

Question ID 1d9a6078

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 1d9a6078

$$\begin{aligned} 48x - 72y &= 30y + 24 \\ ry &= \frac{1}{6} - 16x \end{aligned}$$

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

ID: 1d9a6078 Answer

Correct Answer: -34

Rationale

The correct answer is -34. 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 distinct and parallel. Two lines represented by equations in standard form $Ax + By = C$, where A , B , and C are constants, are parallel if the coefficients for x and y in one equation are proportional to the corresponding coefficients in the other equation. The first equation in the given system can be written in standard form by subtracting $30y$ from both sides of the equation to yield $48x - 102y = 24$. The second equation in the given system can be written in standard form by adding $16x$ to both sides of the equation to yield $16x + ry = \frac{1}{6}$. The coefficient of x in this second equation, 16 , is $\frac{1}{3}$ times the coefficient of x in the first equation, 48 . For the lines to be parallel the coefficient of y in the second equation, r , must also be $\frac{1}{3}$ times the coefficient of y in the first equation, -102 . Thus, $r = \frac{1}{3}(-102)$, or $r = -34$. Therefore, if the given system has no solution, the value of r is -34.

Question Difficulty: Hard

Question ID 9d50428c

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 9d50428c

Which of the following systems of linear equations has no solution?

- A. $x = 3$
 $y = 5$
- B. $y = 6x + 6$
 $y = 5x + 6$
- C. $y = 16x + 3$
 $y = 16x + 19$
- D. $y = 5$
 $y = 5x + 5$

ID: 9d50428c Answer

Correct Answer: C

Rationale

Choice C is correct. A system of two linear equations in two variables, x and y , has no solution if the graphs of the lines represented by the equations in the xy -plane are distinct and parallel. The graphs of two lines in the xy -plane represented by equations in slope-intercept form, $y = mx + b$, where m and b are constants, are parallel if their slopes, m , are the same and are distinct if their y -coordinates of the y -intercepts, b , are different. In the equations $y = 16x + 3$ and $y = 16x + 19$, the values of m are each 16, and the values of b are 3 and 19, respectively. Since the slopes of these lines are the same, and the y -coordinates of the y -intercepts are different, it follows that the system of linear equations in choice C has no solution.

Choice A is incorrect. The lines represented by the equations in this system are a vertical line and a horizontal line. Therefore, this system has a solution, 3, 5, rather than no solution.

Choice B is incorrect. The two lines represented by these equations have different slopes and the same y -coordinate of the y -intercept. Therefore, this system has a solution, 0, 6, rather than no solution.

Choice D is incorrect. The two lines represented by these equations are a horizontal line and a line with a slope of 5 that have the same y -coordinate of the y -intercept. Therefore, this system has a solution, 0, 5, rather than no solution.

Question Difficulty: Hard

Question ID edd6232c

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: edd6232c

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

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

ID: edd6232c 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 $\frac{3}{5}(3)$, 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 25f7665c

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 25f7665c

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

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

ID: 25f7665c 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 2b225f92

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 2b225f92

A bus traveled on the highway and on local roads to complete a trip of **160 miles**. The trip took **4 hours**. The bus traveled at an average speed of **55 miles per hour (mph)** on the highway and an average speed of **25 mph** on local roads. If x is the time, in hours, the bus traveled on the highway and y is the time, in hours, it traveled on local roads, which system of equations represents this situation?

- A. $55x + 25y = 4$
 $x + y = 160$
- B. $55x + 25y = 160$
 $x + y = 4$
- C. $25x + 55y = 4$
 $x + y = 160$
- D. $25x + 55y = 160$
 $x + y = 4$

ID: 2b225f92 Answer

Correct Answer: B

Rationale

Choice B is correct. If the bus traveled at an average speed of 55 miles per hour mph on the highway for x hours, then the bus traveled $55x$ miles on the highway. If the bus traveled at an average speed of 25 mph on local roads for y hours, then the bus traveled $25y$ miles on local roads. It's given that the trip was 160 miles. This can be represented by the equation $55x + 25y = 160$. It's also given that the trip took 4 hours. This can be represented by the equation $x + y = 4$. Therefore, the system consisting of the equations $55x + 25y = 160$ and $x + y = 4$ represents this situation.

Choice A is incorrect. This system of equations represents a situation where the trip was 4 miles and took 160 hours.

Choice C is incorrect. This system of equations represents a situation where the trip was 4 miles and took 160 hours, and the bus traveled at an average speed of 25 mph on the highway and 55 mph on local roads.

