$ for t in the equation $p(t) = 90{,}000(1.06)^t$ yields $p\left(\frac{m}{12}\right) = 90{,}000(1.06)^{\frac{m}{12}}$. Therefore, the function r that best models the population of Lowell m months after the census is $r(m) = 90{,}000(1.06)^{\frac{m}{12}}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:

Hard

Question ID b73ee6cf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: b73ee6cf

The population of a town is currently 50,000, and the population is estimated to increase each year by 3% from the previous year. Which of the following equations can be used to estimate the number of years, *t*, it will take for the population of the town to reach 60,000 ?

A. $50{,}000 = 60{,}000(0.03)^t$

B. $50{,}000 = 60{,}000(3)^t$

C. $60{,}000 = 50{,}000(0.03)^t$

D. $60{,}000 = 50{,}000(1.03)^t$

ID: b73ee6cf Answer

Correct Answer:
D

Rationale

Choice D is correct. Stating that the population will increase each year by 3% from the previous year is equivalent to saying that the population each year will be 103% of the population the year before. Since the initial population is 50,000, the population after t years is given by $50{,}000(1.03)^t$. It follows that the equation $60{,}000 = 50{,}000(1.03)^t$ can be used to estimate the number of years it will take for the population to reach 60,000.

Choice A is incorrect. This equation models how long it will take the population to decrease from 60,000 to 50,000, which is impossible given the growth factor. Choice B is incorrect and may result from misinterpreting a 3% growth as growth by a factor of 3. Additionally, this equation attempts to model how long it will take the population to decrease from 60,000 to 50,000. Choice C is incorrect and may result from misunderstanding how to model percent growth by multiplying the initial amount by a factor greater than 1.

Question Difficulty:
Hard

Question ID 7eed640d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 7eed640d

$$h(x) = -16x^2 + 100x + 10$$

The quadratic function above models the height above the ground h, in feet, of a projectile x seconds after it had been launched vertically. If $y = h(x)$ is graphed in the xy-plane, which of the following represents the real-life meaning of the positive x-intercept of the graph?

A. The initial height of the projectile

B. The maximum height of the projectile

C. The time at which the projectile reaches its maximum height

D. The time at which the projectile hits the ground

ID: 7eed640d Answer

Correct Answer:
D

Rationale

Choice D is correct. The positive x-intercept of the graph of $y = h(x)$ is a point (x, y) for which $y = 0$. Since $y = h(x)$ models the height above the ground, in feet, of the projectile, a y-value of 0 must correspond to the height of the projectile when it is 0 feet above ground or, in other words, when the projectile is on the ground. Since x represents the time since the projectile was launched, it follows that the positive x-intercept, $(x, 0)$, represents the time at which the projectile hits the ground.

Choice A is incorrect and may result from misidentifying the y-intercept as a positive x-intercept. Choice B is incorrect and may result from misidentifying the y-value of the vertex of the graph of the function as an x-intercept. Choice C is incorrect and may result from misidentifying the x-value of the vertex of the graph of the function as an x-intercept.

Question Difficulty:
Hard

Question ID 43926bd9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 43926bd9

x	$f(x)$
1	a
2	a^5
3	a^9

For the exponential function *f*, the table above shows several values of *x* and their corresponding values of $f(x)$, where *a* is a constant greater than 1. If *k* is a constant and $f(k) = a^{29}$, what is the value of *k* ?

ID: 43926bd9 Answer

Rationale

The correct answer is 8. The values of $f(x)$ for the exponential function f shown in the table increase by a factor of a^4 for each increase of 1 in x. This relationship can be represented by the equation $f(x) = a^{4x+b}$, where b is a constant. It's given that when $x = 2$, $f(x) = a^5$. Substituting 2 for x and a^5 for $f(x)$ into $f(x) = a^{4x+b}$ yields $a^5 = a^{4(2)+b}$. Since $4(2) + b = 5$, it follows that $b = -3$. Thus, an equation that defines the function f is $f(x) = a^{4x-3}$. It follows that the value of k such that $f(k) = a^{29}$ can be found by solving the equation $4k - 3 = 29$, which yields $k = 8$.

Question Difficulty:
Hard

Question ID f25a34aa

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: f25a34aa

The area of a triangle is equal to x^2 square centimeters. The length of the base of the triangle is $2x + 22$ centimeters, and the height of the triangle is $x - 10$ centimeters. What is the value of x?

ID: f25a34aa Answer

Correct Answer:
110

Rationale

The correct answer is 110. The area of a triangle is equal to one half of the product of the length of the base of the triangle and the height of the triangle. It's given that the length of the base of the triangle is $2x + 22$ centimeters and the height of the triangle is $x - 10$ centimeters; therefore, its area is $\frac{1}{2}(2x + 22)(x - 10)$ square centimeters. It's also given that the area of the triangle is equal to x^2 square centimeters. Therefore, it follows that $\frac{1}{2}(2x + 22)(x - 10) = x^2$. This equation can be rewritten as $(x + 11)(x - 10) = x^2$, or $x^2 + x - 110 = x^2$. Subtracting x^2 from both sides of this equation yields $x - 110 = 0$. Adding 110 to both sides of this equation yields $x = 110$. Therefore, the value of x is 110.

Question Difficulty:
Hard

Question ID a58232b7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: a58232b7

The functions g and h are defined by the given equations, where $x \geq 0$. Which of the following equations displays, as a constant or coefficient, the minimum value of the function it defines, where $x \geq 0$?

I. $g(x) = 18(1.16)(1.4)^{x+2}$
II. $h(x) = 18(1.4)^{x+4}$

A. I only

B. II only

C. I and II

D. Neither I nor II

ID: a58232b7 Answer

Correct Answer:
D

Rationale

Choice D is correct. A function defined by an equation in the form $f(x) = a(b)^{x+h}$, where a, b, and h are positive constants and $x \geq 0$, has a minimum value of $f(0)$. It's given that function g is defined by $g(x) = 18(1.16)(1.4)^{x+2}$, which is equivalent to $g(x) = 20.88(1.4)^{x+2}$. Substituting 0 for x in this equation yields $g(0) = 20.88(1.4)^{0+2}$, or $g(0) = 40.9248$. Therefore, the minimum value of $g(x)$ is 40.9248, so $g(x) = 18(1.16)(1.4)^{x+2}$ doesn't display its minimum value as a constant or coefficient. It's also given that function h is defined by $h(x) = 18(1.4)^{x+4}$. Substituting 0 for x in this equation yields $h(0) = 18(1.4)^{0+4}$, or $h(0) = 69.1488$. Therefore, the minimum value of $h(x)$ is 69.1488, so $h(x) = 18(1.4)^{x+4}$ doesn't display its minimum value as a constant or coefficient. Therefore, neither I nor II displays, as a constant or coefficient, the minimum value of the function it defines, where $x \geq 0$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID a7711fe8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: a7711fe8

What is the minimum value of the function f defined by $f(x)=(x-2)^2-4$?

A. -4

B. -2

C. 2

D. 4

ID: a7711fe8 Answer

Correct Answer:
A

Rationale

Choice A is correct. The given quadratic function f is in vertex form, $f(x)=(x-h)^2+k$, where (h,k) is the vertex of the graph of $y=f(x)$ in the xy-plane. Therefore, the vertex of the graph of $y=f(x)$ is $(2,-4)$. In addition, the y-coordinate of the vertex represents either the minimum or maximum value of a quadratic function, depending on whether the graph of the function opens upward or downward. Since the leading coefficient of f (the coefficient of the term $(x-2)^2$) is 1, which is positive, the graph of $y=f(x)$ opens upward. It follows that at $x=2$, the minimum value of the function f is -4.

Choice B is incorrect and may result from making a sign error and from using the x-coordinate of the vertex. Choice C is incorrect and may result from using the x-coordinate of the vertex. Choice D is incorrect and may result from making a sign error.

Question Difficulty:
Hard

Question ID 1a722d7d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear functions	

ID: 1a722d7d

Let the function p be defined as $p(x)=\frac{(x-c)^2+160}{2c}$, where c is a constant. If $p(c)=10$, what is the value of $p(12)$?

A. 10.00

B. 10.25

C. 10.75

D. 11.00

ID: 1a722d7d Answer

Correct Answer:
D

Rationale

Choice D is correct. The value of p(12) depends on the value of the constant c, so the value of c must first be determined. It is given that p(c) = 10. Based on the definition of p, it follows that:

$$p(c)=\frac{(c-c)^2+160}{2c}=10$$

$$\frac{160}{2c}=10$$

$$2c=16$$

$$c=8$$

This means that $p(x)=\frac{(x-8)^2+160}{16}$ for all values of x. Therefore:

$$p(12)=\frac{(12-8)^2+160}{16}$$

$$=\frac{16+160}{16}$$

$$=11$$

Choice A is incorrect. It is the value of $p(8)$, not $p(12)$. Choices B and C are incorrect. If one of these values were correct, then $x = 12$ and the selected value of $p(12)$ could be substituted into the equation to solve for c. However, the values of c that result from choices B and C each result in $p(c) < 10$.

Question Difficulty:
Hard

Question ID 58b109d4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Advanced Math	Nonlinear equations in one variable and systems of equations in two variables	

ID: 58b109d4

$$x^2 + y + 7 = 7$$
$$20x + 100 - y = 0$$

The solution to the given system of equations is (x, y). What is the value of x?

ID: 58b109d4 Answer

Correct Answer:
-10

Rationale

The correct answer is -10. Adding y to both sides of the second equation in the given system yields $20x + 100 = y$. Substituting $20x + 100$ for y in the first equation in the given system yields $x^2 + 20x + 100 + 7 = 7$. Subtracting 7 from both sides of this equation yields $x^2 + 20x + 100 = 0$. Factoring the left-hand side of this equation yields $(x + 10)(x + 10) = 0$, or $(x + 10)^2 = 0$. Taking the square root of both sides of this equation yields $x + 10 = 0$. Subtracting 10 from both sides of this equation yields $x = -10$. Therefore, the value of x is -10.

Question Difficulty:
Hard

Question ID 85939da5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Inference from sample statistics and margin of error	

ID: 85939da5

Texting behavior	Talks on cell phone daily	Does not talk on cell phone daily	Total
Light	110	146	256
Medium	139	164	303
Heavy	166	74	240
Total	415	384	799

In a study of cell phone use, 799 randomly selected US teens were asked how often they talked on a cell phone and about their texting behavior. The data are summarized in the table above. Based on the data from the study, an estimate of the percent of US teens who are heavy texters is 30% and the associated margin of error is 3%. Which of the following is a correct statement based on the given margin of error?

A. Approximately 3% of the teens in the study who are classified as heavy texters are not really heavy texters.

B. It is not possible that the percent of all US teens who are heavy texters is less than 27%.

C. The percent of all US teens who are heavy texters is 33%.

D. It is doubtful that the percent of all US teens who are heavy texters is 35%.

ID: 85939da5 Answer

Correct Answer:

D

Rationale

Choice D is correct. The given margin of error of 3% indicates that the actual percent of all US teens who are heavy texters is likely within 3% of the estimate of 30%, or between 27% and 33%. Therefore, it is unlikely, or doubtful, that the percent of all US teens who are heavy texters would be 35%.

Choice A is incorrect. The margin of error doesn't provide any information about the accuracy of reporting in the study. Choice B is incorrect. Based on the estimate and given margin of error, it is unlikely that the percent of all US teens who are heavy texters would be less than 27%, but it is possible. Choice C is incorrect. While the percent of all US teens who are heavy texters is likely between 27% and 33%, any value within this interval is equally likely. We can't be certain that the value is exactly 33%.

Question Difficulty:

Hard

Question ID 954943a4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 954943a4

Jennifer bought a box of Crunchy Grain cereal. The nutrition facts on the box state that a serving size of the cereal is $\frac{3}{4}$ cup and provides 210 calories, 50 of which are calories from fat. In addition, each serving of the cereal provides 180 milligrams of potassium, which is 5% of the daily allowance for adults. If p percent of an adult's daily allowance of potassium is provided by x servings of Crunchy Grain cereal per day, which of the following expresses p in terms of x ?

A. $p = 0.5x$

B. $p = 5x$

C. $p = (0.05)^x$

D. $p = (1.05)^x$

ID: 954943a4 Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that each serving of Crunchy Grain cereal provides 5% of an adult's daily allowance of potassium, so x servings would provide x times 5%. The percentage of an adult's daily allowance of potassium, p, is 5 times the number of servings, x. Therefore, the percentage of an adult's daily allowance of potassium can be expressed as $p = 5x$.

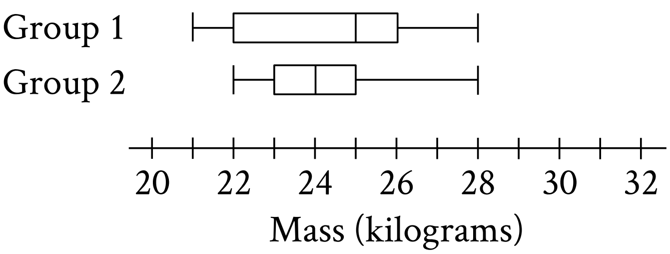
Choices A, C, and D are incorrect and may result from incorrectly converting 5% to its decimal equivalent, which isn't necessary since p is expressed as a percentage. Additionally, choices C and D are incorrect because the context should be represented by a linear relationship, not by an exponential relationship.

Question Difficulty:
Hard

Question ID d3b9c8d8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: d3b9c8d8



The box plots summarize the masses, in kilograms, of two groups of gazelles. Based on the box plots, which of the following statements must be true?

A. The mean mass of group 1 is greater than the mean mass of group 2.

B. The mean mass of group 1 is less than the mean mass of group 2.

C. The median mass of group 1 is greater than the median mass of group 2.

D. The median mass of group 1 is less than the median mass of group 2.

ID: d3b9c8d8 Answer

Correct Answer:
C

Rationale

Choice C is correct. The median of a data set represented in a box plot is represented by the vertical line within the box. It follows that the median mass of the gazelles in group 1 is 25 kilograms, and the median mass of the gazelles in group 2 is 24 kilograms. Since 25 kilograms is greater than 24 kilograms, the median mass of group 1 is greater than the median mass of group 2.

Choice A is incorrect. The mean mass of each of the two groups cannot be determined from the box plots.

Choice B is incorrect. The mean mass of each of the two groups cannot be determined from the box plots.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 65c49824

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 65c49824

A school district is forming a committee to discuss plans for the construction of a new high school. Of those invited to join the committee, 15% are parents of students, 45% are teachers from the current high school, 25% are school and district administrators, and the remaining 6 individuals are students. How many more teachers were invited to join the committee than school and district administrators?

ID: 65c49824 Answer

Rationale

The correct answer is 8. The 6 students represent $(100-15-45-25)\% = 15\%$ of those invited to join the committee. If x people were invited to join the committee, then $0.15x = 6$. Thus, there were $\frac{6}{0.15} = 40$ people invited to join the committee. It follows that there were $0.45(40) = 18$ teachers and $0.25(40) = 10$ school and district administrators invited to join the committee. Therefore, there were 8 more teachers than school and district administrators invited to join the committee.

Question Difficulty:
Hard

Question ID 1ea09200

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Evaluating statistical claims: Observational studies and experiments	

ID: 1ea09200

A sample of 40 fourth-grade students was selected at random from a certain school. The 40 students completed a survey about the morning announcements, and 32 thought the announcements were helpful. Which of the following is the largest population to which the results of the survey can be applied?

A. The 40 students who were surveyed

B. All fourth-grade students at the school

C. All students at the school

D. All fourth-grade students in the county in which the school is located

ID: 1ea09200 Answer

Correct Answer:
B

Rationale

Choice B is correct. Selecting a sample of a reasonable size at random to use for a survey allows the results from that survey to be applied to the population from which the sample was selected, but not beyond this population. In this case, the population from which the sample was selected is all fourth-grade students at a certain school. Therefore, the results of the survey can be applied to all fourth-grade students at the school.

Choice A is incorrect. The results of the survey can be applied to the 40 students who were surveyed. However, this isn't the largest group to which the results of the survey can be applied. Choices C and D are incorrect. Since the sample was selected at random from among the fourth-grade students at a certain school, the results of the survey can't be applied to other students at the school or to other fourth-grade students who weren't represented in the survey results. Students in other grades in the school or other fourth-grade students in the country may feel differently about announcements than the fourth-grade students at the school.

Question Difficulty:
Hard

Question ID 0ea56bb2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 0ea56bb2

Year	Subscriptions sold
2012	5,600
2013	5,880

The manager of an online news service received the report above on the number of subscriptions sold by the service. The manager estimated that the percent increase from 2012 to 2013 would be double the percent increase from 2013 to 2014. How many subscriptions did the manager expect would be sold in 2014?

A. 6,020

B. 6,027

C. 6,440

D. 6,468

ID: 0ea56bb2 Answer

Correct Answer:
B

Rationale

Choice B is correct. The percent increase from 2012 to 2013 was $\frac{5,880-5,600}{5,600}=0.05$, or 5%. Since the percent increase from 2012 to 2013 was estimated to be double the percent increase from 2013 to 2014, the percent increase from 2013 to 2014 was expected to be 2.5%.
Therefore, the number of subscriptions sold in 2014 is expected to be the number of subscriptions sold in 2013 multiplied by $(1+0.025)$, or $5,880(1.025)=6,027$.

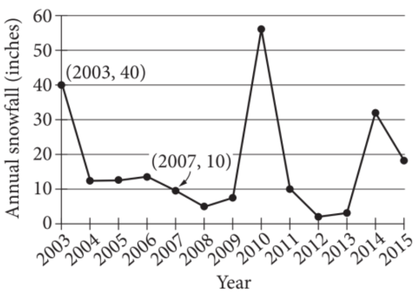
Choice A is incorrect and is the result of adding half of the value of the increase from 2012 to 2013 to the 2013 result. Choice C is incorrect and is the result adding twice the value of the increase from 2012 to 2013 to the 2013 result. Choice D is incorrect and is the result of interpreting the percent increase from 2013 to 2014 as double the percent increase from 2012 to 2013.

Question Difficulty:
Hard

Question ID 0231050d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 0231050d



The line graph shows the total amount of snow, in inches, recorded each year in Washington, DC, from 2003 to 2015. If $p\%$ is the percent decrease in the annual snowfall from 2003 to 2007, what is the value of *p* ?

ID: 0231050d Answer

Rationale

The correct answer is 75. The percent decrease between two values is found by dividing the difference between the two values by the original value and multiplying by 100. The line graph shows that the annual snowfall in 2003 was 40 inches, and the annual snowfall in 2007 was 10 inches. Therefore, the percent decrease in the annual snowfall from 2003 to 2007 is $\left(\frac{40-10}{40}\right)(100)$, or 75. It's given that this is equivalent to $p\%$, so the value of p is 75.

Question Difficulty:
Hard

Question ID d4413871

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Probability and conditional probability	

ID: d4413871

	Blood type			
Rhesus factor	A	B	AB	O
$+$	33	9	3	37
$-$	7	2	1	x

Human blood can be classified into four common blood types—A, B, AB, and O. It is also characterized by the presence $(+)$ or absence $(-)$ of the rhesus factor. The table above shows the distribution of blood type and rhesus factor for a group of people. If one of these people who is rhesus negative $(-)$ is chosen at random, the probability that the person has blood type B is $\frac{1}{9}$. What is the value of x?

ID: d4413871 Answer

Rationale

The correct answer is 8. In this group, $\frac{1}{9}$ of the people who are rhesus negative have blood type B. The total number of people who are rhesus negative in the group is $7+2+1+x$, and there are 2 people who are rhesus negative with blood type B. Therefore, $\frac{2}{(7+2+1+x)}=\frac{1}{9}$. Combining like terms on the left-hand side of the equation yields $\frac{2}{(10+x)}=\frac{1}{9}$. Multiplying both sides of this equation by 9 yields $\frac{18}{(10+x)}=1$, and multiplying both sides of this equation by $(10+x)$ yields $18=10+x$. Subtracting 10 from both sides of this equation yields $8=x$.

Question Difficulty:
Hard

Question ID 190be2fc

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 190be2fc

Data set A consists of 10 positive integers less than 60. The list shown gives 9 of the integers from data set A.

$$43, 45, 44, 43, 38, 39, 40, 46, 40$$

The mean of these 9 integers is 42. If the mean of data set A is an integer that is greater than 42, what is the value of the largest integer from data set A?

