Question ID 3cdbf026

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

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 $y = -\dfrac{ax}{k} + \dfrac{6}{k}$. One of the given points, $(0, -3)$, is the y-intercept. Thus, the y-coordinate of the y-intercept -3 must be equal to $\dfrac{6}{k}$. 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 fdee0fbf

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

3.2

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 ?

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 0b46bad5

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

3.3

$$ax + by = b$$

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.

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.
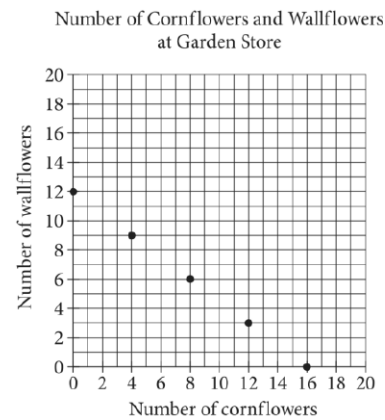
Question Difficulty: Hard

Question ID c362c210

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

Number of Cornflowers and Wallflowers at Garden Store

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 98d3393a

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

3.5

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. $-\dfrac{1}{2}$

C. -2

D. The slope of line ℓ is undefined.

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 $-\dfrac{1}{2}$ 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 $\dfrac{1}{2}$. However, the line with equation x = 2 has undefined slope (not slope of $\dfrac{1}{2}$). 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 0366d965

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

3.6

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.
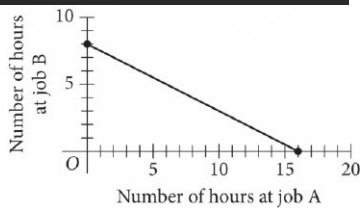
Question Difficulty: Hard

Question ID c4ea43ef

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

3.7

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

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 cb58833c

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

ID: cb58833c

3.8

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 a7a14e87

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

3.9

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. $x - y = -3$

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 a1fd2304

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

3.10

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?

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 49800634

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

3.11

x	y
-18	-48
7	52

The table shows two values of x and their corresponding values of y. In the xy-plane, the graph of the linear equation representing this relationship passes through the point $\left(\frac{1}{7}, a\right)$. What is the value of a?

A. $-\frac{4}{11}$

B. $-\frac{4}{77}$

C. $\frac{4}{7}$

D. $\frac{172}{7}$

Correct Answer: D

Rationale

Choice D is correct. The linear relationship between x and y can be represented by the equation $y = mx + b$, where m is the slope of the graph of this equation in the xy-plane and b is the y-coordinate of the y-intercept. The slope of a line between any two points x_1, y_1 and x_2, y_2 on the line can be calculated using the slope formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. Based on the table, the graph contains the points -18, - 48 and 7, 52. Substituting -18, - 48 and 7, 52 for x_1, y_1 and x_2, y_2, respectively, in the slope formula yields $m = \frac{52 - -48}{7 - -18}$, which is equivalent to $m = \frac{100}{25}$, or $m = 4$. Substituting 4 for m, -18 for x, and -48 for y in the equation $y = mx + b$ yields -48 = 4-18 + b, or -48 = - 72 + b. Adding 72 to both sides of this equation yields 24 = b. Therefore, $m = 4$ and $b = 24$. Substituting 4 for m and 24 for b in the equation $y = mx + b$ yields $y = 4x + 24$. Thus, the equation $y = 4x + 24$ represents the linear relationship between x and y. It's also given that the graph of the linear equation representing this relationship in the xy-plane passes through the point $\frac{1}{7}, a$. Substituting $\frac{1}{7}$ for x and a for y in the equation $y = 4x + 24$ yields $a = 4\frac{1}{7} + 24$, which is equivalent to $a = \frac{4}{7} + \frac{168}{7}$, or $a = \frac{172}{7}$.