Choice D is incorrect. This system of equations represents a situation where the bus traveled at an average speed of 25 mph on the highway and 55 mph on local roads.

Question Difficulty: Hard

Question ID b2d554a4

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: b2d554a4

$$\begin{aligned} 48x - 64y &= 48y + 24 \\ ry &= \frac{1}{8} - 12x \end{aligned}$$

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

ID: b2d554a4 Answer

Correct Answer: -28

Rationale

The correct answer is -28. 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 distinct and parallel. The graphs of two lines in the xy -plane represented by equations in the form $Ax + By = C$, where A , B , and C are constants, are parallel if the coefficients for x and y in one equation are proportional to the corresponding coefficients for x and y in the other equation. The first equation in the given system, $48x - 64y = 48y + 24$, can be written in the form $Ax + By = C$ by subtracting $48y$ from both sides of the equation to yield $48x - 112y = 24$. The second equation in the given system, $ry = \frac{1}{8} - 12x$, can be written in the form $Ax + By = C$ by adding $12x$ to both sides of the equation to yield $12x + ry = \frac{1}{8}$. The coefficient of x in the second equation is $\frac{1}{4}$ times the coefficient of x in the first equation. That is, $48\frac{1}{4} = 12$. For the lines to be parallel, the coefficient of y in the second equation must also be $\frac{1}{4}$ times the coefficient of y in the first equation. Therefore, $-112\frac{1}{4} = r$, or $-28 = r$. Thus, if the given system has no solution, the value of r is -28.

Question Difficulty: Hard

Question ID f55b70f4

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: f55b70f4

A wire with a length of **106** inches is cut into two parts. One part has a length of x inches, and the other part has a length of y inches. The value of x is **6** more than **4** times the value of y . What is the value of x ?

- A. **25**
- B. **28**
- C. **56**
- D. **86**

ID: f55b70f4 Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that a wire with a length of 106 inches is cut into two parts. It's also given that one part has a length of x inches and the other part has a length of y inches. This can be represented by the equation $x + y = 106$. It's also given that the value of x is 6 more than 4 times the value of y . This can be represented by the equation $x = 4y + 6$. Substituting $4y + 6$ for x in the equation $x + y = 106$ yields $4y + 6 + y = 106$, or $5y + 6 = 106$. Subtracting 6 from each side of this equation yields $5y = 100$. Dividing each side of this equation by 5 yields $y = 20$. Substituting 20 for y in the equation $x = 4y + 6$ yields $x = 4(20) + 6$, or $x = 86$.

Choice A is incorrect. This value represents less than half of the total length of 106 inches; however, x represents the length of the longer part of the wire, since it's given that the value of x is 6 more than 4 times the value of y .

Choice B is incorrect. This value represents less than half of the total length of 106 inches; however, x represents the length of the longer part of the wire, since it's given that the value of x is 6 more than 4 times the value of y .

Choice C is incorrect. This represents a part that is 6 more than the length of the other part, rather than 6 more than 4 times the length of the other part.

Question Difficulty: Hard

Question ID 46be5680

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 46be5680

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: 46be5680 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 $5.50r6.5 + 3.00b6.5 = 37.006.5$, or $35.75r + 19.5b = 240.5$. Multiplying both sides of the equation for store B by 5.5 yields $6.50r5.5 + 8.00b5.5 = 66.005.5$, 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 equation by 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 4ca7a295

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 4ca7a295

$$\begin{aligned} -12x + 14y &= 36 \\ -6x + 7y &= -18 \end{aligned}$$

How many solutions does the given system of equations have?

- A. Exactly one
- B. Exactly two
- C. Infinitely many
- D. Zero

ID: 4ca7a295 Answer

Correct Answer: D

Rationale

Choice D is correct. A system of two linear equations in two variables, x and y , has zero solutions if the lines representing the equations in the xy -plane are distinct and parallel. Two lines are distinct and parallel if they have the same slope but different y -intercepts. Each equation in the given system can be written in slope-intercept form $y = mx + b$, where m is the slope of the line representing the equation in the xy -plane and b is the y -intercept. Adding $12x$ to both sides of the first equation in the given system of equations, $-12x + 14y = 36$, yields $14y = 12x + 36$. Dividing both sides of this equation by 14 yields $y = \frac{6}{7}x + \frac{18}{7}$. It follows that the first equation in the given system of equations has a slope of $\frac{6}{7}$ and a y -intercept of $0, \frac{18}{7}$. Adding $6x$ to both sides of the second equation in the given system of equations, $-6x + 7y = -18$, yields $7y = 6x - 18$. Dividing both sides of this equation by 7 yields $y = \frac{6}{7}x - \frac{18}{7}$. It follows that the second equation in the given system of equations has a slope of $\frac{6}{7}$ and a y -intercept of $0, -\frac{18}{7}$. Since the slopes of these lines are the same and the y -intercepts are different, it follows that the given system of equations has zero solutions.