ID: 190be2fc Answer

Correct Answer:

52

Rationale

The correct answer is 52. The mean of a data set is calculated by dividing the sum of the data values by the number of values. It's given that data set A consists of 10 values, 9 of which are shown. Let x represent the 10th data value in data set A, which isn't shown. The mean of data set A can be found using the expression $\frac{43+45+44+43+38+39+40+46+40+x}{10}$, or $\frac{378+x}{10}$. It's given that the mean of the 9 values shown is 42 and that the mean of all 10 numbers is greater than 42. Consequently, the 10th data value, x, is larger than 42. It's also given that the data values in data set A are positive integers less than 60. Thus, $42 < x < 60$. Finally, it's given that the mean of data set A is an integer. This means that the sum of the 10 data values, $378 + x$, is divisible by 10. Thus, $378 + x$ must have a ones digit of 0. It follows that x must have a ones digit of 2. Since $42 < x < 60$ and x has a ones digit of 2, the only possible value of x is 52. Since 52 is larger than any of the integers shown, the largest integer from data set A is 52.

Question Difficulty:

Hard

Question ID c178d4da

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: c178d4da

Value	Data set A frequency	Data set B frequency
30	2	9
34	4	7
38	5	5
42	7	4
46	9	2

Data set A and data set B each consist of 27 values. The table shows the frequencies of the values for each data set. Which of the following statements best compares the means of the two data sets?

A. The mean of data set A is greater than the mean of data set B.

B. The mean of data set A is less than the mean of data set B.

C. The mean of data set A is equal to the mean of data set B.

D. There is not enough information to compare the means of the data sets.

ID: c178d4da Answer

Correct Answer:
A

Rationale

Choice A is correct. The mean value of a data set is the sum of the values of the data set divided by the number of values in the data set. When a data set is represented in a frequency table, the sum of the values in the data set is the sum of the products of each value and its frequency. For data set A, the sum of products of each value and its frequency is $30(2) + 34(4) + 38(5) + 42(7) + 46(9)$, or $1{,}094$. It's given that there are 27 values in data set A. Therefore, the mean of data set A is $\frac{1{,}094}{27}$, or approximately 40.52. Similarly, the mean of data B is $\frac{958}{27}$, or approximately 35.48. Therefore, the mean of data set A is greater than the mean of data set B.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 457d2f2c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 457d2f2c

A data set of 27 different numbers has a mean of 33 and a median of 33. A new data set is created by adding 7 to each number in the original data set that is greater than the median and subtracting 7 from each number in the original data set that is less than the median. Which of the following measures does NOT have the same value in both the original and new data sets?

A. Median

B. Mean

C. Sum of the numbers

D. Standard deviation

ID: 457d2f2c Answer

Correct Answer:
D

Rationale

Choice D is correct. When a data set has an odd number of elements, the median can be found by ordering the values from least to greatest and determining the middle value. Out of the 27 different numbers in this data set, 13 numbers are below the median, one number is exactly 33, and 13 numbers are above the median. When 7 is subtracted from each number below the median and added to each number above the median, the data spread out from the median. Since the median of this data set, 33, is equivalent to the mean of the data set, the data also spread out from the mean. Since standard deviation is a measure of how spread out the data are from the mean, a greater spread from the mean indicates an increased standard deviation.

Choice A is incorrect. All the numbers less than the median decrease and all the numbers greater than the median increase, but the median itself doesn't change. Choices B and C are incorrect. The mean of a data set is found by dividing the sum of the values by the number of values. The net change from subtracting 7 from 13 numbers and adding 7 to 13 numbers is zero. Therefore, neither the mean nor the sum of the numbers changes.

Question Difficulty:
Hard

Question ID d6af3572

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: d6af3572

The scatterplot above shows the federal-mandated minimum wage every 10 years between 1940 and 2010. A line of best fit is shown, and its equation is $y = 0.096x - 0.488$. What does the line of best fit predict about the increase in the minimum wage over the 70-year period?

A. Each year between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.

B. Each year between 1940 and 2010, the average increase in minimum wage was 0.49 dollars.

C. Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.096 dollars.

D. Every 10 years between 1940 and 2010, the average increase in minimum wage was 0.488 dollars.

ID: d6af3572 Answer

Correct Answer:

A

Rationale

Choice A is correct. The given equation is in slope-intercept form, or $y = mx + b$, where m is the value of the slope of the line of best fit. Therefore, the slope of the line of best fit is 0.096. From the definition of slope, it follows that an increase of 1 in the x-value corresponds to an increase of 0.096 in the y-value. Therefore, the line of best fit predicts that for each year between 1940 and 2010, the minimum wage will increase by 0.096 dollar per hour.

Choice B is incorrect and may result from using the y-coordinate of the y-intercept as the average increase, instead of the slope. Choice C is incorrect and may result from using the 10-year increments given on the x-axis to incorrectly interpret the slope of the line of best fit. Choice D is incorrect and may result from using the y-coordinate of the y-intercept as the average increase, instead of the slope, and from using the 10-year increments given on the x-axis to incorrectly interpret the slope of the line of best fit.

Question Difficulty:

Hard

Question ID 3638f413

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: 3638f413

Jeremy deposited x dollars in his investment account on January 1, 2001. The amount of money in the account doubled each year until Jeremy had 480 dollars in his investment account on January 1, 2005. What is the value of x ?

ID: 3638f413 Answer

Rationale

The correct answer is 30. The situation can be represented by the equation $x(2^4) = 480$, where the 2 represents the fact that the amount of money in the account doubled each year and the 4 represents the fact that there are 4 years between January 1, 2001, and January 1, 2005. Simplifying $x(2^4) = 480$ gives $16x = 480$. Therefore, $x = 30$.

Question Difficulty:
Hard

Question ID 1142af44

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 1142af44

Value	Frequency
1	a
2	$2a$
3	$3a$
4	$2a$
5	a

The frequency distribution above summarizes a set of data, where a is a positive integer. How much greater is the mean of the set of data than the median?

A. 0

B. 1

C. 2

D. 3

ID: 1142af44 Answer

Correct Answer:
A

Rationale

Choice A is correct. Since the frequencies of values less than the middle value, 3, are the same as the frequencies of the values greater than 3, the set of data has a symmetric distribution. When a set of data has a symmetric distribution, the mean and median values are equal. Therefore, the mean is 0 greater than the median.

Choices B, C, and D are incorrect and may result from misinterpreting the set of data.

Question Difficulty:
Hard

Question ID 1e8ccffd

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 1e8ccffd

The mean score of 8 players in a basketball game was 14.5 points. If the highest individual score is removed, the mean score of the remaining 7 players becomes 12 points. What was the highest score?

A. 20

B. 24

C. 32

D. 36

ID: 1e8ccffd Answer

Correct Answer:
C

Rationale

Choice C is correct. If the mean score of 8 players is 14.5, then the total of all 8 scores is $14.5 \times 8 = 116$. If the mean of 7 scores is 12, then the total of all 7 scores is $12 \times 7 = 84$. Since the set of 7 scores was made by removing the highest score of the set of 8 scores, then the difference between the total of all 8 scores and the total of all 7 scores is equal to the removed score: $116 - 84 = 32$.

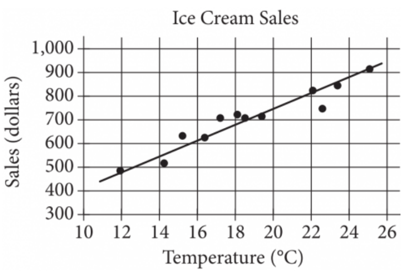
Choice A is incorrect because if 20 is removed from the group of 8 scores, then the mean score of the remaining 7 players is $\frac{(14.5 \times 8) - 20}{7}$ is approximately 13.71, not 12. Choice B is incorrect because if 24 is removed from the group of 8 scores, then the mean score of the remaining 7 players is $\frac{(14.5 \times 8) - 24}{7}$ is approximately 13.14, not 12. Choice D is incorrect because if 36 is removed from the group of 8 scores, then the mean score of the remaining 7 players is $\frac{(14.5 \times 8) - 36}{7}$ or approximately 11.43, not 12.

Question Difficulty:
Hard

Question ID 1e1027a7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: 1e1027a7



The scatterplot above shows a company's ice cream sales *d*, in dollars, and the high temperature *t*, in degrees Celsius (°C), on 12 different days. A line of best fit for the data is also shown. Which of the following could be an equation of the line of best fit?

A. $d = 0.03t + 402$

B. $d = 10t + 402$

C. $d = 33t + 300$

D. $d = 33t + 84$

ID: 1e1027a7 Answer

Correct Answer:
D

Rationale

Choice D is correct. On the line of best fit, d increases from approximately 480 to 880 between $t = 12$ and $t = 24$. The slope of the line of best fit is the difference in d-values divided by the difference in t-values, which gives $\frac{880 - 480}{24 - 12} = \frac{400}{12}$, or approximately 33. Writing the equation of the line of best fit in slope-intercept form gives $d = 33t + b$, where b is the y-coordinate of the y-intercept. This equation is satisfied by all points on the line, so $d = 480$ when $t = 12$. Thus, $480 = 33(12) + b$, which is equivalent to $480 = 396 + b$. Subtracting 396 from both sides of this equation gives $b = 84$. Therefore, an equation for the line of best fit could be $d = 33t + 84$.

Choice A is incorrect and may result from an error in calculating the slope and misidentifying the y-coordinate of the y-intercept of the graph as the value of d at $t = 10$ rather than the value of d at $t = 0$. Choice B is incorrect and may result from using the smallest value of t on the graph as the slope and misidentifying the y-coordinate of the y-intercept of the graph as the value of d at $t = 10$ rather than the value of d at $t = 0$. Choice C is incorrect and may result from misidentifying the y-coordinate of the y-intercept as the smallest value of d on the graph.

Question Difficulty:
Hard

Question ID 8637294f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: 8637294f

If $\frac{4a}{b} = 6.7$ and $\frac{a}{bn} = 26.8$, what is the value of n?

ID: 8637294f Answer

Correct Answer:
.0625, 1/16

Rationale

The correct answer is $.0625$. It's given that $\frac{4a}{b} = 6.7$ and $\frac{a}{bn} = 26.8$. The equation $\frac{4a}{b} = 6.7$ can be rewritten as $(4)\left(\frac{a}{b}\right) = 6.7$. Dividing both sides of this equation by 4 yields $\frac{a}{b} = 1.675$. The equation $\frac{a}{bn} = 26.8$ can be rewritten as $\left(\frac{a}{b}\right)\left(\frac{1}{n}\right) = 26.8$. Substituting 1.675 for $\frac{a}{b}$ in this equation yields $(1.675)\left(\frac{1}{n}\right) = 26.8$, or $\frac{1.675}{n} = 26.8$. Multiplying both sides of this equation by n yields $1.675 = 26.8n$. Dividing both sides of this equation by 26.8 yields $n = 0.0625$. Therefore, the value of n is 0.0625. Note that .0625, 0.062, 0.063, and 1/16 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 308084c5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Inference from sample statistics and margin of error	

ID: 308084c5

Sample	Percent in favor	Margin of error
A	52%	4.2%
B	48%	1.6%

The results of two random samples of votes for a proposition are shown above. The samples were selected from the same population, and the margins of error were calculated using the same method. Which of the following is the most appropriate reason that the margin of error for sample A is greater than the margin of error for sample B?

A. Sample A had a smaller number of votes that could not be recorded.

B. Sample A had a higher percent of favorable responses.

C. Sample A had a larger sample size.

D. Sample A had a smaller sample size.

ID: 308084c5 Answer

Correct Answer:
D

Rationale

Choice D is correct. Sample size is an appropriate reason for the margin of error to change. In general, a smaller sample size increases the margin of error because the sample may be less representative of the whole population.

Choice A is incorrect. The margin of error will depend on the size of the sample of recorded votes, not the number of votes that could not be recorded. In any case, the smaller number of votes that could not be recorded for sample A would tend to decrease, not increase, the comparative size of the margin of error. Choice B is incorrect. Since the percent in favor for sample A is the same distance from 50% as the percent in favor for sample B, the percent of favorable responses doesn't affect the comparative size of the margin of error for the two samples. Choice C is incorrect. If sample A had a larger margin of error than sample B, then sample A would tend to be less representative of the population. Therefore, sample A is not likely to have a larger sample size.

Question Difficulty:
Hard

Question ID 7d721177

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: 7d721177

The density of a certain type of wood is 353 kilograms per cubic meter. A sample of this type of wood is in the shape of a cube and has a mass of 345 kilograms. To the nearest hundredth of a meter, what is the length of one edge of this sample?

A. 0.98

B. 0.99

C. 1.01

D. 1.02

ID: 7d721177 Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that the density of a certain type of wood is 353 kilograms per cubic meter $\left(\text{kg}/\text{m}^3\right)$, and a sample of this type of wood has a mass of $345\ \text{kg}$. Let x represent the volume, in m^3, of the sample. It follows that the relationship between the density, mass, and volume of this sample can be written as $\frac{353\ \text{kg}}{1\ \text{m}^3} = \frac{345\ \text{kg}}{x\ \text{m}^3}$, or $353 = \frac{345}{x}$. Multiplying both sides of this equation by x yields $353x = 345$. Dividing both sides of this equation by 353 yields $x = \frac{345}{353}$. Therefore, the volume of this sample is $\frac{345}{353}\ \text{m}^3$. Since it's given that the sample of this type of wood is a cube, it follows that the length of one edge of this sample can be found using the volume formula for a cube, $V = s^3$, where V represents the volume, in m^3, and s represents the length, in m, of one edge of the cube. Substituting $\frac{345}{353}$ for V in this formula yields $\frac{345}{353} = s^3$. Taking the cube root of both sides of this equation yields $\sqrt[3]{\frac{345}{353}} = s$, or $s \approx 0.99$. Therefore, the length of one edge of this sample to the nearest hundredth of a meter is 0.99.

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

Question Difficulty:
Hard

Question ID 67c0200a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 67c0200a

The number a is 70% less than the positive number b. The number c is 80% greater than a. The number c is how many times b?

ID: 67c0200a Answer

Correct Answer:
.54, 27/50

Rationale

The correct answer is $.54$. It's given that the number a is 70% less than the positive number b. Therefore, $a = \left(1 - \frac{70}{100}\right)b$, which is equivalent to $a = (1 - 0.70)b$, or $a = 0.30b$. It's also given that the number c is 80% greater than a. Therefore, $c = \left(1 + \frac{80}{100}\right)a$, which is equivalent to $c = (1 + 0.80)a$, or $c = 1.80a$. Since $a = 0.30b$, substituting $0.30b$ for a in the equation $c = 1.80a$ yields $c = 1.80(0.30b)$, or $c = 0.54b$. Thus, c is 0.54 times b. Note that .54 and 27/50 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 7d68096f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Evaluating statistical claims: Observational studies and experiments	

ID: 7d68096f

A trivia tournament organizer wanted to study the relationship between the number of points a team scores in a trivia round and the number of hours that a team practices each week. For the study, the organizer selected 55 teams at random from all trivia teams in a certain tournament. The table displays the information for the 40 teams in the sample that practiced for at least 3 hours per week.

Hours practiced	Number of points per round		
	6 to 13 points	14 or more points	Total
3 to 5 hours	6	4	10
More than 5 hours	4	26	30
Total	10	30	40

Which of the following is the largest population to which the results of the study can be generalized?

A. All trivia teams in the tournament that scored 14 or more points in the round

B. The 55 trivia teams in the sample

C. The 40 trivia teams in the sample that practiced for at least 3 hours per week

D. All trivia teams in the tournament

ID: 7d68096f Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that the organizer selected 55 teams at random from all trivia teams in the tournament. A table is also given displaying the information for the 40 teams in the sample that practiced for at least 3 hours per week. Selecting a sample of a reasonable size at random to use for a survey allows the results from that survey to be applied to the population from which the sample was selected, but not beyond this population. Thus, only the sampling method information is necessary to determine the largest population to which the results of the study can be generalized. Since the organizer selected the sample at random from all trivia teams in the tournament, the largest population to which the results of the study can be generalized is all trivia teams in the tournament.

Choice A is incorrect. The sample was selected at random from all trivia teams in the tournament, not just from the teams that scored an average of 14 or more points per round.

Choice B is incorrect. If a study uses a sample selected at random from a population, the results of the study can be generalized to the population, not just the sample.

Choice C is incorrect. If a study uses a sample selected at random from a population, the results of the study can be generalized to the population, not just a subset of the sample.

Question Difficulty:
Hard

Question ID 585de39a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Probability and conditional probability	

ID: 585de39a

On May 10, 2015, there were 83 million Internet subscribers in Nigeria. The major Internet providers were MTN, Globacom, Airtel, Etisalat, and Visafone. By September 30, 2015, the number of Internet subscribers in Nigeria had increased to 97 million. If an Internet subscriber in Nigeria on September 30, 2015, is selected at random, the probability that the person selected was an MTN subscriber is 0.43. There were p million MTN subscribers in Nigeria on September 30, 2015. To the nearest integer, what is the value of p ?

ID: 585de39a Answer

Rationale

The correct answer is 42. It's given that in Nigeria on September 30, 2015, the probability of selecting an MTN subscriber from all Internet subscribers is 0.43, that there were p million, or $p(1,000,000)$, MTN subscribers, and that there were 97 million, or 97,000,000, Internet subscribers. The probability of selecting an MTN subscriber from all Internet subscribers can be found by dividing the number of MTN subscribers by the total number of Internet subscribers. Therefore, the equation $\frac{p(1,000,000)}{97,000,000}=0.43$ can be used to solve for p. Dividing 1,000,000 from the numerator and denominator of the expression on the left-hand side yields $\frac{p}{97}=0.43$. Multiplying both sides of this equation by 97 yields $p=(0.43)(97)=41.71$, which, to the nearest integer, is 42.

Question Difficulty:
Hard

Question ID 4ff597db

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 4ff597db

The mean amount of time that the 20 employees of a construction company have worked for the company is 6.7 years. After one of the employees leaves the company, the mean amount of time that the remaining employees have worked for the company is reduced to 6.25 years. How many years did the employee who left the company work for the company?

A. 0.45

B. 2.30

C. 9.00

D. 15.25

ID: 4ff597db Answer

Correct Answer:
D

Rationale

Choice D is correct. The mean amount of time that the 20 employees worked for the company is 6.7 years. This means that the total number of years all 20 employees worked for the company is $(6.7)(20) = 134$ years. After the employee left, the mean amount of time that the remaining 19 employees worked for the company is 6.25 years. Therefore, the total number of years all 19 employees worked for the company is $(6.25)(19) = 118.75$ years. It follows that the number of years that the employee who left had worked for the company is $134 - 118.75 = 15.25$ years.

Choice A is incorrect; this is the change in the mean, which isn't the same as the amount of time worked by the employee who left. Choice B is incorrect and likely results from making the assumption that there were still 20 employees, rather than 19, at the company after the employee left and then subtracting the original mean of 6.7 from that result. Choice C is incorrect and likely results from making the assumption that there were still 20 employees, rather than 19, at the company after the employee left.

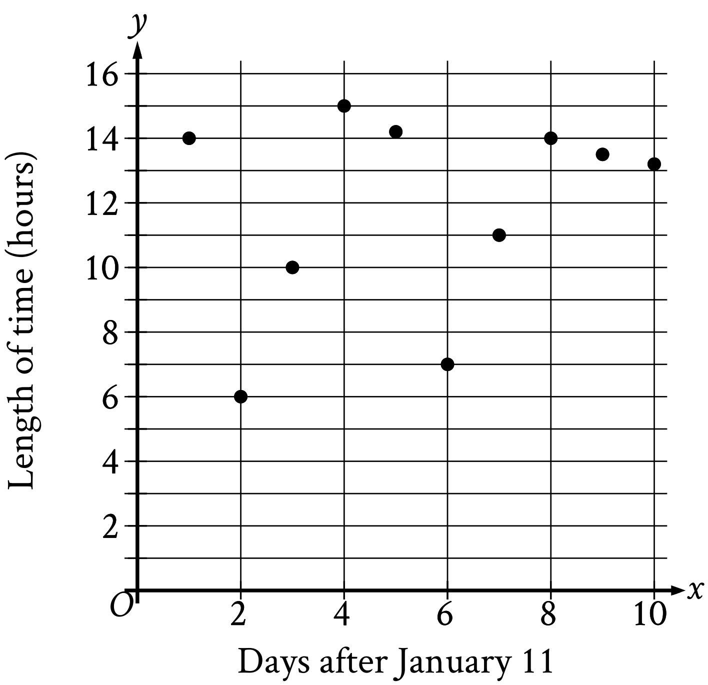
Question Difficulty:
Hard

Question ID 7b52985c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: 7b52985c

The scatterplot shows the relationship between the length of time y, in hours, a certain bird spent in flight and the number of days after January 11, x.