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

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

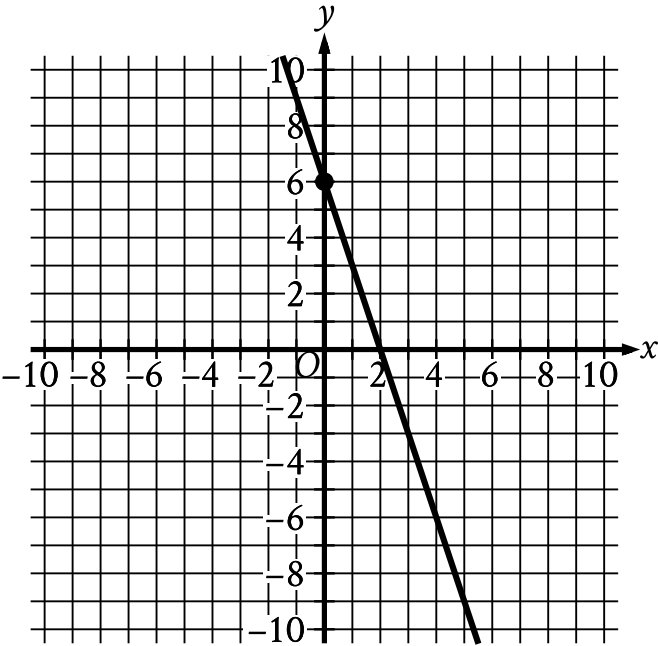Choice C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 5b7599a6

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

3.12

The graph shows a linear relationship between x and y. Which equation represents this relationship, where R is a positive constant?

A. $Rx + 18y = 36$

B. $Rx - 18y = -36$

C. $18x + Ry = 36$

D. $18x - Ry = -36$

Correct Answer: C

Rationale

Choice C is correct. The equation representing the linear relationship shown can be written in slope-intercept form $y = mx + b$, where m is the slope and $0, b$ is the y-intercept of the line. The line shown passes through the points $0, 6$ and $2, 0$. Given two points on a line, x_1, y_1 and x_2, y_2, the slope of the line can be calculated using the equation $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting $0, 6$ and $2, 0$ for x_1, y_1 and x_2, y_2, respectively, in this equation yields $m = \frac{0 - 6}{2 - 0}$, which is equivalent to $m = -\frac{6}{2}$, or $m = -3$. Since $0, 6$ is the y-intercept, it follows that $b = 6$. Substituting -3 for m and 6 for b in the equation $y = mx + b$ yields $y = -3x + 6$. Adding $3x$ to both sides of this equation yields $3x + y = 6$. Multiplying this equation by 6 yields $18x + 6y = 36$. It follows that the equation $18x + Ry = 36$, where R is a positive constant, represents this relationship.

Choice A is incorrect. The graph of this relationship passes through the point $0, 2$, not $0, 6$.

Choice B is incorrect. The graph of this relationship passes through the point $0, 2$, not $0, 6$.

Choice D is incorrect. The graph of this relationship passes through the point $-2, 0$, not $2, 0$.

Question Difficulty: Hard

Question ID 184ce5aa

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

3.13

Line h is defined by $\frac{1}{5}x + \frac{1}{7}y - 70 = 0$. Line j is perpendicular to line h in the xy-plane. What is the slope of line j?

A. $-\frac{7}{5}$

B. $-\frac{5}{7}$

C. $\frac{7}{5}$

D. $\frac{5}{7}$

Correct Answer: D

Rationale

Choice D is correct. It's given that line h is defined by $\frac{1}{5}x + \frac{1}{7}y$ - 70 = 0. This equation can be written in slope-intercept form $y = mx + b$, where m is the slope of line h and b is the y-coordinate of the y-intercept of line h. Adding 70 to both sides of $\frac{1}{5}x + \frac{1}{7}y$ - 70 = 0 yields $\frac{1}{5}x + \frac{1}{7}y = 70$. Subtracting $\frac{1}{5}x$ from both sides of this equation yields $\frac{1}{7}y = -\frac{1}{5}x + 70$. Multiplying both sides of this equation by 7 yields $y = -\frac{7}{5}x + 490$. Therefore, the slope of line h is $-\frac{7}{5}$. It's given that line j is perpendicular to line h in the xy-plane. Two lines are perpendicular if their slopes are negative reciprocals, meaning that the slope of the first line is equal to -1 divided by the slope of the second line. Therefore, the slope of line j is the negative reciprocal of the slope of line h. The negative reciprocal of $-\frac{7}{5}$ is $\frac{-1}{-\frac{7}{5}}$, or $\frac{5}{7}$. Therefore, the slope of line j is $\frac{5}{7}$.