Alternate approach: To solve the system by elimination, multiplying the second equation in the given system of equations, $-6x + 7y = -18$, by -2 yields $12x - 14y = 36$. Adding this equation to the first equation in the given system of equations, $-12x + 14y = 36$, yields $(-12x + 12x) + (-14y + 14y) = 36 + 36$, or $0 = 72$. Since this equation isn't true, the given system of equations has zero 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 C is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Hard

Question ID 2d54169d

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 2d54169d

A piece of wire with a length of **32** inches is cut into two parts. One part has a length of x inches, and the other part has a length of y inches. The value of x is **4** more than **3** times the value of y . What is the value of x ?

ID: 2d54169d Answer

Correct Answer: 25

Rationale

The correct answer is 25. It's given that a piece of wire has a length of 32 inches and is cut into two parts. It's also given that one part has a length of x inches and the other part has a length of y inches. It follows that the equation $x + y = 32$ represents this situation. It's also given that the value of x is 4 more than 3 times the value of y , or $x = 3y + 4$. Substituting $3y + 4$ for x in the equation $x + y = 32$ yields $3y + 4 + y = 32$. Combining like terms on the left-hand side of this equation yields $4y + 4 = 32$. Subtracting 4 from both sides of this equation yields $4y = 28$. Dividing both sides of this equation by 4 yields $y = 7$. Substituting 7 for y in the equation $x = 3y + 4$ yields $x = 3 (7) + 4$, or $x = 25$. Therefore, the value of x is 25.

Question Difficulty: Hard

Question ID df3b20f0

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: df3b20f0

$$\begin{aligned}y &= 4x + 1 \\ 4y &= 15x - 8\end{aligned}$$

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

ID: df3b20f0 Answer

Correct Answer: 35

Rationale

The correct answer is 35. The first equation in the given system of equations defines y as $4x + 1$. Substituting $4x + 1$ for y in the second equation in the given system of equations yields $4(4x + 1) = 15x - 8$. Applying the distributive property on the left-hand side of this equation yields $16x + 4 = 15x - 8$. Subtracting $15x$ from each side of this equation yields $x + 4 = -8$. Subtracting 4 from each side of this equation yields $x = -12$. Substituting -12 for x in the first equation of the given system of equations yields $y = 4(-12) + 1$, or $y = -47$. Substituting -12 for x and -47 for y into the expression $x - y$ yields $-12 - (-47)$, or 35.

Question Difficulty: Hard

Question ID 1ef88808

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 1ef88808

$$x + 3 = -2y + 5$$
$$x - 3 = 2y + 7$$

The solution to the given system of equations is (x, y) . What is the value of $2x$?

- A. **−2**
- B. **6**
- C. **12**
- D. **24**

ID: 1ef88808 Answer

Correct Answer: C

Rationale

Choice C is correct. Adding the second equation in the given system to the first equation in the given system yields $x + 3 + x - 3 = -2y + 5 + 2y + 7$. Adding like terms in this equation yields $2x = 12$. Thus, the value of $2x$ is 12.

Choice A is incorrect. This is the value of y , not $2x$.

Choice B is incorrect. This is the value of x , not $2x$.

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

Question Difficulty: Hard

Question ID 1a85e94a

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 1a85e94a

$$\begin{aligned}8x + 7y &= 9 \\ 24x + 21y &= 27\end{aligned}$$

For each real number r , which of the following points lies on the graph of each equation in the xy -plane for the given system?

- A. $(r, -\frac{8r}{7} + \frac{9}{7})$
- B. $(-\frac{8r}{7} + \frac{9}{7}, r)$
- C. $(-\frac{8r}{7} + 9, \frac{8r}{7} + 27)$
- D. $(\frac{r}{3} + 9, -\frac{r}{3} + 27)$

ID: 1a85e94a Answer

Correct Answer: A

Rationale

Choice A is correct. Dividing both sides of the second equation in the given system by 3 yields $8x + 7y = 9$, which is the first equation in the given system. Therefore, the first and second equations represent the same line in the xy -plane. If the x - and y -coordinates of a point satisfy an equation, the point lies on the graph of the equation in the xy -plane. Choice A is a point with x -coordinate r and y -coordinate $-\frac{8r}{7} + \frac{9}{7}$. Substituting r for x and $-\frac{8r}{7} + \frac{9}{7}$ for y in the equation $8x + 7y = 9$ yields $8r + 7(-\frac{8r}{7} + \frac{9}{7}) = 9$. Applying the distributive property to the left-hand side of this equation yields $8r - 8r + 9 = 9$. Combining like terms on the left-hand side of this equation yields $9 = 9$, so the coordinates of the point $r, -\frac{8r}{7} + \frac{9}{7}$ satisfy both equations in the given system. Therefore, for each real number r , the point $r, -\frac{8r}{7} + \frac{9}{7}$ lies on the graph of each equation in the xy -plane for the given system.