What is the average rate of change, in hours per day, of the length of time the bird spent in flight on January 13 to the length of time the bird spent in flight on January 15?

ID: 7b52985c Answer

Correct Answer:
4.5, 9/2

Rationale

The correct answer is $\frac{9}{2}$. It's given that the scatterplot shows the relationship between the length of time y, in hours, a certain bird spent in flight and the number of days after January 11, x. Since January 13 is 2 days after January 11, it follows that January 13 corresponds to an x-value of 2 in the scatterplot. In the scatterplot, when $x = 2$, the corresponding value of y is 6. In other words, on January 13, the bird spent 6 hours in flight. Since January 15 is 4 days after January 11, it follows that January 15 corresponds to an x-value of 4 in the scatterplot. In the scatterplot, when $x = 4$, the corresponding value of y is 15. In other words, on January 15, the bird spent 15 hours in flight. Therefore, the average rate of change, in hours per day, of the length of time the bird spent in flight on January 13 to the length of time the bird spent in flight on January 15 is the difference in the length of time, in hours, the bird spent in flight divided by the difference in the number of days after January 11, or $\frac{15-6}{4-2}$, which is equivalent to $\frac{9}{2}$. Note that 9/2 and 4.5 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 7ce2830a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Evaluating statistical claims: Observational studies and experiments	

ID: 7ce2830a

A psychologist designed and conducted a study to determine whether playing a certain educational game increases middle school students' accuracy in adding fractions. For the study, the psychologist chose a random sample of 35 students from all of the students at one of the middle schools in a large city. The psychologist found that students who played the game showed significant improvement in accuracy when adding fractions. What is the largest group to which the results of the study can be generalized?

A. The 35 students in the sample

B. All students at the school

C. All middle school students in the city

D. All students in the city

ID: 7ce2830a Answer

Correct Answer:

B

Rationale

Choice B is correct. The largest group to which the results of a study can be generalized is the population from which the random sample was chosen. In this case, the psychologist chose a random sample from all students at one particular middle school. Therefore, the largest group to which the results can be generalized is all the students at the school.

Choice A is incorrect because this isn't the largest group the results can be generalized to. Choices C and D are incorrect because these groups are larger than the population from which the random sample was chosen. Therefore, the sample isn't representative of these groups.

Question Difficulty:

Hard

Question ID 6a715bed

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Probability and conditional probability	

ID: 6a715bed

The table summarizes the distribution of age and assigned group for 90 participants in a study.

	$0–9$ years	$10–19$ years	$20+$ years	Total
Group A	7	14	9	30
Group B	6	4	20	30
Group C	17	12	1	30
Total	30	30	30	90

One of these participants will be selected at random. What is the probability of selecting a participant from group A, given that the participant is at least 10 years of age? (Express your answer as a decimal or fraction, not as a percent.)

ID: 6a715bed Answer

Correct Answer:
.3833, 23/60

Rationale

The correct answer is $\frac{23}{60}$. It's given that one of the participants will be selected at random. The probability of selecting a participant from group A given that the participant is at least 10 years of age is the number of participants in group A who are at least 10 years of age divided by the total number of participants who are at least 10 years of age. The table shows that in group A, there are 14 participants who are $10–19$ years of age and 9 participants who are $20+$ years of age. Therefore, there are $14 + 9$, or 23, participants in group A who are at least 10 years of age. The table also shows that there are a total of 30 participants who are $10–19$ years of age and 30 participants who are $20+$ years of age. Therefore, there are a total of $30 + 30$, or 60, participants who are at least 10 years of age. It follows that the probability of selecting a participant from group A given that the participant is at least 10 years of age is $\frac{23}{60}$. Note that 23/60, .3833, and 0.383 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 61f61789

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: 61f61789

To study the moisture content in a group of trees, samples from the trunk of each tree were taken from 25 trees and cut in the shape of a cube. The length of the edge of one of these cubes is 2.00 centimeters. If this cube has a mass of 2.56 grams, what is the density of this cube, in grams per cubic centimeter?

ID: 61f61789 Answer

Correct Answer:

0.32, 8/25

Rationale

The correct answer is $.32$. The volume of a cube is given by the formula $V = s^3$, where s is the length of an edge of the cube. It's given that each edge of the cube has a length of 2.00 centimeters. Substituting 2.00 centimeters for s in the formula $V = s^3$ yields $V = (2.00 \text{ centimeters})^3$, or $V = 8.00$ cubic centimeters. It's given that the cube has a mass of 2.56 grams. Dividing the mass, in grams, of the cube by the volume, in cubic centimeters, of the cube gives its density, in grams per cubic centimeters. Therefore, the density of the cube is $\frac{2.56 \text{ grams}}{8.00 \text{ cubic centimeters}}$, or $.32$ grams per cubic centimeter. Note that .32 and 8/25 are examples of ways to enter a correct answer.

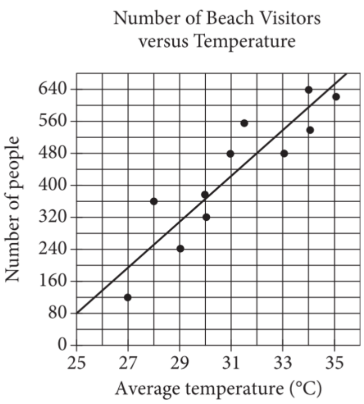
Question Difficulty:

Hard

Question ID d0430601

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: d0430601



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?

ID: d0430601 Answer

Rationale

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 ($^\circ C$), 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 $1^\circ C$ increase in average temperature. Therefore, an increase of $5^\circ C$ 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

Question ID aa43b41f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Evaluating statistical claims: Observational studies and experiments	

ID: aa43b41f

Near the end of a US cable news show, the host invited viewers to respond to a poll on the show's website that asked, "Do you support the new federal policy discussed during the show?" At the end of the show, the host reported that 28% responded "Yes," and 70% responded "No." Which of the following best explains why the results are unlikely to represent the sentiments of the population of the United States?

A. The percentages do not add up to 100%, so any possible conclusions from the poll are invalid.

B. Those who responded to the poll were not a random sample of the population of the United States.

C. There were not 50% "Yes" responses and 50% "No" responses.

D. The show did not allow viewers enough time to respond to the poll.

ID: aa43b41f Answer

Correct Answer:
B

Rationale

Choice B is correct. In order for the poll results from a sample of a population to represent the entire population, the sample must be representative of the population. A sample that is randomly selected from a population is more likely than a sample of the type described to represent the population. In this case, the people who responded were people with access to cable television and websites, which aren't accessible to the entire population. Moreover, the people who responded also chose to watch the show and respond to the poll. The people who made these choices aren't representative of the entire population of the United States because they were not a random sample of the population of the United States.

Choices A, C, and D are incorrect because they present reasons unrelated to whether the sample is representative of the population of the United States.

Question Difficulty:
Hard

Question ID 5dc386fb

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Probability and conditional probability	

ID: 5dc386fb

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%

ID: 5dc386fb Answer

Correct Answer:
C

Rationale

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

Question ID 014c47ab

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Probability and conditional probability	

ID: 014c47ab

	Site A	Site B	Total
Tulip	35	15	50
Daffodil	31	21	52
Total	66	36	102

The table shows the distribution of two types of flowers at two different sites. If a flower represented in the table is selected at random, what is the probability of selecting a flower from site A, given that the flower is a tulip? (Express your answer as a decimal or fraction, not as a percent.)

ID: 014c47ab Answer

Correct Answer:

0.7, 7/10

Rationale

The correct answer is $\frac{35}{50}$. Based on the table, there are a total of 50 tulips, and 35 of these tulips are from site A. The probability of selecting at random a flower from site A, given that the flower is a tulip, is equal to the number of tulips from site A divided by the total number of tulips, which can be written as $\frac{35}{50}$, or $\frac{7}{10}$. Note that 35/50, 7/10, and .7 are examples of ways to enter a correct answer.

Question Difficulty:

Hard

Question ID 98958ae8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 98958ae8

Data set A consists of the heights of 75 objects and has a mean of 25 meters. Data set B consists of the heights of 50 objects and has a mean of 65 meters. Data set C consists of the heights of the 125 objects from data sets A and B. What is the mean, in meters, of data set C?

ID: 98958ae8 Answer

Correct Answer:

41

Rationale

The correct answer is 41. The mean of a data set is computed by dividing the sum of the values in the data set by the number of values in the data set. It's given that data set A consists of the heights of 75 objects and has a mean of 25 meters. This can be represented by the equation $\frac{x}{75} = 25$, where x represents the sum of the heights of the objects, in meters, in data set A. Multiplying both sides of this equation by 75 yields $x = 75(25)$, or $x = 1{,}875$ meters. Therefore, the sum of the heights of the objects in data set A is $1{,}875$ meters. It's also given that data set B consists of the heights of 50 objects and has a mean of 65 meters. This can be represented by the equation $\frac{y}{50} = 65$, where y represents the sum of the heights of the objects, in meters, in data set B. Multiplying both sides of this equation by 50 yields $y = 50(65)$, or $y = 3{,}250$ meters. Therefore, the sum of the heights of the objects in data set B is $3{,}250$ meters. Since it's given that data set C consists of the heights of the 125 objects from data sets A and B, it follows that the mean of data set C is the sum of the heights of the objects, in meters, in data sets A and B divided by the number of objects represented in data sets A and B, or $\frac{1{,}875 + 3{,}250}{125}$, which is equivalent to 41 meters. Therefore, the mean, in meters, of data set C is 41.

Question Difficulty:

Hard

Question ID 623dbebb

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 623dbebb

A reseller buys certain books for a purchase price of 5.00 dollars each and then marks them each for sale at a consumer price that is 270% of the purchase price. After 4 months, any remaining books not yet sold are marked at a discounted price that is 70% off the consumer price. What is the discounted price of each of the remaining books, in dollars?

ID: 623dbebb Answer

Correct Answer:
4.05, 81/20

Rationale

The correct answer is 4.05. It's given that the purchase price for certain books is 5.00 dollars each. It's also given that each book is marked for sale at a consumer price that is 270% of the purchase price. Since the consumer price is 270% of the purchase price of 5.00 dollars, it follows that the consumer price is $(2.7)(5.00)$, or 13.50, dollars. It's given that after 4 months, any remaining books are discounted at 70% off the consumer price. Thus, the discount amount is $(0.7)(13.50)$, or 9.45, dollars. Subtracting the discount amount from the consumer price gives the discounted price of each of the remaining books: $13.50 - 9.45 = 4.05$. Note that 4.05 and 81/20 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 2e92cc21

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 2e92cc21

The number a is 110% greater than the number b. The number b is 90% less than 47. What is the value of a?

ID: 2e92cc21 Answer

Correct Answer:
9.87, 987/100

Rationale

The correct answer is 9.87. It's given that the number a is 110% greater than the number b. It follows that $a = \left(1 + \frac{110}{100}\right)b$, or $a = 2.1b$. It's also given that the number b is 90% less than 47. It follows that $b = \left(1 - \frac{90}{100}\right)(47)$, or $b = 0.1(47)$, which yields $b = 4.7$. Substituting 4.7 for b in the equation $a = 2.1b$ yields $a = 2.1(4.7)$, which is equivalent to $a = 9.87$. Therefore, the value of a is 9.87.

Question Difficulty:
Hard

Question ID 4a422e3e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Evaluating statistical claims: Observational studies and experiments	

ID: 4a422e3e

To determine the mean number of children per household in a community, Tabitha surveyed 20 families at a playground. For the 20 families surveyed, the mean number of children per household was 2.4. Which of the following statements must be true?

A. The mean number of children per household in the community is 2.4.

B. A determination about the mean number of children per household in the community should not be made because the sample size is too small.

C. The sampling method is flawed and may produce a biased estimate of the mean number of children per household in the community.

D. The sampling method is not flawed and is likely to produce an unbiased estimate of the mean number of children per household in the community.

ID: 4a422e3e Answer

Correct Answer:
C

Rationale

Choice C is correct. In order to use a sample mean to estimate the mean for a population, the sample must be representative of the population (for example, a simple random sample). In this case, Tabitha surveyed 20 families in a playground. Families in the playground are more likely to have children than other households in the community. Therefore, the sample isn’t representative of the population. Hence, the sampling method is flawed and may produce a biased estimate.

Choices A and D are incorrect because they incorrectly assume the sampling method is unbiased. Choice B is incorrect because a sample of size 20 could be large enough to make an estimate if the sample had been representative of all the families in the community.

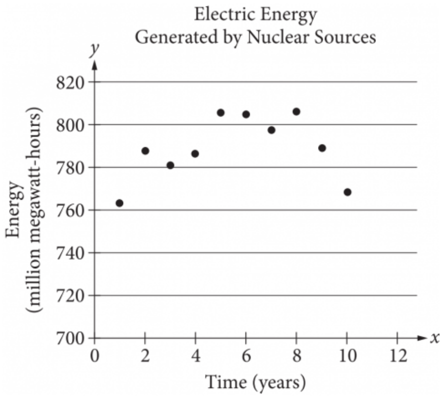
Question Difficulty:
Hard

Question ID e821a26d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: e821a26d

The scatterplot below shows the amount of electric energy generated, in millions of megawatt-hours, by nuclear sources over a 10-year period.



Of the following equations, which best models the data in the scatterplot?

A. $y = 1.674x^2 + 19.76x - 745.73$

B. $y = -1.674x^2 - 19.76x - 745.73$

C. $y = 1.674x^2 + 19.76x + 745.73$

D. $y = -1.674x^2 + 19.76x + 745.73$

ID: e821a26d Answer

Correct Answer:

D

Rationale

Choice D is correct. The data in the scatterplot roughly fall in the shape of a downward-opening parabola; therefore, the coefficient for the x^2 term must be negative. Based on the location of the data points, the y-intercept of the parabola should be somewhere between 740 and 760. Therefore, of the equations given, the best model is $y = -1.674x^2 + 19.76x + 745.73$.

Choices A and C are incorrect. The positive coefficient of the x^2 term means that these equations each define upward-opening parabolas, whereas a parabola that fits the data in the scatterplot must open downward. Choice B is incorrect because it defines a parabola with a y-intercept that has a negative y-coordinate, whereas a parabola that fits the data in the scatterplot must have a y-intercept with a positive y-coordinate.

Question Difficulty:
Hard

Question ID 9d935bd8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 9d935bd8

Percent of Residents Who Earned a Bachelor's Degree or Higher

State	Percent of residents
State A	21.9%
State B	27.9%
State C	25.9%
State D	19.5%
State E	30.1%
State F	36.4%
State G	35.5%

A survey was given to residents of all 50 states asking if they had earned a bachelor's degree or higher. The results from 7 of the states are given in the table above. The median percent of residents who earned a bachelor's degree or higher for all 50 states was 26.95%. What is the difference between the median percent of residents who earned a bachelor's degree or higher for these 7 states and the median for all 50 states?

A. 0.05%

B. 0.95%

C. 1.22%

D. 7.45%

ID: 9d935bd8 Answer

Correct Answer:
B

Rationale

Choice B is correct. The median of a set of numbers is the middle value of the set values when ordered from least to greatest. If the percents in the table are ordered from least to greatest, the middle value is 27.9%. The difference between 27.9% and 26.95% is 0.95%.

Choice A is incorrect and may be the result of calculation errors or not finding the median of the data in the table correctly. Choice C is incorrect and may be the result of finding the mean instead of the median. Choice D is incorrect and may be the result of using the middle value of the unordered list.

Question Difficulty:
Hard

Question ID 8c5dbd3e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 8c5dbd3e

The number w is 110% greater than the number z. The number z is 55% less than 50. What is the value of w?

ID: 8c5dbd3e Answer

Correct Answer:
189/4, 47.25

Rationale

The correct answer is 47.25. It's given that the number w is 110% greater than the number z. It follows that $w = \left(1 + \frac{110}{100}\right)z$, or $w = 2.1z$. It's also given that the number z is 55% less than 50. It follows that $z = \left(1 - \frac{55}{100}\right)(50)$, or $z = 0.45(50)$, which yields $z = 22.5$. Substituting 22.5 for z in the equation $w = 2.1z$ yields $w = 2.1(22.5)$, which is equivalent to $w = 47.25$. Therefore, the value of w is 47.25. Note that 47.25 and 189/4 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 9ba3e283

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Inference from sample statistics and margin of error	

ID: 9ba3e283

In State X, Mr. Camp's eighth-grade class consisting of 26 students was surveyed and 34.6 percent of the students reported that they had at least two siblings. The average eighth-grade class size in the state is 26. If the students in Mr. Camp's class are representative of students in the state's eighth-grade classes and there are 1,800 eighth-grade classes in the state, which of the following best estimates the number of eighth-grade students in the state who have fewer than two siblings?

A. 16,200

B. 23,400

C. 30,600

D. 46,800

ID: 9ba3e283 Answer

Correct Answer:
C

Rationale

Choice C is correct. It is given that 34.6% of 26 students in Mr. Camp's class reported that they had at least two siblings. Since 34.6% of 26 is 8.996, there must have been 9 students in the class who reported having at least two siblings and 17 students who reported that they had fewer than two siblings. It is also given that the average eighth-grade class size in the state is 26 and that Mr. Camp's class is representative of all eighth-grade classes in the state. This means that in each eighth-grade class in the state there are about 17 students who have fewer than two siblings. Therefore, the best estimate of the number of eighth-grade students in the state who have fewer than two siblings is 17 × (number of eighth-grade classes in the state), or $17 \times 1,800 = 30,600$.

Choice A is incorrect because 16,200 is the best estimate for the number of eighth-grade students in the state who have at least, not fewer than, two siblings. Choice B is incorrect because 23,400 is half of the estimated total number of eighth-grade students in the state; however, since the students in Mr. Camp's class are representative of students in the eighth-grade classes in the state and more than half of the students in Mr. Camp's class have fewer than two siblings, more than half of the students in each eighth-grade class in the state have fewer than two siblings, too. Choice D is incorrect because 46,800 is the estimated total number of eighth-grade students in the state.

Question Difficulty:
Hard

Question ID 89f20d9e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Probability and conditional probability	

ID: 89f20d9e

The table summarizes the distribution of age and assigned group for 90 participants in a study.

	0–9 years	10–19 years	$20+$ years	Total
Group A	5	17	8	30
Group B	6	8	16	30
Group C	19	5	6	30
Total	30	30	30	90

One of these participants will be selected at random. What is the probability of selecting a participant from group A, given that the participant is at least 10 years of age?

A. $\frac{5}{18}$

B. $\frac{5}{12}$

C. $\frac{17}{30}$

D. $\frac{5}{6}$

ID: 89f20d9e Answer

Correct Answer:
B

Rationale

Choice B is correct. Since the participant will be selected at random, the probability of selecting a participant from group A, given that the participant is at least 10 years of age, is equal to the number of participants from group A who are at least 10 years of age divided by the total number of participants who are at least 10 years of age. Based on the table, in group A, there are 17 participants who are 10–19 years of age and 8 participants who are $20+$ years of age. Therefore, there are a total of $17 + 8$, or 25, participants in group A who are at least 10 years of age. Based on the table, of the total number of participants, there are 30 participants who are 10–19 years of age and 30 participants who are $20+$ years of age. Therefore, a total of $30 + 30$, or 60, of the participants are at least 10 years of age. Thus, the probability of selecting a participant from group A, given that the participant is at least 10 years of age, is $\frac{25}{60}$, or $\frac{5}{12}$.

Choice A is incorrect. This is the number of participants from group A who are at least 10 years of age divided by the total number of participants, rather than divided by the number of participants who are at least 10 years of age.

Choice C is incorrect. This is the probability of randomly selecting a participant from group A, given that the participant is 10–19 years of age, rather than given that the participant is at least 10 years of age.

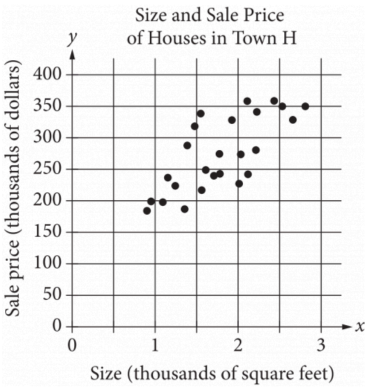
Choice D is incorrect. This is the probability of randomly selecting a participant who is at least 10 years of age, given that the participant is in group A.

Question Difficulty:
Hard

Question ID 79137c1b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: 79137c1b



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. $y = 100x$

ID: 79137c1b Answer

Correct Answer:

B

Rationale

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

Question ID 54d93874

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 54d93874

	Masses (kilograms)					
Andrew	2.4	2.5	3.6	3.1	2.5	2.7
Maria	x	3.1	2.7	2.9	3.3	2.8

Andrew and Maria each collected six rocks, and the masses of the rocks are shown in the table above. The mean of the masses of the rocks Maria collected is 0.1 kilogram greater than the mean of the masses of the rocks Andrew collected. What is the value of x ?