Choice A is incorrect. This is the slope of a line in the xy-plane that is parallel, not perpendicular, to line h.

Choice B is incorrect. This is the reciprocal, not the negative reciprocal, of $-\frac{7}{5}$.

Choice C is incorrect. This is the negative, not the negative reciprocal, of $-\frac{7}{5}$.

Question Difficulty: Hard

Question ID d0e614a6

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

3.14

$\frac{3}{5}x + \frac{3}{4}y = 7$ Which table gives three values of x and their corresponding values of y for the given equation?

A.

x	y
1	$\frac{113}{20}$
2	$\frac{101}{20}$
4	$\frac{77}{20}$

B.

x	y
1	$\frac{47}{5}$
2	$\frac{44}{5}$
4	$\frac{38}{5}$

C.

x	y
1	$\frac{148}{15}$
2	$\frac{136}{15}$
4	$\frac{112}{15}$

D.

x	y
1	$\frac{128}{15}$
2	$\frac{116}{15}$
4	$\frac{92}{15}$

Correct Answer: D

Rationale

Choice D is correct. Each of the tables gives the same three values of x: 1, 2, and 4. Substituting 1 for x in the given equation yields $\frac{3}{5}1 + \frac{3}{4}y = 7$, or $\frac{3}{5} + \frac{3}{4}y = \frac{35}{5}$. Subtracting $\frac{3}{5}$ from both sides of this equation yields $\frac{3}{4}y = \frac{32}{5}$. Multiplying both sides of this equation by $\frac{4}{3}$ yields $y = \frac{128}{15}$. Therefore, when $x = 1$, the corresponding value of y for the given equation is $\frac{128}{15}$. Substituting 2 for x in the given equation yields $\frac{3}{5}2 + \frac{3}{4}y = 7$, or $\frac{6}{5} + \frac{3}{4}y = \frac{35}{5}$. Subtracting $\frac{6}{5}$ from both sides of this equation yields $\frac{3}{4}y = \frac{29}{5}$. Multiplying both sides of this equation by $\frac{4}{3}$ yields $y = \frac{116}{15}$. Therefore, when $x = 2$, the corresponding value of y for the given equation is $\frac{116}{15}$. Substituting 4 for x in the given equation yields $\frac{3}{5}4 + \frac{3}{4}y = 7$, or $\frac{12}{5} + \frac{3}{4}y = \frac{35}{5}$. Subtracting $\frac{12}{5}$ from both sides of this equation yields $\frac{3}{4}y = \frac{23}{5}$. Multiplying both sides of this equation by $\frac{4}{3}$ yields $y = \frac{92}{15}$. Therefore, when $x = 4$, the corresponding value of y for the given equation is $\frac{92}{15}$. The table in choice D gives x-values of 1, 2, and 4 and corresponding y-values of $\frac{128}{15}$, $\frac{116}{15}$, and $\frac{92}{15}$, respectively. Therefore, the table in choice D gives three values of x and their corresponding values of y for the given equation.

Choice A is incorrect. This table gives three values of x and their corresponding values of y for the equation $\frac{3}{5}x + \frac{3}{4} + y = 7$.

Choice B is incorrect. This table gives three values of x and their corresponding values of y for the equation $\frac{3}{5}x + y = 10$.

Choice C is incorrect. This table gives three values of x and their corresponding values of y for the equation $\frac{3}{5}x + \frac{3}{4}y = 8$.

Question Difficulty: Hard