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 73da0278

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 73da0278

The combined original price for a mirror and a vase is **\$60**. After a **25%** discount to the mirror and a **45%** discount to the vase are applied, the combined sale price for the two items is **\$39**. Which system of equations gives the original price m , in dollars, of the mirror and the original price v , in dollars, of the vase?

- A. $m + v = 60$
 $0.55m + 0.75v = 39$
- B. $m + v = 60$
 $0.45m + 0.25v = 39$
- C. $m + v = 60$
 $0.75m + 0.55v = 39$
- D. $m + v = 60$
 $0.25m + 0.45v = 39$

ID: 73da0278 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that m represents the original price, in dollars, of the mirror, and v represents the original price, in dollars, of the vase. It's also given that the combined original price for the mirror and the vase is \$ 60. This can be represented by the equation $m + v = 60$. After a 25% discount to the mirror is applied, the sale price of the mirror is 75% of its original price. This can be represented by the expression $0.75m$. After a 45% discount to the vase is applied, the sale price of the vase is 55% of its original price. This can be represented by the expression $0.55v$. It's given that the combined sale price for the two items is \$ 39. This can be represented by the equation $0.75m + 0.55v = 39$. Therefore, the system of equations consisting of the equations $m + v = 60$ and $0.75m + 0.55v = 39$ gives the original price m , in dollars, of the mirror and the original price v , in dollars, of the vase.

Choice A is incorrect. The second equation in this system of equations represents a 45% discount to the mirror and a 25% discount to the vase.

Choice B is incorrect. The second equation in this system of equations represents a 55% discount to the mirror and a 75% discount to the vase.

Choice D is incorrect. The second equation in this system of equations represents a 75% discount to the mirror and a 55% discount to the vase.

Question Difficulty: Hard

Question ID 58d03572

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 58d03572

$$\begin{aligned}\frac{7}{8}y - \frac{5}{8}x &= \frac{4}{7} - \frac{7}{8}y \\ \frac{5}{4}x + \frac{7}{4} &= py + \frac{15}{4}\end{aligned}$$

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

ID: 58d03572 Answer

Correct Answer: 3.5, 7/2

Rationale

The correct answer is $\frac{7}{2}$. 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 distinct and parallel. Two lines represented by equations in standard form $Ax + By = C$, where A , B , and C are constants, are parallel if the coefficients for x and y in one equation are proportional to the corresponding coefficients in the other equation. The first equation in the given system, $\frac{7}{8}y - \frac{5}{8}x = \frac{4}{7} - \frac{7}{8}y$, can be written in standard form by adding $\frac{7}{8}y$ to both sides of the equation, which yields $\frac{14}{8}y - \frac{5}{8}x = \frac{4}{7}$, or $-\frac{5}{8}x + \frac{14}{8}y = \frac{4}{7}$. Multiplying each term in this equation by -8 yields $5x - 14y = -\frac{32}{7}$. The second equation in the given system, $\frac{5}{4}x + \frac{7}{4} = py + \frac{15}{4}$, can be written in standard form by subtracting $\frac{7}{4}$ and py from both sides of the equation, which yields $\frac{5}{4}x - py = \frac{8}{4}$. Multiplying each term in this equation by 4 yields $5x - 4py = 8$. The coefficient of x in the first equation, $5x - 14y = -\frac{32}{7}$, is equal to the coefficient of x in the second equation, $5x - 4py = 8$. For the lines to be parallel, and for the coefficients for x and y in one equation to be proportional to the corresponding coefficients in the other equation, the coefficient of y in the second equation must also be equal to the coefficient of y in the first equation. Therefore, $-14 = -4p$. Dividing both sides of this equation by -4 yields $\frac{-14}{-4} = p$, or $p = \frac{7}{2}$. Therefore, if the given system of equations has no solution, the value of p is $\frac{7}{2}$. Note that $7/2$ and 3.5 are examples of ways to enter a correct answer.