ID: 54d93874 Answer

Rationale

The correct answer is 2.6. Since the mean of a set of numbers can be found by adding the numbers together and dividing by how many numbers there are in the set, the mean mass, in kilograms, of the rocks Andrew collected is $\frac{2.4+2.5+3.6+3.1+2.5+2.7}{6}=\frac{16.8}{6}$, or 2.8. Since the mean mass of the rocks Maria collected is 0.1 kilogram greater than the mean mass of rocks Andrew collected, the mean mass of the rocks Maria collected is $2.8+0.1=2.9$ kilograms. The value of x can be found by writing an equation for finding the mean: $\frac{x+3.1+2.7+2.9+3.3+2.8}{6}=2.9$. Solving this equation gives $x=2.6$. Note that 2.6 and 13/5 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID af142f8d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: af142f8d

	Amount invested	Balance increase
Account A	\$500	6% annual interest
Account B	\$1,000	\$25 per year

Two investments were made as shown in the table above. The interest in Account A is compounded once per year. Which of the following is true about the investments?

A. Account A always earns more money per year than Account B.

B. Account A always earns less money per year than Account B.

C. Account A earns more money per year than Account B at first but eventually earns less money per year.

D. Account A earns less money per year than Account B at first but eventually earns more money per year.

ID: af142f8d Answer

Correct Answer:

A

Rationale

Choice A is correct. Account A starts with \$500 and earns interest at 6% per year, so in the first year Account A earns $(500)(0.06) =$ \$30, which is greater than the \$25 that Account B earns that year. Compounding interest can be modeled by an increasing exponential function, so each year Account A will earn more money than it did the previous year. Therefore, each year Account A earns at least \$30 in interest. Since Account B always earns \$25 each year, Account A always earns more money per year than Account B.

Choices B and D are incorrect. Account A earns \$30 in the first year, which is greater than the \$25 Account B earns in the first year. Therefore, neither the statement that Account A always earns less money per year than Account B nor the statement that Account A earns less money than Account B at first can be true. Choice C is incorrect. Since compounding interest can be modeled by an increasing exponential function, each year Account A will earn more money than it did the previous year. Therefore, Account A always earns at least \$30 per year, which is more than the \$25 per year that Account B earns.

Question Difficulty:

Hard

Question ID 8213b1b3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 8213b1b3

According to a set of standards, a certain type of substance can contain a maximum of 0.001% phosphorus by mass. If a sample of this substance has a mass of 140 grams, what is the maximum mass, in grams, of phosphorus the sample can contain to meet these standards?

ID: 8213b1b3 Answer

Correct Answer:
.0014

Rationale

The correct answer is $.0014$. It's given that a certain type of substance can contain a maximum of 0.001% phosphorus by mass to meet a set of standards. If a sample of the substance has a mass of 140 grams, it follows that the maximum mass, in grams, of phosphorus the sample can contain to meet the standards is 0.001% of 140, or $\frac{0.001}{100}(140)$, which is equivalent to $(0.00001)(140)$, or 0.0014. Note that .0014 and 0.001 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 34f8cd89

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Percentages	

ID: 34f8cd89

37% of the items in a box are green. Of those, 37% are also rectangular. Of the green rectangular items, 42% are also metal. Which of the following is closest to the percentage of the items in the box that are not rectangular green metal items?

A. 1.16%

B. 57.50%

C. 94.25%

D. 98.84%

ID: 34f8cd89 Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that 37% of the items in a box are green. Let x represent the total number of items in the box. It follows that $\frac{37}{100}x$, or $0.37x$, items in the box are green. It's also given that of those, 37% are also rectangular. Therefore, $\frac{37}{100}(0.37x)$, or $0.1369x$, items in the box are green rectangular items. It's also given that of the green rectangular items, 42% are also metal. Therefore, $\frac{42}{100}(0.1369x)$, or $0.057498x$, items in the box are rectangular green metal items. The number of the items in the box that are not rectangular green metal items is the total number of items in the box minus the number of rectangular green metal items in the box. Therefore, the number of items in the box that are not rectangular green metal items is $x - 0.057498x$, or $0.942502x$. The percentage of items in the box that are not rectangular green metal items is the percentage that $0.942502x$ is of x. If $p\%$ represents this percentage, the value of p is $100\left(\frac{0.942502x}{x}\right)$, or 94.2502. Of the given choices, 94.25% is closest to the percentage of items in the box that are not rectangular green metal items.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 6fca0144

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Evaluating statistical claims: Observational studies and experiments	

ID: 6fca0144

For a baobab tree habitat in South Africa, a scientist randomly selected 50 baobab trees that were 17 years old and randomly assigned them to two groups. Each group was subjected to a different watering pattern for 2 consecutive years to observe whether the watering pattern affects the trees' growth rate. Based on the design of the study, what is the largest group to which these results can be applied?

A. All the 50 baobab trees that were selected in this habitat

B. All the baobab trees that were 19 years old in this habitat

C. All the baobab trees that were 17 years old in South Africa

D. All the baobab trees that were 17 years old in this habitat

ID: 6fca0144 Answer

Correct Answer:
D

Rationale

Choice D is correct. When a study uses a randomly selected sample, the largest group to which the results of the study can be applied is the population from which the sample was selected. It's given that the scientist randomly selected the trees from the baobab trees in a certain habitat that were 17 years old. Therefore, the largest group to which the results of this study can be applied is all the baobab trees that were 17 years old in this habitat.

Choice A is incorrect. Since the sample was randomly selected from a population, the results can be applied to a larger group than the sample.

Choice B is incorrect. The sample was selected from a population of baobab trees that were 17 years old, not 19 years old.

Choice C is incorrect. The sample was selected from a certain tree habitat in South Africa, not from all the baobab trees that were 17 years old in South Africa.

Question Difficulty:
Hard

Question ID 20b69297

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: 20b69297

Anita created a batch of green paint by mixing 2 ounces of blue paint with 3 ounces of yellow paint. She must mix a second batch using the same ratio of blue and yellow paint as the first batch. If she uses 5 ounces of blue paint for the second batch, how much yellow paint should Anita use?

A. Exactly 5 ounces

B. 3 ounces more than the amount of yellow paint used in the first batch

C. 1.5 times the amount of yellow paint used in the first batch

D. 1.5 times the amount of blue paint used in the second batch

ID: 20b69297 Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that Anita used a ratio of 2 ounces of blue paint to 3 ounces of yellow paint for the first batch. For any batch of paint that uses the same ratio, the amount of yellow paint used will be $\frac{3}{2}$, or 1.5, times the amount of blue paint used in the batch. Therefore, the amount of yellow paint Anita will use in the second batch will be 1.5 times the amount of blue paint used in the second batch.

Alternate approach: It's given that Anita used a ratio of 2 ounces of blue paint to 3 ounces of yellow paint for the first batch and that she will use 5 ounces of blue paint for the second batch. A proportion can be set up to solve for x, the amount of yellow paint she will use for the second batch: $\frac{2}{3} = \frac{5}{x}$. Multiplying both sides of this equation by 3 yields $2 = \frac{15}{x}$, and multiplying both sides of this equation by x yields $2x = 15$. Dividing both sides of this equation by 2 yields $x = 7.5$. Since Anita will use 7.5 ounces of yellow paint for the second batch, this is $\frac{7.5}{5} = 1.5$ times the amount of blue paint (5 ounces) used in the second batch.

Choices A, B, and C are incorrect and may result from incorrectly interpreting the ratio of blue paint to yellow paint used.

Question Difficulty:
Hard

Question ID 94237701

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	One-variable data: Distributions and measures of center and spread	

ID: 94237701

For a certain computer game, individuals receive an integer score that ranges from 2 through 10. The table below shows the frequency distribution of the scores of the 9 players in group A and the 11 players in group B.

Score	Score Frequencies	
	Group A	Group B
2	1	0
3	1	0
4	2	0
5	1	4
6	3	2
7	0	0
8	0	2
9	1	1
10	0	2
Total	9	11

The median of the scores for group B is how much greater than the median of the scores for group A?

ID: 94237701 Answer

Rationale

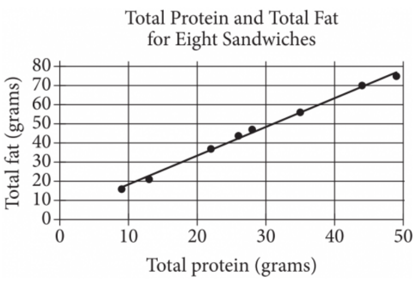
The correct answer is 1. When there are an odd number of values in a data set, the median of the data set is the middle number when the data values are ordered from least to greatest. The scores for group A, ordered from least to greatest, are 2, 3, 4, 4, 5, 6, 6, 6, and 9. The median of the scores for group A is therefore 5. The scores for group B, ordered from least to greatest, are 5, 5, 5, 5, 6, 6, 8, 8, 9, 10, and 10. The median of the scores for group B is therefore 6. The median score for group B is $6 - 5 = 1$ more than the median score for group A.

Question Difficulty:
Hard

Question ID 9d95e7ad

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Two-variable data: Models and scatterplots	

ID: 9d95e7ad



The scatterplot above shows the numbers of grams of both total protein and total fat for eight sandwiches on a restaurant menu. The line of best fit for the data is also shown. According to the line of best fit, which of the following is closest to the predicted increase in total fat, in grams, for every increase of 1 gram in total protein?

A. 2.5

B. 2.0

C. 1.5

D. 1.0

ID: 9d95e7ad Answer

Correct Answer:
C

Rationale

Choice C is correct. The predicted increase in total fat, in grams, for every increase of 1 gram in total protein is represented by the slope of the line of best fit. Any two points on the line can be used to calculate the slope of the line as the change in total fat over the change in total protein. For instance, it can be estimated that the points $(20, 34)$ and $(30, 48)$ are on the line of best fit, and the slope of the line that passes through them is $\frac{48-34}{30-20} = \frac{14}{10}$, or 1.4. Of the choices given, 1.5 is the closest to the slope of the line of best fit.

Choices A, B, and D are incorrect and may be the result of incorrectly finding ordered pairs that lie on the line of best fit or of incorrectly calculating the slope.

Question Difficulty:
Hard

Question ID 11b06e35

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: 11b06e35

The density of a certain solid substance is 813 kilograms per cubic meter. A sample of this substance is in the shape of a cube, where each edge has a length of 0.60 meters. To the nearest whole number, what is the mass, in kilograms, of this sample?

A. 176

B. 488

C. $1{,}355$

D. $3{,}764$

ID: 11b06e35 Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that the sample is in the shape of a cube with edge lengths of 0.60 meters. Therefore, the volume of the sample is 0.60^3, or 0.216, cubic meters. It's also given that the sample has a density of 813 kilograms per 1 cubic meter. Therefore, the mass of this sample is $(0.216 \text{ cubic meters})\left(\frac{813 \text{ kilograms}}{1 \text{ cubic meter}}\right)$, or 175.608 kilograms. Rounding this mass to the nearest whole number gives 176 kilograms. Therefore, to the nearest whole number, the mass, in kilograms, of this sample is 176.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID d6456c7a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Problem-Solving and Data Analysis	Ratios, rates, proportional relationships, and units	

ID: d6456c7a

A certain park has an area of $11{,}863{,}808$ square yards. What is the area, in square miles, of this park? $(1 \text{ mile} = 1{,}760 \text{ yards})$

A. 1.96

B. 3.83

C. $3{,}444.39$

D. $6{,}740.8$

ID: d6456c7a Answer

Correct Answer:
B

Rationale

Choice B is correct. Since 1 mile is equal to $1{,}760$ yards, 1 square mile is equal to $1{,}760^2$, or $3{,}097{,}600$, square yards. It's given that the park has an area of $11{,}863{,}808$ square yards. Therefore, the park has an area of $(11{,}863{,}808 \text{ square yards})\left(\frac{1 \text{ square mile}}{3{,}097{,}600 \text{ square yards}}\right)$, or $\frac{11{,}863{,}808}{3{,}097{,}600}$ square miles. Thus, the area, in square miles, of the park is 3.83.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This is the square root of the area of the park in square yards, not the area of the park in square miles.

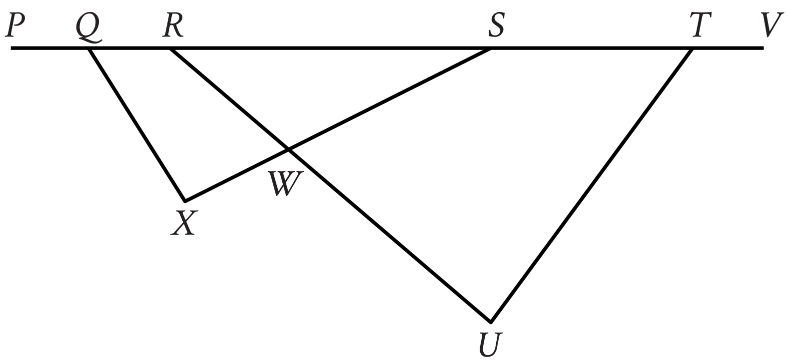
Choice D is incorrect and may result from converting $11{,}863{,}808$ yards to miles, rather than converting $11{,}863{,}808$ square yards to square miles.

Question Difficulty:
Hard

Question ID e10d8313

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: e10d8313



Note: Figure not drawn to scale.

In the figure shown, points Q, R, S, and T lie on line segment PV, and line segment RU intersects line segment SX at point W. The measure of $\angle SQX$ is 48°, the measure of $\angle SXQ$ is 86°, the measure of $\angle SWU$ is 85°, and the measure of $\angle VTU$ is 162°. What is the measure, in degrees, of $\angle TUR$?

ID: e10d8313 Answer

Correct Answer:
123

Rationale

The correct answer is 123. The triangle angle sum theorem states that the sum of the measures of the interior angles of a triangle is 180 degrees. It's given that the measure of $\angle SQX$ is 48° and the measure of $\angle SXQ$ is 86°. Since points S, Q, and X form a triangle, it follows from the triangle angle sum theorem that the measure, in degrees, of $\angle QSX$ is $180 - 48 - 86$, or 46. It's also given that the measure of $\angle SWU$ is 85°. Since $\angle SWU$ and $\angle SWR$ are supplementary angles, the sum of their measures is 180 degrees. It follows that the measure, in degrees, of $\angle SWR$ is $180 - 85$, or 95. Since points R, S, and W form a triangle, and $\angle RSW$ is the same angle as $\angle QSX$, it follows from the triangle angle sum theorem that the measure, in degrees, of $\angle WRS$ is $180 - 46 - 95$, or 39. It's given that the measure of $\angle VTU$ is 162°. Since $\angle VTU$ and $\angle STU$ are supplementary angles, the sum of their measures is 180 degrees. It follows that the measure, in degrees, of $\angle STU$ is $180 - 162$, or 18. Since points R, T, and U form a triangle, and $\angle URT$ is the same angle as $\angle WRS$, it follows from the triangle angle sum theorem that the measure, in degrees, of $\angle TUR$ is $180 - 39 - 18$, or 123.

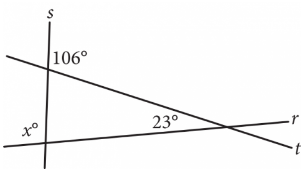
Question Difficulty:
Hard

Question ID f88f27e5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: f88f27e5

Intersecting lines *r*, *s*, and *t* are shown below.



What is the value of *x* ?

ID: f88f27e5 Answer

Rationale

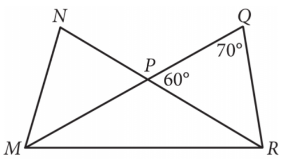
The correct answer is 97. The intersecting lines form a triangle, and the angle with measure of $x°$ is an exterior angle of this triangle. The measure of an exterior angle of a triangle is equal to the sum of the measures of the two nonadjacent interior angles of the triangle. One of these angles has measure of $23°$ and the other, which is supplementary to the angle with measure $106°$, has measure of $180° - 106° = 74°$. Therefore, the value of x is $23 + 74 = 97$.

Question Difficulty:
Hard

Question ID 947a3cde

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: 947a3cde



In the figure above, $\overline{MQ}$ and $\overline{NR}$ intersect at point *P*, $NP = QP$, and $MP = PR$. What is the measure, in degrees, of $\angle QMR$? (Disregard the degree symbol when gridding your answer.)

ID: 947a3cde Answer

Rationale

The correct answer is 30. It is given that the measure of $\angle QPR$ is $60°$. Angle MPR and $\angle QPR$ are collinear and therefore are supplementary angles. This means that the sum of the two angle measures is $180°$, and so the measure of $\angle MPR$ is $120°$. The sum of the angles in a triangle is $180°$. Subtracting the measure of $\angle MPR$ from $180°$ yields the sum of the other angles in the triangle MPR. Since $180 - 120 = 60$, the sum of the measures of $\angle QMR$ and $\angle NRM$ is $60°$. It is given that $MP = PR$, so it follows that triangle MPR is isosceles. Therefore $\angle QMR$ and $\angle NRM$ must be congruent. Since the sum of the measure of these two angles is $60°$, it follows that the measure of each angle is $30°$.

An alternate approach would be to use the exterior angle theorem, noting that the measure of $\angle QPR$ is equal to the sum of the measures of $\angle QMR$ and $\angle NRM$. Since both angles are equal, each of them has a measure of $30°$.

Question Difficulty:
Hard

Question ID deff8a2f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: deff8a2f

The circumference of the base of a right circular cylinder is 20π meters, and the height of the cylinder is 6 meters. What is the volume, in cubic meters, of the cylinder?

A. 60π

B. 120π

C. 600π

D. $2{,}400\pi$

ID: deff8a2f Answer

Correct Answer:
C

Rationale

Choice C is correct. The volume, V, of a right circular cylinder is given by the formula $V = \pi r^2 h$, where r is the radius of the base of the cylinder and h is the height of the cylinder. It's given that a right circular cylinder has a height of 6 meters. Therefore, $h = 6$. It's also given that the right circular cylinder has a base with a circumference of 20π meters. The circumference, C, of a circle is given by $C = 2\pi r$, where r is the radius of the circle. Substituting 20π for C in the formula $C = 2\pi r$ yields $20\pi = 2\pi r$. Dividing each side of this equation by 2π yields $10 = r$. Substituting 10 for r and 6 for h in the formula $V = \pi r^2 h$ yields $V = \pi(10)^2(6)$, or $V = 600\pi$. Therefore, the volume, in cubic meters, of the cylinder is 600π.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect. This is the lateral surface area, not the volume, of the cylinder.

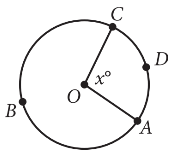
Choice D is incorrect. This is the result of using the diameter, not the radius, for the value of r in the formula $V = \pi r^2 h$.

Question Difficulty:
Hard

Question ID c8345903

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: c8345903



The circle above has center O, the length of arc $\overparen{ADC}$ is 5π, and $x = 100$. What is the length of arc $\overparen{ABC}$?

A. 9π

B. 13π

C. 18π

D. $\frac{13}{2}\pi$

ID: c8345903 Answer

Correct Answer:
B

Rationale

Choice B is correct. The ratio of the lengths of two arcs of a circle is equal to the ratio of the measures of the central angles that subtend the arcs. It's given that arc $\overparen{ADC}$ is subtended by a central angle with measure 100°. Since the sum of the measures of the angles about a point is 360°, it follows that arc $\overparen{ABC}$ is subtended by a central angle with measure $360° - 100° = 260°$. If s is the length of arc $\overparen{ABC}$, then s must satisfy the ratio $\frac{s}{5\pi} = \frac{260}{100}$. Reducing the fraction $\frac{260}{100}$ to its simplest form gives $\frac{13}{5}$. Therefore, $\frac{s}{5\pi} = \frac{13}{5}$. Multiplying both sides of $\frac{s}{5\pi} = \frac{13}{5}$ by 5π yields $s = 13\pi$.

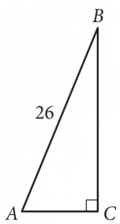
Choice A is incorrect. This is the length of an arc consisting of exactly half of the circle, but arc $\overparen{ABC}$ is greater than half of the circle. Choice C is incorrect. This is the total circumference of the circle. Choice D is incorrect. This is half the length of arc $\overparen{ABC}$, not its full length.

Question Difficulty:
Hard

Question ID bd87bc09

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: bd87bc09



Triangle ABC above is a right triangle, and $\sin(B) = \frac{5}{13}$.