Question Difficulty: Hard

Question ID 652cb78d

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 652cb78d

$$\begin{aligned}2x + 3y &= 7 \\ 10x + 15y &= 35\end{aligned}$$

For each real number r , which of the following points lies on the graph of each equation in the xy -plane for the given system?

- A. $(\frac{r}{5} + 7, -\frac{r}{5} + 35)$
- B. $(-\frac{3r}{2} + \frac{7}{2}, r)$
- C. $(r, \frac{2r}{3} + \frac{7}{3})$
- D. $(r, -\frac{3r}{2} + \frac{7}{2})$

ID: 652cb78d Answer

Correct Answer: B

Rationale

Choice B is correct. The two given equations are equivalent because the second equation can be obtained from the first equation by multiplying each side of the equation by 5. Thus, the graphs of the equations are coincident, so if a point lies on the graph of one of the equations, it also lies on the graph of the other equation. A point x, y lies on the graph of an equation in the xy -plane if and only if this point represents a solution to the equation. It is sufficient, therefore, to find the point that represents a solution to the first given equation. Substituting the x - and y -coordinates of choice B, $-\frac{3r}{2} + \frac{7}{2}$ and r , for x and y , respectively, in the first equation yields $2(-\frac{3r}{2} + \frac{7}{2}) + 3r = 7$, which is equivalent to $-3r + 7 + 3r = 7$, or $7 = 7$. Therefore, the point $-\frac{3r}{2} + \frac{7}{2}, r$ represents a solution to the first equation and thus lies on the graph of each equation in the xy -plane for the given system.

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 551de84f

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 551de84f

Which of the following systems of linear equations has no solution?

- A. $y = 6x + 3$
 $y = 6x + 9$
- B. $y = 10$
 $y = 10x + 10$
- C. $y = 14x + 14$
 $y = 10x + 14$
- D. $x = 3$
 $y = 10$

ID: 551de84f Answer

Correct Answer: A

Rationale

Choice A is correct. A system of two linear equations in two variables, x and y , has no solution if the graphs of the lines represented by the equations in the xy -plane are distinct and parallel. The graphs of two lines in the xy -plane represented by equations in slope-intercept form, $y = mx + b$, where m and b are constants, are parallel if their slopes, m , are the same and are distinct if their y -coordinates of the y -intercepts, b , are different. In the equations $y = 6x + 3$ and $y = 6x + 9$, the values of m are each 6, and the values of b are 3 and 9, respectively. Since the slopes of these lines are the same and the y -coordinates of the y -intercepts are different, it follows that the system of linear equations in choice A has no solution.

Choice B is incorrect. The two lines represented by these equations are a horizontal line and a line with a slope of 10 that have the same y -coordinate of the y -intercept. Therefore, this system has a solution, 0, 10, rather than no solution.

Choice C is incorrect. The two lines represented by these equations have different slopes and the same y -coordinate of the y -intercept. Therefore, this system has a solution, 0, 14, rather than no solution.

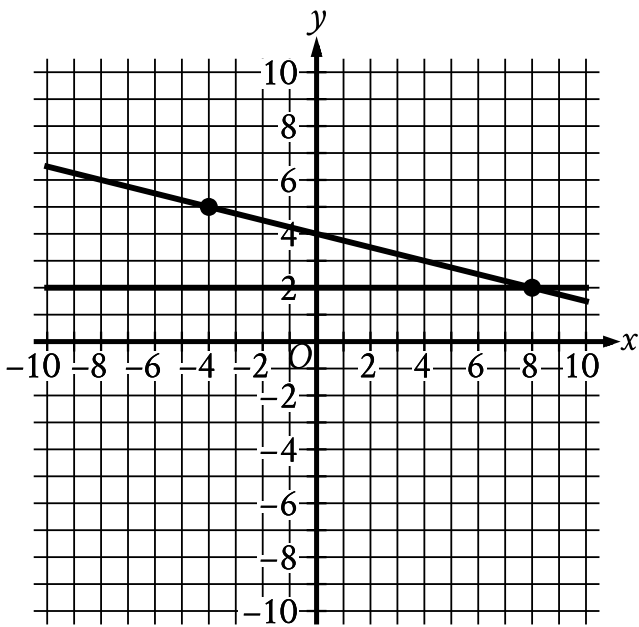
Choice D is incorrect. The two lines represented by these equations are a vertical line and a horizontal line. Therefore, this system has a solution, 3, 10, rather than no solution.

Question Difficulty: Hard

Question ID ffe7118f

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: ffe7118f



If a new graph of three linear equations is created using the system of equations shown and the equation $x + 4y = -16$, how many solutions (x, y) will the resulting system of three equations have?

- A. Zero
- B. Exactly one
- C. Exactly two
- D. Infinitely many

ID: ffe7118f Answer

Correct Answer: A

Rationale

Choice A is correct. A solution to a system of equations must satisfy each equation in the system. It follows that if an ordered pair x, y is a solution to the system, the point x, y lies on the graph in the xy -plane of each equation in the system. The only point that lies on each graph of the system of two linear equations shown is their intersection point 8, 2. It follows that if a new graph of three linear equations is created using the system of equations shown and the graph of $x + 4y = -16$, this system has either zero solutions or one solution, the point 8, 2. Substituting 8 for x and 2 for y in the equation $x + 4y = -16$ yields $8 + 4(2) = -16$, or $16 = -16$. Since this equation is not true, the point 8, 2 does not lie on the graph of $x + 4y = -16$. Therefore, 8, 2 is not a solution to the system of three equations. It follows that there are zero solutions to this system.

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 cf9a5572

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: cf9a5572

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

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

ID: cf9a5572 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.

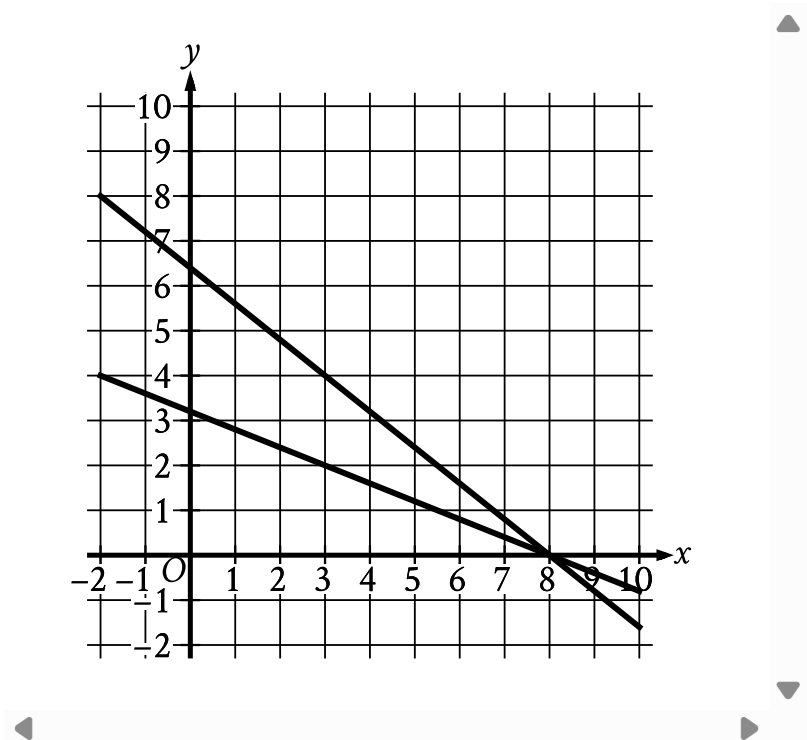
Alternate approach: A system of two linear equations in two variables, x and y , has no solution if the lines represented by the equations in the xy -plane are parallel and distinct. Lines represented by equations in the form $Ax + By = C$, where A , B , and C are constant terms, are parallel if the 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 $ty - 2x = \frac{1}{2} + 2x - 2x$, 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 $\frac{\frac{1}{2}}{2}$, 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 $-\frac{1}{2} \cdot -16 = -\frac{t}{16} \cdot -16$, 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 5d5d0dc7

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 5d5d0dc7



What system of linear equations is represented by the lines shown?

- A. $8x + 4y = 32$
 $-10x - 4y = -64$
- B. $8x - 4y = 32$
 $-10x + 4y = -64$
- C. $4x - 10y = 32$
 $-8x + 10y = -64$
- D. $4x + 10y = 32$
 $-8x - 10y = -64$