What is the length of side $\overline{BC}$?

ID: bd87bc09 Answer

Rationale

The correct answer is 24. The sine of an acute angle in a right triangle is equal to the ratio of the length of the side opposite the angle to the length of the hypotenuse. In the triangle shown, the sine of angle B, or $\sin(B)$, is equal to the ratio of the length of side $\overline{AC}$ to the length of side $\overline{AB}$. It's given that the length of side $\overline{AB}$ is 26 and that $\sin(B) = \frac{5}{13}$. Therefore, $\frac{5}{13} = \frac{AB}{26}$. Multiplying both sides of this equation by 26 yields $AC = 10$.

By the Pythagorean Theorem, the relationship between the lengths of the sides of triangle ABC is as follows: $26^2 = 10^2 + BC^2$, or $676 = 100 + BC^2$. Subtracting 100 from both sides of $676 = 100 + BC^2$ yields $576 = BC^2$. Taking the square root of both sides of $576 = BC^2$ yields $24 = BC$.

Question Difficulty:
Hard

Question ID f7dbde16

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: f7dbde16

In triangles LMN and RST, angles L and R each have measure 60°, $LN = 10$, and $RT = 30$. Which additional piece of information is sufficient to prove that triangle LMN is similar to triangle RST?

A. $MN = 7$ and $ST = 7$

B. $MN = 7$ and $ST = 21$

C. The measures of angles M and S are 70° and 60°, respectively.

D. The measures of angles M and T are 70° and 50°, respectively.

ID: f7dbde16 Answer

Correct Answer:
D

Rationale

Choice D is correct. Two triangles are similar if they have three pairs of congruent corresponding angles. It's given that angles L and R each measure 60°, and so these corresponding angles are congruent. If angle M is 70°, then angle N must be 50° so that the sum of the angles in triangle LMN is 180°. If angle T is 50°, then angle S must be 70° so that the sum of the angles in triangle RST is 180°. Therefore, if the measures of angles M and T are 70° and 50°, respectively, then corresponding angles M and S are both 70°, and corresponding angles N and T are both 50°. It follows that triangles LMN and RST have three pairs of congruent corresponding angles, and so the triangles are similar. Therefore, the additional piece of information that is sufficient to prove that triangle LMN is similar to triangle RST is that the measures of angles M and T are 70° and 50°, respectively.

Choice A is incorrect. If the measures of two sides in one triangle are proportional to the corresponding sides in another triangle and the included angles are congruent, then the triangles are similar. However, the two sides given are not proportional and the angle given is not included by the given sides.

Choice B is incorrect. If the measures of two sides in one triangle are proportional to the corresponding sides in another triangle and the included angles are congruent, then the triangles are similar. However, the angle given is not included between the proportional sides.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 58c26db8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 58c26db8

The perimeter of an isosceles right triangle is $18+18\sqrt{2}$ inches. What is the length, in inches, of the hypotenuse of this triangle?

A. 9

B. $9\sqrt{2}$

C. 18

D. $18\sqrt{2}$

ID: 58c26db8 Answer

Correct Answer:
C

Rationale

Choice C is correct. The perimeter of a triangle is the sum of the lengths of its sides. Since the given triangle is an isosceles right triangle, the length of each leg is the same and the length of the hypotenuse is equal to $\sqrt{2}$ times the length of a leg. Let x represent the length, in inches, of a leg of this isosceles right triangle. Therefore, the perimeter, in inches, of the triangle is $x+x+x\sqrt{2}$, or $2x+x\sqrt{2}$, which is equivalent to $x\left(2+\sqrt{2}\right)$. It's given that the perimeter of this triangle is $18+18\sqrt{2}$ inches. Thus, $x\left(2+\sqrt{2}\right)=18+18\sqrt{2}$. Dividing both sides of this equation by $2+\sqrt{2}$ yields $x=\frac{18+18\sqrt{2}}{2+\sqrt{2}}$. Multiplying the right-hand side of this equation by $\frac{2-\sqrt{2}}{2-\sqrt{2}}$ yields $x=\frac{36+36\sqrt{2}-18\sqrt{2}-36}{2}$, or $x=9\sqrt{2}$. It follows that the length, in inches, of a leg of this isosceles right triangle is $9\sqrt{2}$. Therefore, the length, in inches, of the hypotenuse of this isosceles right triangle is $\left(9\sqrt{2}\right)\left(\sqrt{2}\right)$, or 18.

Choice A is incorrect. If this were the length of the hypotenuse, the perimeter would be $9+9\sqrt{2}$ inches.

Choice B is incorrect. This is the length, in inches, of a leg of this triangle, not the hypotenuse.

Choice D is incorrect. If this were the length of the hypotenuse, the perimeter would be $36+18\sqrt{2}$ inches.

Question Difficulty:
Hard

Question ID 35d37640

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 35d37640

Point F lies on a unit circle in the *xy*-plane and has coordinates $(1, 0)$. Point G is the center of the circle and has coordinates $(0, 0)$. Point H also lies on the circle and has coordinates $(-1, y)$, where y is a constant. Which of the following could be the positive measure of angle FGH, in radians?

A. $\frac{27\pi}{2}$

B. $\frac{29\pi}{2}$

C. 24π

D. 25π

ID: 35d37640 Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that the circle is a unit circle, which means the circle has a radius of 1. It's also given that point G is the center of the circle and has coordinates $(0, 0)$ and that point H lies on the circle and has coordinates $(-1, y)$. Since the radius of the circle is 1, the value of y must be 0, as all other points with an *x*-coordinate of -1 are a distance greater than 1 away from point G. Since F and H are points on the unit circle centered at G, let side FG be the starting side of the angle and side GH be the terminal side of the angle. Since side FG is on the positive *x*-axis and side GH is on the negative *x*-axis, side FG is half of a rotation around the unit circle, or π radians, away from side GH. Therefore, the positive measure of angle FGH, in radians, is equal to π plus an integer multiple of 2π. In other words, the positive measure of angle FGH, in radians, is an odd integer multiple of π. Of the given choices, only 25π is an odd integer multiple of π.

Choice A is incorrect. This could be the positive measure of an angle where the starting side is FG and the terminal side contains the point $(0, -1)$, not $(-1, 0)$.

Choice B is incorrect. This could be the positive measure of an angle where the starting side is FG and the terminal side contains the point $(0, 1)$, not $(-1, 0)$.

Choice C is incorrect. This could be the positive measure of an angle where the starting side is FG and the terminal side contains the point $(1, 0)$, not $(-1, 0)$.

Question Difficulty:
Hard

Question ID 2266984b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 2266984b

$$x^2 + 20x + y^2 + 16y = -20$$

The equation above defines a circle in the *xy*-plane. What are the coordinates of the center of the circle?

A. $(-20, -16)$

B. $(-10, -8)$

C. $(10, 8)$

D. $(20, 16)$

ID: 2266984b Answer

Correct Answer:

B

Rationale

Choice B is correct. The standard equation of a circle in the xy-plane is of the form $(x-h)^2 + (y-k)^2 = r^2$, where (h, k) are the coordinates of the center of the circle and r is the radius. The given equation can be rewritten in standard form by completing the squares. So the sum of the first two terms, $x^2 + 20x$, needs a 100 to complete the square, and the sum of the second two terms, $y^2 + 16y$, needs a 64 to complete the square. Adding 100 and 64 to both sides of the given equation yields $(x^2 + 20x + 100) + (y^2 + 16y + 64) = -20 + 100 + 64$, which is equivalent to $(x+10)^2 + (y+8)^2 = 144$. Therefore, the coordinates of the center of the circle are $(-10, -8)$.

Choices A, C, and D are incorrect and may result from computational errors made when attempting to complete the squares or when identifying the coordinates of the center.

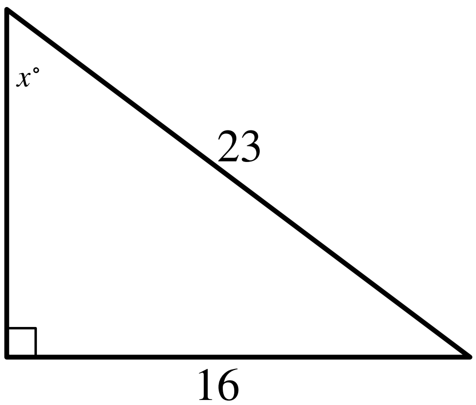
Question Difficulty:

Hard

Question ID 1429dcdf

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 1429dcdf



Note: Figure not drawn to scale.

In the triangle shown, what is the value of $\sin x^\circ$?

ID: 1429dcdf Answer

Correct Answer:
.6956, .6957, 16/23

Rationale

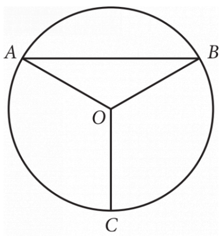
The correct answer is $\frac{16}{23}$. In a right triangle, the sine of an acute angle is defined as the ratio of the length of the side opposite the angle to the length of the hypotenuse. In the triangle shown, the length of the side opposite the angle with measure x° is 16 units and the length of the hypotenuse is 23 units. Therefore, the value of $\sin x^\circ$ is $\frac{16}{23}$. Note that 16/23, .6956, .6957, 0.695, and 0.696 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 69b0d79d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 69b0d79d



Point O is the center of the circle above, and the measure of $\angle OAB$ is $30°$. If the length of $\overline{OC}$ is 18, what is the length of arc $\overset{\frown}{AB}$?

A. 9π

B. 12π

C. 15π

D. 18π

ID: 69b0d79d Answer

Correct Answer:
B

Rationale

Choice B is correct. Because segments OA and OB are radii of the circle centered at point O, these segments have equal lengths. Therefore, triangle AOB is an isosceles triangle, where angles OAB and OBA are congruent base angles of the triangle. It's given that angle OAB measures $30°$. Therefore, angle OBA also measures $30°$. Let $x°$ represent the measure of angle AOB. Since the sum of the measures of the three angles of any triangle is $180°$, it follows that $30° + 30° + x° = 180°$, or $60° + x° = 180°$. Subtracting $60°$ from both sides of this equation yields $x° = 120°$, or $\frac{2\pi}{3}$ radians. Therefore, the measure of angle AOB, and thus the measure of arc $\overset{\frown}{AB}$, is $\frac{2\pi}{3}$ radians. Since $\overline{OC}$ is a radius of the given circle and its length is 18, the length of the radius of the circle is 18. Therefore, the length of arc $\overset{\frown}{AB}$ can be calculated as $\left(\frac{2\pi}{3}\right)(18)$, or 12π.

Choices A, C, and D are incorrect and may result from conceptual or computational errors.

Question Difficulty:
Hard

Question ID 502d9690

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 502d9690

Rectangle $ABCD$ is similar to rectangle $EFGH$. The area of rectangle $ABCD$ is 648 square inches, and the area of rectangle $EFGH$ is 72 square inches. The length of the longest side of rectangle $ABCD$ is 36 inches. What is the length, in inches, of the longest side of rectangle $EFGH$?

A. 4

B. 9

C. 12

D. 36

ID: 502d9690 Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that rectangle $ABCD$ is similar to rectangle $EFGH$. Therefore, if the length of each side of rectangle $ABCD$ is k times the length of the corresponding side of rectangle $EFGH$, then the area of rectangle $ABCD$ is k^2 times the area of rectangle $EFGH$. It's given that the area of rectangle $ABCD$ is 648 square inches and the area of rectangle $EFGH$ is 72 square inches. It follows that $k^2 = \frac{648}{72}$, or $k^2 = 9$. Taking the square root of each side of this equation yields $k = \sqrt{9}$, or $k = 3$. It follows that the length of each side of rectangle $ABCD$ is 3 times the length of the corresponding side of rectangle $EFGH$. It's given that the length of the longest side of rectangle $ABCD$ is 36 inches. Therefore, 36 inches is 3 times the length of the longest side of rectangle $EFGH$, and the longest side of rectangle $EFGH$ is equal to $\frac{36}{3}$, or 12, inches.

Choice A is incorrect. This is the length, in inches, of the longest side of a rectangle with side lengths that are $\frac{1}{9}$ the corresponding side lengths of rectangle $ABCD$, rather than a rectangle with an area that is $\frac{1}{9}$ the area of rectangle $ABCD$.

Choice B is incorrect. This is the factor by which the area of rectangle $ABCD$ is larger than the area of rectangle $EFGH$, not the length, in inches, of the longest side of rectangle $EFGH$.

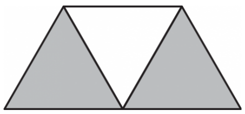
Choice D is incorrect. This is the length, in inches, of the longest side of rectangle $ABCD$, not rectangle $EFGH$.

Question Difficulty:
Hard

Question ID 4c95c7d4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 4c95c7d4



A graphic designer is creating a logo for a company. The logo is shown in the figure above. The logo is in the shape of a trapezoid and consists of three congruent equilateral triangles. If the perimeter of the logo is 20 centimeters, what is the combined area of the shaded regions, in square centimeters, of the logo?

A. $2\sqrt{3}$

B. $4\sqrt{3}$

C. $8\sqrt{3}$

D. 16

ID: 4c95c7d4 Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that the logo is in the shape of a trapezoid that consists of three congruent equilateral triangles, and that the perimeter of the trapezoid is 20 centimeters (cm). Since the perimeter of the trapezoid is the sum of the lengths of 5 of the sides of the triangles, the length of each side of an equilateral triangle is $\frac{20}{5} = 4 \text{ cm}$. Dividing up one equilateral triangle into two right triangles yields a pair of congruent 30°-60°-90° triangles. The shorter leg of each right triangle is half the length of the side of an equilateral triangle, or 2 cm. Using the Pythagorean Theorem, $a^2 + b^2 = c^2$, the height of the equilateral triangle can be found. Substituting $a = 2$ and $c = 4$ and solving for b yields $\sqrt{4^2 - 2^2} = \sqrt{12} = 2\sqrt{3}$ cm. The area of one equilateral triangle is $\frac{1}{2}bh$, where $b = 2$ and $h = 2\sqrt{3}$. Therefore, the area of one equilateral triangle is $\frac{1}{2}(4)(2\sqrt{3}) = 4\sqrt{3} \text{ cm}^2$. The shaded area consists of two such triangles, so its area is $(2)(4)\sqrt{3} = 8\sqrt{3} \text{ cm}^2$.

Alternate approach: The area of a trapezoid can be found by evaluating the expression $\frac{1}{2}(b_1 + b_2)h$, where b_1 is the length of one base, b_2 is the length of the other base, and h is the height of the trapezoid. Substituting $b_1 = 8$, $b_2 = 4$, and $h = 2\sqrt{3}$ yields the expression $\frac{1}{2}(8 + 4)(2\sqrt{3})$, or $\frac{1}{2}(12)(2\sqrt{3})$, which gives an area of $12\sqrt{3} \text{ cm}^2$ for the trapezoid. Since two-thirds of the trapezoid is shaded, the area of the shaded region is $\frac{2}{3} \times 12\sqrt{3} = 8\sqrt{3}$.

Choice A is incorrect. This is the height of the trapezoid. Choice B is incorrect. This is the area of one of the equilateral triangles, not two. Choice D is incorrect and may result from using a height of 4 for each triangle rather than the height of $2\sqrt{3}$.

Question Difficulty:
Hard

Question ID b8a225ff

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: b8a225ff

Circle A in the *xy*-plane has the equation $(x+5)^2+(y-5)^2=4$. Circle B has the same center as circle A. The radius of circle B is two times the radius of circle A. The equation defining circle B in the *xy*-plane is $(x+5)^2+(y-5)^2=k$, where k is a constant. What is the value of k?

ID: b8a225ff Answer

Correct Answer:
16

Rationale

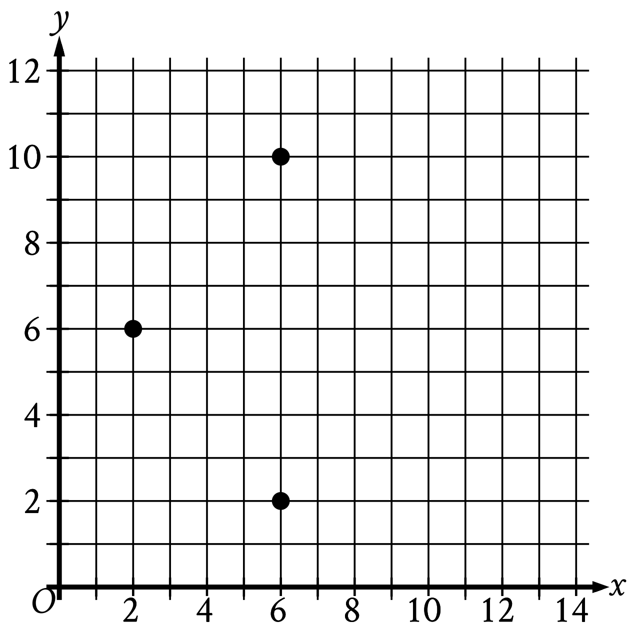
The correct answer is 16. An equation of a circle in the *xy*-plane can be written as $(x-t)^2+(y-u)^2=r^2$, where the center of the circle is (t, u) , the radius of the circle is r, and where t, u, and r are constants. It's given that the equation of circle A is $(x+5)^2+(y-5)^2=4$, which is equivalent to $(x+5)^2+(y-5)^2=2^2$. Therefore, the center of circle A is $(-5, 5)$ and the radius of circle A is 2. It's given that circle B has the same center as circle A and that the radius of circle B is two times the radius of circle A. Therefore, the center of circle B is $(-5, 5)$ and the radius of circle B is $2(2)$, or 4. Substituting -5 for t, 5 for u, and 4 for r into the equation $(x-t)^2+(y-u)^2=r^2$ yields $(x+5)^2+(y-5)^2=4^2$, which is equivalent to $(x+5)^2+(y-5)^2=16$. It follows that the equation of circle B in the *xy*-plane is $(x+5)^2+(y-5)^2=16$. Therefore, the value of k is 16.

Question Difficulty:
Hard

Question ID b2528e6b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: b2528e6b



The three points shown define a circle. The circumference of this circle is $k\pi$, where k is a constant. What is the value of k?

ID: b2528e6b Answer

Correct Answer:
8

Rationale

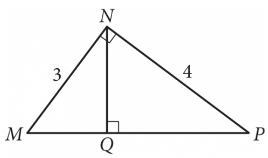
The correct answer is 8. It's given that the three points shown define a circle, so the center of that circle is an equal distance from each of the three points. The point $(6, 6)$ is halfway between the points $(6, 2)$ and $(6, 10)$, and is a distance of 4 units from each of those two points. The point $(6, 6)$ is also a distance of 4 units from $(2, 6)$. Because the point $(6, 6)$ is the same distance from all three points shown, it must be the center of the circle. Since that distance is 4, it follows that the radius of the circle is 4. The circumference of a circle with radius r is equal to $2\pi r$. It follows that the circumference of the given circle is $2\pi(4)$, or 8π. It's given that the circumference of the circle is $k\pi$. Therefore, the value of k is 8.

Question Difficulty:
Hard

Question ID 740bf79f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: 740bf79f



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

A. 2.2

B. 2.3

C. 2.4

D. 2.5

ID: 740bf79f Answer

Correct Answer:
C

Rationale

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

Question ID ab176ad6

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: ab176ad6

The equation $(x+6)^2+(y+3)^2=121$ defines a circle in the *xy*-plane. What is the radius of the circle?

ID: ab176ad6 Answer

Rationale

The correct answer is 11. A circle with equation $(x-a)^2+(y-b)^2=r^2$, where a, b, and r are constants, has center (a,b) and radius r. Therefore, the radius of the given circle is $\sqrt{121}$, or 11.

Question Difficulty:
Hard

Question ID 3e577e4a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 3e577e4a

A circle in the *xy*-plane has its center at $(-4, -6)$. Line k is tangent to this circle at the point $(-7, -7)$. What is the slope of line k?

A. -3

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

C. $\frac{1}{3}$

D. 3

ID: 3e577e4a Answer

Correct Answer:
A

Rationale

Choice A is correct. A line that's tangent to a circle is perpendicular to the radius of the circle at the point of tangency. It's given that the circle has its center at $(-4, -6)$ and line k is tangent to the circle at the point $(-7, -7)$. The slope of a radius defined by the points (q, r) and (s, t) can be calculated as $\frac{t-r}{s-q}$. The points $(-7, -7)$ and $(-4, -6)$ define the radius of the circle at the point of tangency. Therefore, the slope of this radius can be calculated as $\frac{(-6)-(-7)}{(-4)-(-7)}$, or $\frac{1}{3}$. If a line and a radius are perpendicular, the slope of the line must be the negative reciprocal of the slope of the radius. The negative reciprocal of $\frac{1}{3}$ is -3. Thus, the slope of line k is -3.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This is the slope of the radius of the circle at the point of tangency, not the slope of line k.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID b0dc920d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: b0dc920d

A manufacturer determined that right cylindrical containers with a height that is 4 inches longer than the radius offer the optimal number of containers to be displayed on a shelf. Which of the following expresses the volume, *V*, in cubic inches, of such containers, where *r* is the radius, in inches?