ID: 5d5d0dc7 Answer

Correct Answer: D

Rationale

Choice D is correct. A line in the xy -plane that passes through the points x_1, y_1 and x_2, y_2 has slope m , where $m = \frac{y_2 - y_1}{x_2 - x_1}$, and can be defined by an equation of the form $y - y_1 = m(x - x_1)$. One of the lines shown in the graph passes through the points 8, 0 and 3, 4. Substituting 8 for x_1 , 0 for y_1 , 3 for x_2 , and 4 for y_2 in the equation $m = \frac{y_2 - y_1}{x_2 - x_1}$ yields $m = \frac{4 - 0}{3 - 8}$, or $m = -\frac{4}{5}$. Substituting $-\frac{4}{5}$ for m , 8 for x_1 and 0 for y_1 in the equation $y - y_1 = m(x - x_1)$ yields $y - 0 = -\frac{4}{5}(x - 8)$, which is equivalent to $y = -\frac{4}{5}x + \frac{32}{5}$. Adding $\frac{4}{5}x$ to both sides

of this equation yields $\frac{4}{5}x + y = \frac{32}{5}$. Multiplying both sides of this equation by -10 yields $-8x - 10y = -64$. Therefore, an equation of this line is $-8x - 10y = -64$. Similarly, the other line shown in the graph passes through the points 8, 0 and 3, 2. Substituting 8 for x_1 , 0 for y_1 , 3 for x_2 , and 2 for y_2 in the equation $m = \frac{y_2 - y_1}{x_2 - x_1}$ yields $m = \frac{2 - 0}{3 - 8}$, or $m = -\frac{2}{5}$. Substituting $-\frac{2}{5}$ for m , 8 for x_1 , and 0 for y_1 in the equation $y - y_1 = mx - x_1$ yields $y - 0 = -\frac{2}{5}x - 8$, which is equivalent to $y = -\frac{2}{5}x + \frac{16}{5}$. Adding $\frac{2}{5}x$ to both sides of this equation yields $\frac{2}{5}x + y = \frac{16}{5}$. Multiplying both sides of this equation by 10 yields $4x + 10y = 32$. Therefore, an equation of this line is $4x + 10y = 32$. So, the system of linear equations represented by the lines shown is $4x + 10y = 32$ and $-8x - 10y = -64$.

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 6bee1d56

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 6bee1d56

$$-15x + 25y = 65$$

One of the two equations in a system of linear equations is given. The system has infinitely many solutions. Which of the following could be the second equation in the system?

- A. $12x + 20y = 52$
- B. $12x + 20y = -52$
- C. $-12x + 20y = 52$
- D. $-12x + 20y = -52$

ID: 6bee1d56 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that the system has infinitely many solutions. A system of two linear equations has infinitely many solutions when the two linear equations are equivalent. Dividing both sides of the given equation by 5 yields $-3x + 5y = 13$. Dividing both sides of choice C by 4 also yields $-3x + 5y = 13$, so choice C is equivalent to the given equation. Thus, choice C could be the second equation in the system.

Choice A is incorrect. The system consisting of this equation and the given equation has one solution, not infinitely many solutions.

Choice B is incorrect. The system consisting of this equation and the given equation has one solution, not infinitely many solutions.

Choice D is incorrect. The system consisting of this equation and the given equation has no solution, not infinitely many solutions.

Question Difficulty: Hard

Question ID 12a4a51b

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 12a4a51b

A proposal for a new library was included on an election ballot. A radio show stated that **3** times as many people voted in favor of the proposal as people who voted against it. A social media post reported that **15,000** more people voted in favor of the proposal than voted against it. Based on these data, how many people voted against the proposal?

- A. **7,500**
- B. **15,000**
- C. **22,500**
- D. **45,000**

ID: 12a4a51b Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that a radio show stated that 3 times as many people voted in favor of the proposal as people who voted against it. Let x represent the number of people who voted against the proposal. It follows that $3x$ is the number of people who voted in favor of the proposal and $3x - x$, or $2x$, is how many more people voted in favor of the proposal than voted against it. It's also given that a social media post reported that 15,000 more people voted in favor of the proposal than voted against it. Thus, $2x = 15,000$. Since $2x = 15,000$, the value of x must be half of 15,000, or 7,500. Therefore, 7,500 people voted against the proposal.

Choice B is incorrect. This is how many more people voted in favor of the proposal than voted against it, not the number of people who voted against the proposal.

Choice C is incorrect. This is the number of people who voted in favor of the proposal, not the number of people who voted against the proposal.

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

Question Difficulty: Hard

Question ID f08b80b6

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: f08b80b6

$$5y = 10x + 11$$

$$-5y = 5x - 21$$

The solution to the given system of equations is (x, y) . What is the value of $30x$?

ID: f08b80b6 Answer

Correct Answer: 20

Rationale

The correct answer is 20. Adding the first equation to the second equation in the given system yields $5y - 5y = 10x + 5x + 11 - 21$, or $0 = 15x - 10$. Adding 10 to both sides of this equation yields $10 = 15x$. Multiplying both sides of this equation by 2 yields $20 = 30x$. Therefore, the value of $30x$ is 20.