A. $V = 4\pi r^3$

B. $V = \pi(2r)^3$

C. $V = \pi r^2 + 4\pi r$

D. $V = \pi r^3 + 4\pi r^2$

ID: b0dc920d Answer

Correct Answer:

D

Rationale

Choice D is correct. The volume, V, of a right cylinder is given by the formula $V = \pi r^2 h$, where r represents the radius of the base of the cylinder and h represents the height. Since the height is 4 inches longer than the radius, the expression $r+4$ represents the height of each cylindrical container. It follows that the volume of each container is represented by the equation $V = \pi r^2(r+4)$. Distributing the expression πr^2 into each term in the parentheses yields $V = \pi r^3 + 4\pi r^2$.

Choice A is incorrect and may result from representing the height as $4r$ instead of $r+4$. Choice B is incorrect and may result from representing the height as $2r$ instead of $r+4$. Choice C is incorrect and may result from representing the volume of a right cylinder as $V = \pi r h$ instead of $V = \pi r^2 h$.

Question Difficulty:

Hard

Question ID fa2771d5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: fa2771d5

Circle A has equation $(x-7)^2+(y+3)^2=1$. In the xy-plane, circle B is obtained by translating circle A to the right 4 units. Which equation represents circle B?

A. $(x-7)^2+(y+7)^2=1$

B. $(x-3)^2+(y+3)^2=1$

C. $(x-11)^2+(y+3)^2=1$

D. $(x-7)^2+(y-1)^2=1$

ID: fa2771d5 Answer

Correct Answer:

C

Rationale

Choice C is correct. The equation of a circle in the *xy*-plane can be written as $(x-h)^2+(y-k)^2=r^2$, where the center of the circle is (h,k) and the radius of the circle is r units. It's given that circle A has the equation $(x-7)^2+(y+3)^2=1$, which can be written as $(x-7)^2+\left(y-(-3)\right)^2=1^2$. It follows that $h=7$, $k=-3$, and $r=1$. Therefore, the center of circle A is $(7,-3)$ and its radius is 1 unit. If circle A is translated 4 units to the right, the *x*-coordinate of the center will increase by 4, while the *y*-coordinate and the radius of the circle will remain unchanged. Translating the center of circle A to the right 4 units yields $(7+4,-3)$, or $(11,-3)$. Therefore, the center of circle B is $(11,-3)$. Substituting 11 for h, -3 for k, and 1 for r into the equation $(x-h)^2+(y-k)^2=r^2$ yields $(x-11)^2+\left(y-(-3)\right)^2=1$, or $(x-11)^2+(y+3)^2=1$. Therefore, the equation $(x-11)^2+(y+3)^2=1$ represents circle B.

Choice A is incorrect. This equation represents a circle obtained by shifting circle A down, rather than right, 4 units.

Choice B is incorrect. This equation represents a circle obtained by shifting circle A left, rather than right, 4 units.

Choice D is incorrect. This equation represents a circle obtained by shifting circle A up, rather than right, 4 units.

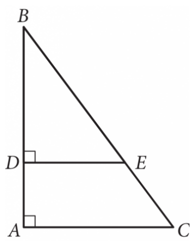
Question Difficulty:

Hard

Question ID 55bb437a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 55bb437a



In the figure above, $\tan B = \frac{3}{4}$. If $BC = 15$ and $DA = 4$, what is the length of $\overline{DE}$?

ID: 55bb437a Answer

Rationale

The correct answer is 6. Since $\tan B = \frac{3}{4}$, $\triangle ABC$ and $\triangle DBE$ are both similar to 3-4-5 triangles. This means that they are both similar to the right triangle with sides of lengths 3, 4, and 5. Since $BC = 15$, which is 3 times as long as the hypotenuse of the 3-4-5 triangle, the similarity ratio of $\triangle ABC$ to the 3-4-5 triangle is 3:1. Therefore, the length of $\overline{AC}$ (the side opposite to $\angle B$) is $3 \times 3 = 9$, and the length of $\overline{AB}$ (the side adjacent to $\angle B$) is $4 \times 3 = 12$. It is also given that $DA = 4$. Since $AB = DA + DB$ and $AB = 12$, it follows that $DB = 8$, which means that the similarity ratio of $\triangle DBE$ to the 3-4-5 triangle is 2:1 ($\overline{DB}$ is the side adjacent to $\angle B$). Therefore, the length of $\overline{DE}$, which is the side opposite to $\angle B$, is $3 \times 2 = 6$.

Question Difficulty:
Hard

Question ID fecc446d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: fecc446d

A line intersects two parallel lines, forming four acute angles and four obtuse angles. The measure of one of these eight angles is $(7x - 250)^\circ$. The sum of the measures of four of the eight angles is k°. Which of the following could NOT be equivalent to k, for all values of x?

A. $-14x + 1{,}540$

B. $14x - 320$

C. $-28x + 1{,}720$

D. 360

ID: fecc446d Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that a line intersects two parallel lines, forming four acute angles and four obtuse angles. Since there are two parallel lines intersected by a transversal, all four acute angles have the same measure and all four obtuse angles have the same measure. Additionally, each acute angle is supplementary to each obtuse angle. It's given that the measure of one of these eight angles is $(7x - 250)^\circ$. It follows that a supplementary angle has measure $(180 - (7x - 250))^\circ$, or $(-7x + 430)^\circ$. It's also given that the sum of the measures of four of the eight angles is k°. It follows that the possible values of k are $4(7x - 250)$; $(7x - 250) + 3(-7x + 430)$; $2(7x - 250) + 2(-7x + 430)$; $3(7x - 250) + (-7x + 430)$; and $4(-7x + 430)$. These values are equivalent to $28x - 1{,}000$; $-14x + 1{,}040$; 360; $14x - 320$; and $-28x + 1{,}720$, respectively. It follows that of the given choices, only $-14x + 1{,}540$ could NOT be equivalent to k, for all values of x.

Choice B is incorrect. This is the sum of three angles with measure $(7x - 250)^\circ$ and one angle with measure $(-7x + 430)^\circ$.

Choice C is incorrect. This is the sum of four angles with measure $(-7x + 430)^\circ$.

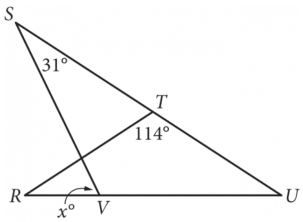
Choice D is incorrect. This is the sum of two angles with measure $(7x - 250)^\circ$ and two angles with measure $(-7x + 430)^\circ$.

Question Difficulty:
Hard

Question ID bd7f6e30

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: bd7f6e30



In the figure above, $RT = TU$.

What is the value of *x* ?

A. 72

B. 66

C. 64

D. 58

ID: bd7f6e30 Answer

Correct Answer:
C

Rationale

Choice C is correct. Since $RT = TU$, it follows that $\triangle RTU$ is an isosceles triangle with base RU. Therefore, $\angle TRU$ and $\angle TUR$ are the base angles of an isosceles triangle and are congruent. Let the measures of both $\angle TRU$ and $\angle TUR$ be $t°$. According to the triangle sum theorem, the sum of the measures of the three angles of a triangle is $180°$. Therefore, $114° + 2t° = 180°$, so $t = 33$.

Note that $\angle TUR$ is the same angle as $\angle SUV$. Thus, the measure of $\angle SUV$ is $33°$. According to the triangle exterior angle theorem, an external angle of a triangle is equal to the sum of the opposite interior angles. Therefore, $x°$ is equal to the sum of the measures of $\angle VSU$ and $\angle SUV$; that is, $31° + 33° = 64°$. Thus, the value of x is 64.

Choice B is incorrect. This is the measure of $\angle STR$, but $\angle STR$ is not congruent to $\angle SVR$. Choices A and D are incorrect and may result from a calculation error.

Question Difficulty:
Hard

Question ID 6708546e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 6708546e

Parallelogram $ABCD$ is similar to parallelogram $PQRS$. The length of each side of parallelogram $PQRS$ is 2 times the length of its corresponding side of parallelogram $ABCD$. The area of parallelogram $ABCD$ is 5 square centimeters. What is the area, in square centimeters, of parallelogram $PQRS$?

A. 7

B. 10

C. 20

D. 25

ID: 6708546e Answer

Correct Answer:
C

Rationale

Choice C is correct. It's given that parallelogram $ABCD$ is similar to parallelogram $PQRS$. When two parallelograms are similar, if the scale factor between their corresponding side lengths is k, the scale factor between their areas is k^2. It's given that the length of each side of parallelogram $PQRS$ is 2 times the length of its corresponding side of parallelogram $ABCD$, so the scale factor between their corresponding side lengths is 2. It follows that the scale factor between their areas is 2^2, or 4. It's given that the area, in square centimeters, of parallelogram $ABCD$ is 5. It follows that the area, in square centimeters, of parallelogram $PQRS$ is $5(4)$, or 20.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 9e44284b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 9e44284b

In the *xy*-plane, the graph of $2x^2 - 6x + 2y^2 + 2y = 45$ is a circle. What is the radius of the circle?

A. 5

B. 6.5

C. $\sqrt{40}$

D. $\sqrt{50}$

ID: 9e44284b Answer

Correct Answer:
A

Rationale

Choice A is correct. One way to find the radius of the circle is to rewrite the given equation in standard form, $(x-h)^2 + (y-k)^2 = r^2$, where (h, k) is the center of the circle and the radius of the circle is r. To do this, divide the original equation, $2x^2 - 6x + 2y^2 + 2y = 45$, by 2 to make the leading coefficients of x^2 and y^2 each equal to 1: $x^2 - 3x + y^2 + y = 22.5$. Then complete the square to put the equation in standard form. To do so, first rewrite $x^2 - 3x + y^2 + y = 22.5$ as $(x^2 - 3x + 2.25) - 2.25 + (y^2 + y + 0.25) - 0.25 = 22.5$. Second, add 2.25 and 0.25 to both sides of the equation: $(x^2 - 3x + 2.25) + (y^2 + y + 0.25) = 25$. Since $x^2 - 3x + 2.25 = (x - 1.5)^2$, $y^2 + y + 0.25 = (y + 0.5)^2$, and $25 = 5^2$, it follows that $(x - 1.5)^2 + (y + 0.5)^2 = 5^2$. Therefore, the radius of the circle is 5.

Choices B, C, and D are incorrect and may be the result of errors in manipulating the equation or of a misconception about the standard form of the equation of a circle in the xy-plane.

Question Difficulty:
Hard

Question ID 568d66a7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 568d66a7

An isosceles right triangle has a perimeter of $94 + 94\sqrt{2}$ inches. What is the length, in inches, of one leg of this triangle?

A. 47

B. $47\sqrt{2}$

C. 94

D. $94\sqrt{2}$

ID: 568d66a7 Answer

Correct Answer:
B

Rationale

Choice B is correct. It's given that the right triangle is isosceles. In an isosceles right triangle, the two legs have equal lengths, and the length of the hypotenuse is $\sqrt{2}$ times the length of one of the legs. Let ℓ represent the length, in inches, of each leg of the isosceles right triangle. It follows that the length of the hypotenuse is $\ell\sqrt{2}$ inches. The perimeter of a figure is the sum of the lengths of the sides of the figure. Therefore, the perimeter of the isosceles right triangle is $\ell + \ell + \ell\sqrt{2}$ inches. It's given that the perimeter of the triangle is $94 + 94\sqrt{2}$ inches. It follows that $\ell + \ell + \ell\sqrt{2} = 94 + 94\sqrt{2}$. Factoring the left-hand side of this equation yields $\left(1 + 1 + \sqrt{2}\right)\ell = 94 + 94\sqrt{2}$, or $\left(2 + \sqrt{2}\right)\ell = 94 + 94\sqrt{2}$. Dividing both sides of this equation by $2 + \sqrt{2}$ yields $\ell = \frac{94+94\sqrt{2}}{2+\sqrt{2}}$. Rationalizing the denominator of the right-hand side of this equation by multiplying the right-hand side of the equation by $\frac{2-\sqrt{2}}{2-\sqrt{2}}$ yields $\ell = \frac{\left(94+94\sqrt{2}\right)\left(2-\sqrt{2}\right)}{\left(2+\sqrt{2}\right)\left(2-\sqrt{2}\right)}$. Applying the distributive property to the numerator and to the denominator of the right-hand side of this equation yields $\ell = \frac{188-94\sqrt{2}+188\sqrt{2}-94\sqrt{4}}{4-2\sqrt{2}+2\sqrt{2}-\sqrt{4}}$. This is equivalent to $\ell = \frac{94\sqrt{2}}{2}$, or $\ell = 47\sqrt{2}$. Therefore, the length, in inches, of one leg of the isosceles right triangle is $47\sqrt{2}$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This is the length, in inches, of the hypotenuse.

Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 322a6dfe

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: 322a6dfe

Quadrilaterals $PQRS$ and $WXYZ$ are similar, where P, Q, and R correspond to W, X, and Y, respectively. The measure of $\angle S$ is 135°, $PS = 45$, and $WZ = 9$. What is the measure of $\angle Z$?

A. 5°

B. 27°

C. 45°

D. 135°

ID: 322a6dfe Answer

Correct Answer:
D

Rationale

Choice D is correct. Corresponding angles in similar figures have equal measure. It's given that quadrilaterals $PQRS$ and $WXYZ$ are similar and that P, Q, and R correspond to W, X, and Y. It follows that $\angle S$ corresponds to $\angle Z$. It's also given that the measure of $\angle S$ is 135°. Therefore, the measure of $\angle Z$ is 135°.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice C is incorrect. This is the supplement of the measure of $\angle Z$, not the measure of $\angle Z$.

Question Difficulty:
Hard

Question ID 0e709a29

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 0e709a29

$$RS = 440$$
$$ST = 384$$
$$TR = 584$$

The side lengths of right triangle RST are given. Triangle RST is similar to triangle UVW, where S corresponds to V and T corresponds to W. What is the value of $\tan W$?

A. $\frac{48}{73}$

B. $\frac{55}{73}$

C. $\frac{48}{55}$

D. $\frac{55}{48}$

ID: 0e709a29 Answer

Correct Answer:

D

Rationale

Choice D is correct. The hypotenuse of triangle RST is the longest side and is across from the right angle. The longest side length given is 584, which is the length of side TR. Therefore, the hypotenuse of triangle RST is side TR, so the right angle is angle S. The tangent of an acute angle in a right triangle is the ratio of the length of the opposite side, which is the side across from the angle, to the length of the adjacent side, which is the side closest to the angle that is not the hypotenuse. It follows that the opposite side of angle T is side RS and the adjacent side of angle T is side ST. Therefore, $\tan T = \frac{RS}{ST}$. Substituting 440 for RS and 384 for ST in this equation yields $\tan T = \frac{440}{384}$. This is equivalent to $\tan T = \frac{55}{48}$. It's given that triangle RST is similar to triangle UVW, where S corresponds to V and T corresponds to W. It follows that R corresponds to U. Therefore, the hypotenuse of triangle UVW is side WU, which means $\tan W = \frac{UV}{VW}$. Since the lengths of corresponding sides of similar triangles are proportional, $\frac{RS}{ST} = \frac{UV}{VW}$. Therefore, $\tan W = \frac{UV}{VW}$ is equivalent to $\tan W = \frac{RS}{ST}$, or $\tan W = \tan T$. Thus, $\tan W = \frac{55}{48}$.

Choice A is incorrect. This is the value of $\cos W$, not $\tan W$.

Choice B is incorrect. This is the value of $\sin W$, not $\tan W$.

Choice C is incorrect. This is the value of $\frac{1}{\tan W}$, not $\tan W$.

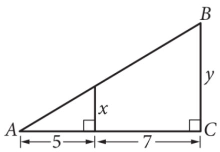
Question Difficulty:

Hard

Question ID eeb4143c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: eeb4143c



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* ?

ID: eeb4143c Answer

Rationale

The correct answer is either $\frac{10}{3}$, $\frac{15}{4}$, 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, 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 $\frac{10}{3}$. Substituting 9 for y in the proportion results in $\frac{x}{9} = \frac{5}{12}$. Cross multiplying and solving for x yields $\frac{15}{4}$. Substituting 10 for y in the proportion results in $\frac{x}{10} = \frac{5}{12}$. Cross multiplying and solving for x yields $\frac{25}{6}$. Note that 10/3, 15/4, 25/6, 3.333, 3.75, 4.166, and 4.167 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 5b2b8866

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 5b2b8866

A rectangular poster has an area of 360 square inches. A copy of the poster is made in which the length and width of the original poster are each increased by 20%. What is the area of the copy, in square inches?

ID: 5b2b8866 Answer

Correct Answer:
2592/5, 518.4

Rationale

The correct answer is 518.4. It's given that the area of the original poster is 360 square inches. Let ℓ represent the length, in inches, of the original poster, and let w represent the width, in inches, of the original poster. Since the area of a rectangle is equal to its length times its width, it follows that $360 = \ell w$. It's also given that a copy of the poster is made in which the length and width of the original poster are each increased by 20%. It follows that the length of the copy is the length of the original poster plus 20% of the length of the original poster, which is equivalent to $\ell + \frac{20}{100}\ell$ inches. This length can be rewritten as $\ell + 0.2\ell$ inches, or 1.2ℓ inches. Similarly, the width of the copy is the width of the original poster plus 20% of the width of the original poster, which is equivalent to $w + \frac{20}{100}w$ inches. This width can be rewritten as $w + 0.2w$ inches, or $1.2w$ inches. Since the area of a rectangle is equal to its length times its width, it follows that the area, in square inches, of the copy is equal to $(1.2\ell)(1.2w)$, which can be rewritten as $(1.2)(1.2)(\ell w)$. Since $360 = \ell w$, the area, in square inches, of the copy can be found by substituting 360 for ℓw in the expression $(1.2)(1.2)(\ell w)$, which yields $(1.2)(1.2)(360)$, or 518.4. Therefore, the area of the copy, in square inches, is 518.4.

Question Difficulty:
Hard

Question ID 2855cb58

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 2855cb58

A circle in the *xy*-plane has its center at $(16, 17)$ and has a radius of $7k$. Which equation represents this circle?

A. $(x-16)^2+(y-17)^2=49k$

B. $(x-16)^2+(y-17)^2=49k^2$

C. $(x-16)^2+(y-17)^2=7k$

D. $(x-16)^2+(y-17)^2=7k^2$

ID: 2855cb58 Answer

Correct Answer:

B

Rationale

Choice B is correct. The equation of a circle in the *xy*-plane can be written as $(x-h)^2+(y-k)^2=r^2$, where the center of the circle is (h, k) and the radius of the circle is r. It's given that this circle has a center at $(16, 17)$ and a radius of $7k$. Substituting 16 for h, 17 for k, and $7k$ for r in $(x-h)^2+(y-k)^2=r^2$ yields $(x-16)^2+(y-17)^2=(7k)^2$, or $(x-16)^2+(y-17)^2=49k^2$. Therefore, the equation that represents this circle is $(x-16)^2+(y-17)^2=49k^2$.

Choice A is incorrect. This equation represents a circle with radius $7\sqrt{k}$, not $7k$.

Choice C is incorrect. This equation represents a circle with radius $\sqrt{7k}$, not $7k$.

Choice D is incorrect. This equation represents a circle with radius $\sqrt{7}k$, not $7k$.

Question Difficulty:

Hard

Question ID dc71597b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: dc71597b

A right circular cone has a volume of $\frac{1}{3}\pi$ cubic feet and a height of 9 feet. What is the radius, in feet, of the base of the cone?

A. $\frac{1}{3}$

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

C. $\sqrt{3}$

D. 3

ID: dc71597b Answer

Correct Answer:
A

Rationale

Choice A is correct. The equation for the volume of a right circular cone is $V = \frac{1}{3}\pi r^2 h$. It's given that the volume of the right circular cone is $\frac{1}{3}\pi$ cubic feet and the height is 9 feet. Substituting these values for V and h, respectively, gives $\frac{1}{3}\pi = \frac{1}{3}\pi r^2(9)$. Dividing both sides of the equation by $\frac{1}{3}\pi$ gives $1 = r^2(9)$. Dividing both sides of the equation by 9 gives $\frac{1}{9} = r^2$. Taking the square root of both sides results in two possible values for the radius, $\sqrt{\left(\frac{1}{9}\right)}$ or $-\sqrt{\left(\frac{1}{9}\right)}$. Since the radius can't have a negative value, that leaves $\sqrt{\left(\frac{1}{9}\right)}$ as the only possibility. Applying the quotient property of square roots, $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$, results in $r = \frac{\sqrt{1}}{\sqrt{9}}$, or $r = \frac{1}{3}$.

Choices B and C are incorrect and may result from incorrectly evaluating $\sqrt{\left(\frac{1}{9}\right)}$. Choice D is incorrect and may result from solving $r^2 = 9$ instead of $r^2 = \frac{1}{9}$.

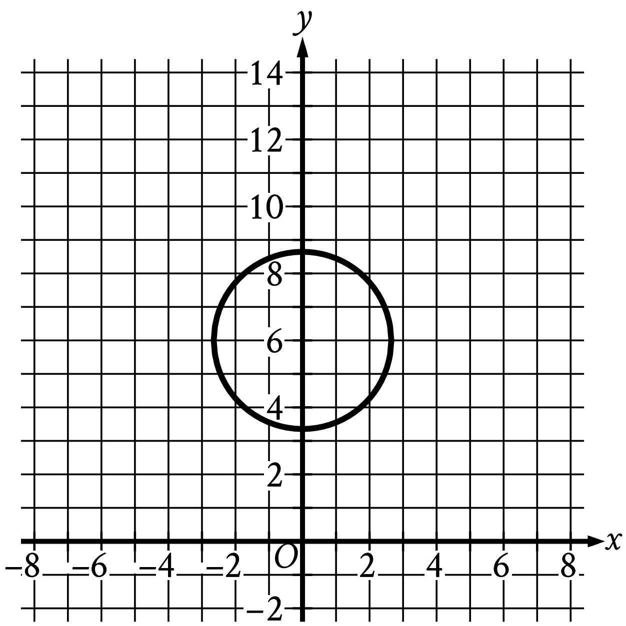
Question Difficulty:

Hard

Question ID 1b2b20b9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 1b2b20b9



Circle A shown is defined by the equation $x^2 + (y - 6)^2 = 7$. Circle B (not shown) has the same radius but is translated 96 units to the right. If the equation of circle B is $(x - h)^2 + (y - k)^2 = a$, where h, k, and a are constants, what is the value of $4a$?

ID: 1b2b20b9 Answer

Correct Answer:
28

Rationale

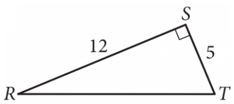
The correct answer is 28. The equation of a circle in the *xy*-plane can be written as $(x - t)^2 + (y - s)^2 = r^2$, where the center of the circle is (t, s) and the radius of the circle is r. It's given that circle A is defined by the equation $x^2 + (y - 6)^2 = 7$, which can be written as $(x - 0)^2 + (y - 6)^2 = \left(\sqrt{7}\right)^2$. It follows that $r = \sqrt{7}$ and the radius of circle A is $\sqrt{7}$. It's also given that circle B has the same radius as circle A. If the equation of circle B is $(x - h)^2 + (y - k)^2 = a$, then $a = r^2$. Substituting $\sqrt{7}$ for r in this equation yields $a = \left(\sqrt{7}\right)^2$, or $a = 7$. It follows that the value of $4a$ is $4(7)$, or 28.

Question Difficulty:
Hard

Question ID 6933b3d9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 6933b3d9



In triangle *RST* above, point *W* (not shown) lies on $\overline{RT}$. What is the value of $\cos(\angle RSW) - \sin(\angle WST)$?

ID: 6933b3d9 Answer

Rationale

The correct answer is 0. Note that no matter where point W is on $\overline{RT}$, the sum of the measures of $\angle RSW$ and $\angle WST$ is equal to the measure of $\angle RST$, which is $90°$. Thus, $\angle RSW$ and $\angle WST$ are complementary angles. Since the cosine of an angle is equal to the sine of its complementary angle, $\cos(\angle RSW) = \sin(\angle WST)$. Therefore, $\cos(\angle RSW) - \sin(\angle WST) = 0$.

Question Difficulty:
Hard

Question ID 6ab30ce3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 6ab30ce3

Triangle ABC is similar to triangle DEF, where A corresponds to D and C corresponds to F. Angles C and F are right angles. If $\tan(A) = \sqrt{3}$ and $DF = 125$, what is the length of $\overline{DE}$?

A. $125\frac{\sqrt{3}}{3}$

B. $125\frac{\sqrt{3}}{2}$

C. $125\sqrt{3}$

D. 250

ID: 6ab30ce3 Answer

Correct Answer:
D

Rationale

Choice D is correct. Corresponding angles in similar triangles have equal measures. It's given that triangle ABC is similar to triangle DEF, where A corresponds to D, so the measure of angle A is equal to the measure of angle D. Therefore, if $\tan(A) = \sqrt{3}$, then $\tan(D) = \sqrt{3}$. It's given that angles C and F are right angles, so triangles ABC and DEF are right triangles. The adjacent side of an acute angle in a right triangle is the side closest to the angle that is not the hypotenuse. It follows that the adjacent side of angle D is side DF. The opposite side of an acute angle in a right triangle is the side across from the acute angle. It follows that the opposite side of angle D is side EF. The tangent of an acute angle in a right triangle is the ratio of the length of the opposite side to the length of the adjacent side. Therefore, $\tan(D) = \frac{EF}{DF}$. If $DF = 125$, the length of side EF can be found by substituting $\sqrt{3}$ for $\tan(D)$ and 125 for DF in the equation $\tan(D) = \frac{EF}{DF}$, which yields $\sqrt{3} = \frac{EF}{125}$. Multiplying both sides of this equation by 125 yields $125\sqrt{3} = EF$. Since the length of side EF is $\sqrt{3}$ times the length of side DF, it follows that triangle DEF is a special right triangle with angle measures 30°, 60°, and 90°. Therefore, the length of the hypotenuse, $\overline{DE}$, is 2 times the length of side DF, or $DE = 2(DF)$. Substituting 125 for DF in this equation yields $DE = 2(125)$, or $DE = 250$. Thus, if $\tan(A) = \sqrt{3}$ and $DF = 125$, the length of $\overline{DE}$ is 250.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect. This is the length of $\overline{EF}$, not $\overline{DE}$.

Question Difficulty:
Hard

Question ID 5b4757df

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: 5b4757df

In triangle RST, angle T is a right angle, point L lies on $\overline{RS}$, point K lies on $\overline{ST}$, and $\overline{LK}$ is parallel to $\overline{RT}$. If the length of $\overline{RT}$ is 72 units, the length of $\overline{LK}$ is 24 units, and the area of triangle RST is 792 square units, what is the length of $\overline{KT}$, in units?

ID: 5b4757df Answer

Correct Answer:
14.66, 14.67, 44/3

Rationale

The correct answer is $\frac{44}{3}$. It's given that in triangle RST, angle T is a right angle. The area of a right triangle can be found using the formula $A = \frac{1}{2}\ell_1\ell_2$, where A represents the area of the right triangle, ℓ_1 represents the length of one leg of the triangle, and ℓ_2 represents the length of the other leg of the triangle. In triangle RST, the two legs are $\overline{RT}$ and $\overline{ST}$. Therefore, if the length of $\overline{RT}$ is 72 and the area of triangle RST is 792, then $792 = \frac{1}{2}(72)(ST)$, or $792 = (36)(ST)$. Dividing both sides of this equation by 36 yields $22 = ST$. Therefore, the length of $\overline{ST}$ is 22. It's also given that point L lies on $\overline{RS}$, point K lies on $\overline{ST}$, and $\overline{LK}$ is parallel to $\overline{RT}$. It follows that angle LKS is a right angle. Since triangles RST and LSK share angle S and have right angles T and K, respectively, triangles RST and LSK are similar triangles. Therefore, the ratio of the length of $\overline{RT}$ to the length of $\overline{LK}$ is equal to the ratio of the length of $\overline{ST}$ to the length of $\overline{SK}$. If the length of $\overline{RT}$ is 72 and the length of $\overline{LK}$ is 24, it follows that the ratio of the length of $\overline{RT}$ to the length of $\overline{LK}$ is $\frac{72}{24}$, or 3, so the ratio of the length of $\overline{ST}$ to the length of $\overline{SK}$ is 3. Therefore, $\frac{22}{SK} = 3$. Multiplying both sides of this equation by SK yields $22 = (3)(SK)$. Dividing both sides of this equation by 3 yields $\frac{22}{3} = SK$. Since the length of $\overline{ST}$, 22, is the sum of the length of $\overline{SK}$, $\frac{22}{3}$, and the length of $\overline{KT}$, it follows that the length of $\overline{KT}$ is $22 - \frac{22}{3}$, or $\frac{44}{3}$. Note that 44/3, 14.66, and 14.67 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID ca2235f6

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: ca2235f6

A circle has center O, and points A and B lie on the circle. The measure of arc AB is $45°$ and the length of arc AB is 3 inches. What is the circumference, in inches, of the circle?

A. 3

B. 6

C. 9

D. 24

ID: ca2235f6 Answer

Correct Answer:
D

Rationale

Choice D is correct. It's given that the measure of arc AB is 45° and the length of arc AB is 3 inches. The arc measure of the full circle is 360°. If x represents the circumference, in inches, of the circle, it follows that $\frac{45^\circ}{360^\circ} = \frac{3 \text{ inches}}{x \text{ inches}}$. This equation is equivalent to $\frac{45}{360} = \frac{3}{x}$, or $\frac{1}{8} = \frac{3}{x}$. Multiplying both sides of this equation by $8x$ yields $1(x) = 3(8)$, or $x = 24$. Therefore, the circumference of the circle is 24 inches.

Choice A is incorrect. This is the length of arc AB.

Choice B is incorrect and may result from multiplying the length of arc AB by 2.

Choice C is incorrect and may result from squaring the length of arc AB.

Question Difficulty:
Hard

Question ID 981275d2

Assessment	Test	Math	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 981275d2

$$(x-6)^2+(y+5)^2=16$$

In the *xy*-plane, the graph of the equation above is a circle. Point *P* is on the circle and has coordinates $(10,-5)$. If $\overline{PQ}$ is a diameter of the circle, what are the coordinates of point *Q* ?

A. $(2,-5)$

B. $(6,-1)$

C. $(6,-5)$

D. $(6,-9)$

ID: 981275d2 Answer

Correct Answer:
A

Rationale

Choice A is correct. The standard form for the equation of a circle is $(x-h)^2+(y-k)^2=r^2$, where (h,k) are the coordinates of the center and r is the length of the radius. According to the given equation, the center of the circle is $(6,-5)$. Let (x_1,y_1) represent the coordinates of point Q. Since point P $(10,-5)$ and point Q (x_1,y_1) are the endpoints of a diameter of the circle, the center $(6,-5)$ lies on the diameter, halfway between P and Q. Therefore, the following relationships hold: $\frac{x_1+10}{2}=6$ and $\frac{y_1+(-5)}{2}=-5$. Solving the equations for x_1 and y_1, respectively, yields $x_1=2$ and $y_1=-5$. Therefore, the coordinates of point Q are $(2,-5)$.

Alternate approach: Since point P $(10,-5)$ on the circle and the center of the circle $(6,-5)$ have the same y-coordinate, it follows that the radius of the circle is $10-6=4$. In addition, the opposite end of the diameter $\overline{PQ}$ must have the same y-coordinate as P and be 4 units away from the center. Hence, the coordinates of point Q must be $(2,-5)$.

Choices B and D are incorrect because the points given in these choices lie on a diameter that is perpendicular to the diameter $\overline{PQ}$. If either of these points were point Q, then $\overline{PQ}$ would not be the diameter of the circle. Choice C is incorrect because $(6,-5)$ is the center of the circle and does not lie on the circle.

Question Difficulty:
Hard

Question ID 89661424

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: 89661424

A circle in the *xy*-plane has its center at $(-5, 2)$ and has a radius of 9. An equation of this circle is $x^2 + y^2 + ax + by + c = 0$, where a, b, and c are constants. What is the value of c?

ID: 89661424 Answer

Correct Answer:
-52

Rationale

The correct answer is -52. The equation of a circle in the *xy*-plane with its center at (h, k) and a radius of r can be written in the form $(x-h)^2 + (y-k)^2 = r^2$. It's given that a circle in the *xy*-plane has its center at $(-5, 2)$ and has a radius of 9. Substituting -5 for h, 2 for k, and 9 for r in the equation $(x-h)^2 + (y-k)^2 = r^2$ yields $(x-(-5))^2 + (y-2)^2 = 9^2$, or $(x+5)^2 + (y-2)^2 = 81$. It's also given that an equation of this circle is $x^2 + y^2 + ax + by + c = 0$, where a, b, and c are constants. Therefore, $(x+5)^2 + (y-2)^2 = 81$ can be rewritten in the form $x^2 + y^2 + ax + by + c = 0$. The equation $(x+5)^2 + (y-2)^2 = 81$, or $(x+5)(x+5) + (y-2)(y-2) = 81$, can be rewritten as $x^2 + 5x + 5x + 25 + y^2 - 2y - 2y + 4 = 81$. Combining like terms on the left-hand side of this equation yields $x^2 + y^2 + 10x - 4y + 29 = 81$. Subtracting 81 from both sides of this equation yields $x^2 + y^2 + 10x - 4y - 52 = 0$, which is equivalent to $x^2 + y^2 + 10x + (-4)y + (-52) = 0$. This equation is in the form $x^2 + y^2 + ax + by + c = 0$. Therefore, the value of c is -52.

Question Difficulty:
Hard

Question ID 7c25b0dc

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 7c25b0dc

The length of a rectangle's diagonal is $3\sqrt{17}$, and the length of the rectangle's shorter side is 3. What is the length of the rectangle's longer side?

ID: 7c25b0dc Answer

Correct Answer:
12

Rationale

The correct answer is 12. The diagonal of a rectangle forms a right triangle, where the shorter side and the longer side of the rectangle are the legs of the triangle and the diagonal of the rectangle is the hypotenuse of the triangle. It's given that the length of the rectangle's diagonal is $3\sqrt{17}$ and the length of the rectangle's shorter side is 3. Thus, the length of the hypotenuse of the right triangle formed by the diagonal is $3\sqrt{17}$ and the length of one of the legs is 3. By the Pythagorean theorem, if a right triangle has a hypotenuse with length c and legs with lengths a and b, then $a^2 + b^2 = c^2$. Substituting $3\sqrt{17}$ for c and 3 for b in this equation yields $a^2 + (3)^2 = \left(3\sqrt{17}\right)^2$, or $a^2 + 9 = 153$. Subtracting 9 from both sides of this equation yields $a^2 = 144$. Taking the square root of both sides of this equation yields $a = \pm\sqrt{144}$, or $a = \pm 12$. Since a represents a length, which must be positive, the value of a is 12. Thus, the length of the rectangle's longer side is 12.

Question Difficulty:
Hard

Question ID 93de3f84

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 93de3f84

The volume of right circular cylinder A is 22 cubic centimeters. What is the volume, in cubic centimeters, of a right circular cylinder with twice the radius and half the height of cylinder A?

A. 11

B. 22

C. 44

D. 66

ID: 93de3f84 Answer

Correct Answer:
C

Rationale

Choice C is correct. The volume of right circular cylinder A is given by the expression $\pi r^2 h$, where r is the radius of its circular base and h is its height. The volume of a cylinder with twice the radius and half the height of cylinder A is given by $\pi(2r)^2\left(\frac{1}{2}\right)h$, which is equivalent to $4\pi r^2\left(\frac{1}{2}\right)h = 2\pi r^2 h$. Therefore, the volume is twice the volume of cylinder A, or $2 \times 22 = 44$.

Choice A is incorrect and likely results from not multiplying the radius of cylinder A by 2. Choice B is incorrect and likely results from not squaring the 2 in 2r when applying the volume formula. Choice D is incorrect and likely results from a conceptual error.

Question Difficulty:
Hard

Question ID fb58c0db

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: fb58c0db

Points *A* and *B* lie on a circle with radius 1, and arc $\overparen{AB}$ has length $\frac{\pi}{3}$. What fraction of the circumference of the circle is the length of arc $\overparen{AB}$?

ID: fb58c0db Answer

Rationale

The correct answer is $\frac{1}{6}$. The circumference, C, of a circle is $C = 2\pi r$, where r is the length of the radius of the circle. For the given circle with a radius of 1, the circumference is $C = 2(\pi)(1)$, or $C = 2\pi$. To find what fraction of the circumference the length of arc $\overparen{AB}$ is, divide the length of the arc by the circumference, which gives $\frac{\pi}{3} \div 2\pi$. This division can be represented by $\frac{\pi}{3} \cdot \frac{1}{2\pi} = \frac{1}{6}$. Note that 1/6, .1666, .1667, 0.166, and 0.167 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID c6dff223

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: c6dff223

Triangle ABC is similar to triangle DEF, where angle A corresponds to angle D and angles C and F are right angles. The length of $\overline{AB}$ is 2.9 times the length of $\overline{DE}$. If $\tan A = \frac{21}{20}$, what is the value of $\sin D$?

ID: c6dff223 Answer

Correct Answer:
.7241, 21/29

Rationale

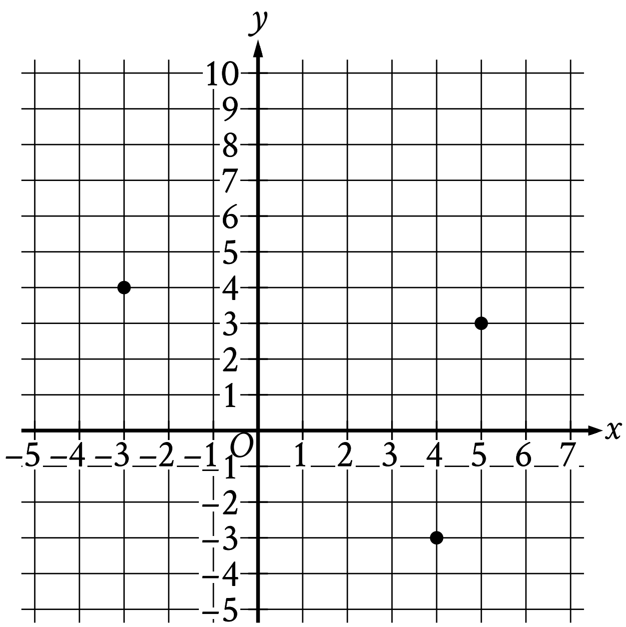
The correct answer is $\frac{21}{29}$. It's given that triangle ABC is similar to triangle DEF, where angle A corresponds to angle D and angles C and F are right angles. In similar triangles, the tangents of corresponding angles are equal. Therefore, if $\tan A = \frac{21}{20}$, then $\tan D = \frac{21}{20}$. In a right triangle, the tangent of an acute angle is the ratio of the length of the leg opposite the angle to the length of the leg adjacent to the angle. Therefore, in triangle DEF, if $\tan D = \frac{21}{20}$, the ratio of the length of $\overline{EF}$ to the length of $\overline{DF}$ is $\frac{21}{20}$. If the lengths of $\overline{EF}$ and $\overline{DF}$ are 21 and 20, respectively, then the ratio of the length of $\overline{EF}$ to the length of $\overline{DF}$ is $\frac{21}{20}$. In a right triangle, the sine of an acute angle is the ratio of the length of the leg opposite the angle to the length of the hypotenuse. Therefore, the value of $\sin D$ is the ratio of the length of $\overline{EF}$ to the length of $\overline{DE}$. The length of $\overline{DE}$ can be calculated using the Pythagorean theorem, which states that if the lengths of the legs of a right triangle are a and b and the length of the hypotenuse is c, then $a^2 + b^2 = c^2$. Therefore, if the lengths of $\overline{EF}$ and $\overline{DF}$ are 21 and 20, respectively, then $(21)^2 + (20)^2 = (DE)^2$, or $841 = (DE)^2$. Taking the positive square root of both sides of this equation yields $29 = DE$. Therefore, if the lengths of $\overline{EF}$ and $\overline{DF}$ are 21 and 20, respectively, then the length of $\overline{DE}$ is 29 and the ratio of the length of $\overline{EF}$ to the length of $\overline{DE}$ is $\frac{21}{29}$. Thus, if $\tan A = \frac{21}{20}$, the value of $\sin D$ is $\frac{21}{29}$. Note that 21/29, .7241, and 0.724 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID eb70d2d0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: eb70d2d0



What is the area, in square units, of the triangle formed by connecting the three points shown?

ID: eb70d2d0 Answer

Correct Answer:

24.5, 49/2

Rationale

The correct answer is 24.5. It's given that a triangle is formed by connecting the three points shown, which are $(-3, 4)$, $(5, 3)$, and $(4, -3)$. Let this triangle be triangle A. The area of triangle A can be found by calculating the area of the rectangle that circumscribes it and subtracting the areas of the three triangles that are inside the rectangle but outside triangle A. The rectangle formed by the points $(-3, 4)$, $(5, 4)$, $(5, -3)$, and $(-3, -3)$ circumscribes triangle A. The width, in units, of this rectangle can be found by calculating the distance between the points $(5, 4)$ and $(5, -3)$. This distance is $4 - (-3)$, or 7. The length, in units, of this rectangle can be found by calculating the distance between the points $(5, 4)$ and $(-3, 4)$. This distance is $5 - (-3)$, or 8. It follows that the area, in square units, of the rectangle is $(7)(8)$, or 56. One of the triangles that lies inside the rectangle but outside triangle A is formed by the points $(-3, 4)$, $(5, 4)$, and $(5, 3)$. The length, in units, of a base of this triangle can be found by calculating the distance between the points $(5, 4)$ and $(5, 3)$. This distance is $4 - 3$, or 1. The corresponding height, in units, of this triangle can be found by calculating the distance between the points $(5, 4)$ and $(-3, 4)$. This distance is $5 - (-3)$, or 8. It follows that the area, in square units, of this triangle is $\frac{1}{2}(8)(1)$, or 4. A second triangle that lies inside the rectangle but outside triangle A is formed by the points $(4, -3)$, $(5, 3)$, and $(5, -3)$. The length, in units, of a base of this triangle can be found by calculating the distance between the points $(5, 3)$ and $(5, -3)$. This distance is $3 - (-3)$, or 6. The corresponding height, in units, of this triangle can be found by calculating the distance between the points $(5, -3)$ and $(4, -3)$. This distance is $5 - 4$, or 1. It follows that the area, in square units, of this triangle is $\frac{1}{2}(1)(6)$, or 3. The third triangle that lies inside the rectangle but outside triangle A is formed by the points $(-3, 4)$, $(-3, -3)$, and $(4, -3)$. The length, in units, of a base of this triangle can be found by calculating the distance between the points $(4, -3)$ and $(-3, -3)$. This distance is $4 - (-3)$, or 7. The corresponding height, in units, of this triangle can be found by calculating the distance between the points $(-3, 4)$ and $(-3, -3)$. This distance is $4 - (-3)$, or 7. It follows that the area, in square units, of this triangle is $\frac{1}{2}(7)(7)$, or 24.5. Thus, the area, in square units, of the triangle formed by connecting the three points shown is $56 - 4 - 3 - 24.5$, or 24.5. Note that 24.5 and 49/2 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 92eb236a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 92eb236a

In a right triangle, the tangent of one of the two acute angles is $\frac{\sqrt{3}}{3}$. What is the tangent of the other acute angle?

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

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

C. $\frac{\sqrt{3}}{3}$

D. $\frac{3}{\sqrt{3}}$

ID: 92eb236a Answer

Correct Answer:
D

Rationale

Choice D is correct. The tangent of a nonright angle in a right triangle is defined as the ratio of the length of the leg opposite the angle to the length of the leg adjacent to the angle. Using that definition for tangent, in a right triangle with legs that have lengths a and b, the tangent of one acute angle is $\frac{a}{b}$ and the tangent for the other acute angle is $\frac{b}{a}$. It follows that the tangents of the acute angles in a right triangle are reciprocals of each other. Therefore, the tangent of the other acute angle in the given triangle is the reciprocal of $\frac{\sqrt{3}}{3}$ or $\frac{3}{\sqrt{3}}$.

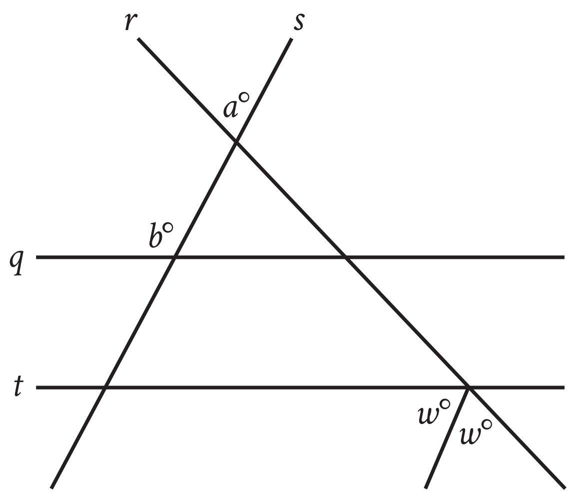
Choice A is incorrect and may result from assuming that the tangent of the other acute angle is the negative of the tangent of the angle described. Choice B is incorrect and may result from assuming that the tangent of the other acute angle is the negative of the reciprocal of the tangent of the angle described. Choice C is incorrect and may result from interpreting the tangent of the other acute angle as equal to the tangent of the angle described.

Question Difficulty:
Hard

Question ID 17912810

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: 17912810



Note: Figure not drawn to scale.

In the figure, parallel lines q and t are intersected by lines r and s. If $a = 43$ and $b = 122$, what is the value of w?

ID: 17912810 Answer

Correct Answer:

101/2, 50.5

Rationale

The correct answer is $\frac{101}{2}$. In the figure, lines q, r, and s form a triangle. One interior angle of this triangle is vertical to the angle marked a°; therefore, the interior angle also has measure a°. It's given that $a = 43$. Therefore, the interior angle of the triangle has measure 43°. A second interior angle of the triangle forms a straight line, q, with the angle marked b°. Therefore, the sum of the measures of these two angles is 180°. It's given that $b = 122$. Therefore, the angle marked b° has measure 122° and the second interior angle of the triangle has measure $(180 - 122)^\circ$, or 58°. The sum of the interior angles of a triangle is 180°. Therefore, the measure of the third interior angle of the triangle is $(180 - 43 - 58)^\circ$, or 79°. It's given that parallel lines q and t are intersected by line r. It follows that the triangle's interior angle with measure 79° is congruent to the same side interior angle between lines q and t formed by lines t and r. Since this angle is supplementary to the two angles marked w°, the sum of 79°, w°, and w° is 180°. It follows that $79 + w + w = 180$, or $79 + 2w = 180$. Subtracting 79 from both sides of this equation yields $2w = 101$. Dividing both sides of this equation by 2 yields $w = \frac{101}{2}$. Note that 101/2 and 50.5 are examples of ways to enter a correct answer.

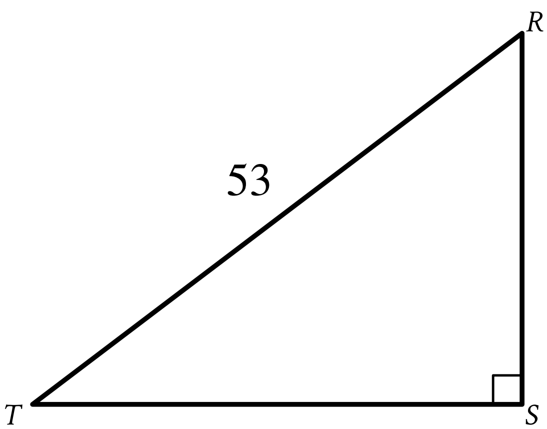
Question Difficulty:

Hard

Question ID a67b9f88

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: a67b9f88



Note: Figure not drawn to scale.

In the triangle shown, $RS = \sqrt{105}$. What is the value of $\sin R$?

ID: a67b9f88 Answer

Correct Answer:
.9811, 52/53

Rationale

The correct answer is $\frac{52}{53}$. In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the two legs. The length of the hypotenuse of the right triangle shown is 53. It's given that $RS = \sqrt{105}$. Therefore, the length of one of the legs of the triangle shown is $\sqrt{105}$. Let x represent TS, the length of the other leg of the triangle shown. Therefore, $53^2 = \left(\sqrt{105}\right)^2 + x^2$, or $2{,}809 = 105 + x^2$. Subtracting 105 from both sides of this equation yields $2{,}704 = x^2$. Taking the positive square root of both sides of this equation yields $52 = x$. Therefore, TS, the length of the other leg of the triangle shown, is 52. The sine of an acute angle in a right triangle is defined as the ratio of the length of the leg opposite the angle to the length of the hypotenuse. The length of the leg opposite angle R is 52, and the length of the hypotenuse is 53. Therefore, the value of $\sin R$ is $\frac{52}{53}$. Note that 52/53 or .9811 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID f7e626b2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: f7e626b2

The dimensions of a right rectangular prism are 4 inches by 5 inches by 6 inches. What is the surface area, in square inches, of the prism?

A. 30

B. 74

C. 120

D. 148

ID: f7e626b2 Answer

Rationale

Choice D is correct. The surface area is found by summing the area of each face. A right rectangular prism consists of three pairs of congruent rectangles, so the surface area is found by multiplying the areas of three adjacent rectangles by 2 and adding these products. For this prism, the surface area is equal to $2(4 \cdot 5) + 2(5 \cdot 6) + 2(4 \cdot 6)$, or $2(20) + 2(30) + 2(24)$, which is equal to 148.

Choice A is incorrect. This is the area of one of the faces of the prism. Choice B is incorrect and may result from adding the areas of three adjacent rectangles without multiplying by 2. Choice C is incorrect. This is the volume, in cubic inches, of the prism.

Question Difficulty:
Hard

Question ID 2be01bd9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 2be01bd9

Triangle ABC is similar to triangle DEF, where angle A corresponds to angle D and angle C corresponds to angle F. Angles C and F are right angles. If $\tan(A) = \frac{50}{7}$, what is the value of $\tan(E)$?

ID: 2be01bd9 Answer

Correct Answer:

.14, 7/50

Rationale

The correct answer is $\frac{7}{50}$. It's given that triangle ABC is similar to triangle DEF, where angle A corresponds to angle D and angle C corresponds to angle F. In similar triangles, the tangents of corresponding angles are equal. Since angle A and angle D are corresponding angles, if $\tan(A) = \frac{50}{7}$, then $\tan(D) = \frac{50}{7}$. It's also given that angles C and F are right angles. It follows that triangle DEF is a right triangle with acute angles D and E. The tangent of one acute angle in a right triangle is the inverse of the tangent of the other acute angle in the triangle. Therefore, $\tan(E) = \frac{1}{\tan(D)}$. Substituting $\frac{50}{7}$ for $\tan(D)$ in this equation yields $\tan(E) = \frac{1}{\frac{50}{7}}$, or $\tan(E) = \frac{7}{50}$. Thus, if $\tan(A) = \frac{50}{7}$, the value of $\tan(E)$ is $\frac{7}{50}$. Note that 7/50 and .14 are examples of ways to enter a correct answer.

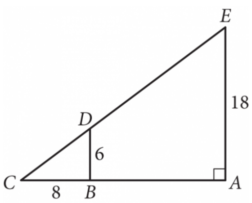
Question Difficulty:

Hard

Question ID dba6a25a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: dba6a25a



In the figure above, $\overline{BD}$ is parallel to $\overline{AE}$.

What is the length of $\overline{CE}$?

ID: dba6a25a Answer

Rationale

The correct answer is 30. In the figure given, since $\overline{BD}$ is parallel to $\overline{AE}$ and both segments are intersected by $\overline{CE}$, then angle BDC and angle AEC are corresponding angles and therefore congruent. Angle BCD and angle ACE are also congruent because they are the same angle. Triangle BCD and triangle ACE are similar because if two angles of one triangle are congruent to two angles of another triangle, the triangles are similar. Since triangle BCD and triangle ACE are similar, their corresponding sides are proportional. So in triangle BCD and triangle ACE, $\overline{BD}$ corresponds to $\overline{AE}$ and $\overline{CD}$ corresponds to $\overline{CE}$. Therefore, $\frac{BD}{CD} = \frac{AE}{CE}$. Since triangle BCD is a right triangle, the Pythagorean theorem can be used to give the value of CD: $6^2 + 8^2 = CD^2$. Taking the square root of each side gives $CD = 10$. Substituting the values in the proportion $\frac{BD}{CD} = \frac{AE}{CE}$ yields $\frac{6}{10} = \frac{18}{CE}$. Multiplying each side by CE, and then multiplying by $\frac{10}{6}$ yields $CE = 30$. Therefore, the length of $\overline{CE}$ is 30.

Question Difficulty:
Hard

Question ID c984f1a5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: c984f1a5

A hemisphere is half of a sphere. If a hemisphere has a radius of 27 inches, which of the following is closest to the volume, in cubic inches, of this hemisphere?

A. $1{,}500$

B. $6{,}100$

C. $30{,}900$

D. $41{,}200$

ID: c984f1a5 Answer

Correct Answer:

D

Rationale

Choice D is correct. The volume, V, of a sphere is given by $V = \frac{4}{3}\pi r^3$, where r is the radius of the sphere. Since a hemisphere is half of a sphere, it follows that the volume, V, of a hemisphere is given by $V = \left(\frac{1}{2}\right)\left(\frac{4}{3}\right)\pi r^3$, or $V = \frac{2}{3}\pi r^3$. Substituting 27 for r in this formula yields $V = \frac{2}{3}\pi(27)^3$, which gives $V = 13{,}122\pi$, or V is approximately equal to $41{,}223.98$. Therefore, the choice that is closest to the volume, in cubic inches, of this hemisphere is $41{,}200$.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty:

Hard

Question ID acd30391

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Circles	

ID: acd30391

A circle in the *xy*-plane has equation $(x+3)^2+(y-1)^2=25$. Which of the following points does NOT lie in the interior of the circle?

A. $(-7, 3)$

B. $(-3, 1)$

C. $(0, 0)$

D. $(3, 2)$

ID: acd30391 Answer

Correct Answer:
D

Rationale

Choice D is correct. The circle with equation $(x+3)^2+(y-1)^2=25$ has center $(-3,1)$ and radius 5. For a point to be inside of the circle, the distance from that point to the center must be less than the radius, 5. The distance between $(3,2)$ and $(-3,1)$ is $\sqrt{(-3-3)^2+(1-2)^2}=\sqrt{(-6)^2+(-1)^2}=\sqrt{37}$, which is greater than 5. Therefore, $(3,2)$ does NOT lie in the interior of the circle.

Choice A is incorrect. The distance between $(-7,3)$ and $(-3,1)$ is $\sqrt{(-7+3)^2+(3-1)^2}=\sqrt{(-4)^2+(2)^2}=\sqrt{20}$, which is less than 5, and therefore $(-7,3)$ lies in the interior of the circle. Choice B is incorrect because it is the center of the circle. Choice C is incorrect because the distance between $(0,0)$ and $(-3,1)$ is $\sqrt{(0+3)^2+(0-1)^2}=\sqrt{(3)^2+(1)^2}=\sqrt{8}$, which is less than 5, and therefore $(0,0)$ in the interior of the circle.

Question Difficulty:
Hard

Question ID 14e7c1f4

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 14e7c1f4

For two acute angles, $\angle Q$ and $\angle R$, $\cos(Q) = \sin(R)$. The measures, in degrees, of $\angle Q$ and $\angle R$ are $x + 61$ and $4x + 4$, respectively. What is the value of x?

A. 5

B. 19

C. 23

D. 29

ID: 14e7c1f4 Answer

Correct Answer:
A

Rationale

Choice A is correct. It's given that for two acute angles, $\angle Q$ and $\angle R$, $\cos(Q) = \sin(R)$. For two acute angles, if the sine of one angle is equal to the cosine of the other angle, the angles are complementary. It follows that $\angle Q$ and $\angle R$ are complementary. That is, the sum of the measures of the angles is 90 degrees. It's given that the measure of $\angle Q$ is $x + 61$ degrees and the measure of $\angle R$ is $4x + 4$ degrees. It follows that $(x + 61) + (4x + 4) = 90$. By combining like terms, this equation can be rewritten as $5x + 65 = 90$. Subtracting 65 from each side of this equation yields $5x = 25$. Dividing each side of this equation by 5 yields $x = 5$.

Choice B is incorrect. This would be the value of x if $\cos(Q) = \cos(R)$ rather than $\cos(Q) = \sin(R)$.

Choice C is incorrect. This would be the value of x if $\cos(Q) = -\cos(R)$ rather than $\cos(Q) = \sin(R)$ and if $\angle R$ were obtuse rather than acute.

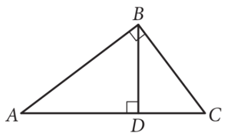
Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty:
Hard

Question ID 6a3fbec3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Lines, angles, and triangles	

ID: 6a3fbec3



Note: Figure not drawn to scale.

In the figure above, $BD = 6$ and $AD = 8$.

What is the length of $\overline{DC}$?

ID: 6a3fbec3 Answer

Rationale

The correct answer is 4.5. According to the properties of right triangles, BD divides triangle ABC into two similar triangles, ABD and BCD. The corresponding sides of ABD and BCD are proportional, so the ratio of BD to AD is the same as the ratio of DC to BD. Expressing this information as a proportion gives $\frac{6}{8} = \frac{DC}{6}$. Solving the proportion for DC results in $DC = 4.5$. Note that 4.5 and 9/2 are examples of ways to enter a correct answer.

Question Difficulty:
Hard

Question ID 459dd6c5

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 459dd6c5

Triangles ABC and DEF are similar. Each side length of triangle ABC is 4 times the corresponding side length of triangle DEF. The area of triangle ABC is 270 square inches. What is the area, in square inches, of triangle DEF?

ID: 459dd6c5 Answer

Correct Answer:

135/8, 16.87, 16.88

Rationale

The correct answer is $\frac{135}{8}$. It's given that triangles ABC and DEF are similar and each side length of triangle ABC is 4 times the corresponding side length of triangle DEF. For two similar triangles, if each side length of the first triangle is k times the corresponding side length of the second triangle, then the area of the first triangle is k^2 times the area of the second triangle. Therefore, the area of triangle ABC is 4^2, or 16, times the area of triangle DEF. It's given that the area of triangle ABC is 270 square inches. Let a represent the area, in square inches, of triangle DEF. It follows that 270 is 16 times a, or $270 = 16a$. Dividing both sides of this equation by 16 yields $\frac{270}{16} = a$, which is equivalent to $\frac{135}{8} = a$. Thus, the area, in square inches, of triangle DEF is $\frac{135}{8}$. Note that 135/8, 16.87, and 16.88 are examples of ways to enter a correct answer.

Question Difficulty:

Hard

Question ID 25da87f8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Right triangles and trigonometry	

ID: 25da87f8

A triangle with angle measures 30°, 60°, and 90° has a perimeter of $18+6\sqrt{3}$. What is the length of the longest side of the triangle?

ID: 25da87f8 Answer

Rationale

The correct answer is 12. It is given that the triangle has angle measures of 30°, 60°, and 90°, and so the triangle is a special right triangle. The side measures of this type of special triangle are in the ratio $2:1:\sqrt{3}$. If x is the measure of the shortest leg, then the measure of the other leg is $\sqrt{3}x$ and the measure of the hypotenuse is 2x. The perimeter of the triangle is given to be $18+6\sqrt{3}$, and so the equation for the perimeter can be written as $2x+x+\sqrt{3}x=18+6\sqrt{3}$. Combining like terms and factoring out a common factor of x on the left-hand side of the equation gives $(3+\sqrt{3})x=18+6\sqrt{3}$. Rewriting the right-hand side of the equation by factoring out 6 gives $(3+\sqrt{3})x=6(3+\sqrt{3})$. Dividing both sides of the equation by the common factor $(3+\sqrt{3})$ gives x = 6. The longest side of the right triangle, the hypotenuse, has a length of 2x, or 2(6), which is 12.

Question Difficulty:
Hard

Question ID 310c87fe

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Geometry and Trigonometry	Area and volume	

ID: 310c87fe

A cube has a surface area of 54 square meters. What is the volume, in cubic meters, of the cube?

A. 18

B. 27

C. 36

D. 81

ID: 310c87fe Answer

Correct Answer:
B

Rationale

Choice B is correct. The surface area of a cube with side length s is equal to $6s^2$. Since the surface area is given as 54 square meters, the equation $54 = 6s^2$ can be used to solve for s. Dividing both sides of the equation by 6 yields $9 = s^2$. Taking the square root of both sides of this equation yields $3 = s$ and $-3 = s$. Since the side length of a cube must be a positive value, $s = -3$ can be discarded as a possible solution, leaving $s = 3$. The volume of a cube with side length s is equal to s^3. Therefore, the volume of this cube, in cubic meters, is 3^3, or 27.

Choices A, C, and D are incorrect and may result from calculation errors.

Question Difficulty:
Hard