Question Difficulty: Hard

Question ID 3f613d99

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 3f613d99

$$\begin{aligned}x + 2y &= 6 \\ x - 2y &= 4\end{aligned}$$

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

- A. 2.5
- B. 5
- C. 6
- D. 10

ID: 3f613d99 Answer

Correct Answer: B

Rationale

Choice B is correct. Adding the first equation to the second equation in the given system yields $x + 2y + x - 2y = 6 + 4$, or $x + x + 2y - 2y = 10$. Combining like terms in this equation yields $2x = 10$. Dividing both sides of this equation by 2 yields $x = 5$. Thus, the value of x is 5.

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. This is the value of $2x$, not x .

Question Difficulty: Hard

Question ID 8bc32738

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 8bc32738

$$y = \frac{1}{3}x - 14$$
$$y = -x + 18$$

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

ID: 8bc32738 Answer

Correct Answer: 24

Rationale

The correct answer is 24. The given system of equations can be solved by the substitution method. The first equation in the given system of equations is $y = \frac{1}{3}x - 14$. Substituting $\frac{1}{3}x - 14$ for y in the second equation in the given system yields $\frac{1}{3}x - 14 = -x + 18$. Adding 14 to both sides of this equation yields $\frac{1}{3}x = -x + 32$. Adding x to both sides of this equation yields $\frac{4}{3}x = 32$. Multiplying both sides of this equation by $\frac{3}{4}$ yields $x = 24$.

Question Difficulty: Hard

Question ID 6f9dabea

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 6f9dabea

$$\begin{aligned}24x + y &= 48 \\ 6x + y &= 72\end{aligned}$$

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

ID: 6f9dabea Answer

Correct Answer: 80

Rationale

The correct answer is 80. Subtracting the second equation in the given system from the first equation yields $24x + y - 6x + y = 48 - 72$, which is equivalent to $24x - 6x + y - y = -24$, or $18x = -24$. Dividing each side of this equation by 3 yields $6x = -8$. Substituting -8 for $6x$ in the second equation yields $-8 + y = 72$. Adding 8 to both sides of this equation yields $y = 80$.

Alternate approach: Multiplying each side of the second equation in the given system by 4 yields $24x + 4y = 288$. Subtracting the first equation in the given system from this equation yields $24x + 4y - 24x + y = 288 - 48$, which is equivalent to $24x - 24x + 4y - y = 240$, or $3y = 240$. Dividing each side of this equation by 3 yields $y = 80$.

Question Difficulty: Hard

Question ID 85059bec

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 85059bec

$$\begin{aligned}6 + 7r &= pw \\ 7r - 5w &= 5w + 11\end{aligned}$$

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

ID: 85059bec Answer

Correct Answer: 10

Rationale

The correct answer is 10. Solving by substitution, the given system of equations, where p is a constant, can be written so that the left-hand side of each equation is equal to $7r$. Subtracting 6 from each side of the first equation in the given system, $6 + 7r = pw$, yields $7r = pw - 6$. Adding $5w$ to each side of the second equation in the given system, $7r - 5w = 5w + 11$, yields $7r = 10w + 11$. Since the left-hand side of each equation is equal to $7r$, setting the the right-hand side of the equations equal to each other yields $pw - 6 = 10w + 11$. A linear equation in one variable, w , has no solution if and only if the equation is false; that is, when there's no value of w that produces a true statement. For the equation $pw - 6 = 10w + 11$, there's no value of w that produces a true statement when $pw = 10w$. Therefore, for the equation $pw - 6 = 10w + 11$, there's no value of w that produces a true statement when the value of p is 10. It follows that in the given system of equations, the system has no solution when the value of p is 10.

Question Difficulty: Hard

Question ID c55794d8

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: c55794d8

A sample of a certain alloy has a total mass of **50.0** grams and is **50.0%** silicon by mass. The sample was created by combining two pieces of different alloys. The first piece was **30.0%** silicon by mass and the second piece was **80.0%** silicon by mass. What was the mass, in grams, of the silicon in the second piece?

- A. **9.0**
- B. **16.0**
- C. **20.0**
- D. **30.0**

ID: c55794d8 Answer

Correct Answer: B

Rationale

Choice B is correct. Let x represent the total mass, in grams, of the first piece, and let y represent the total mass, in grams, of the second piece. It's given that the sample has a total mass of 50.0 grams. Therefore, the equation $x + y = 50.0$ represents this situation. It's also given that the sample is 50.0% silicon by mass. Therefore, the total mass of the silicon in the sample is 0.500×50.0 , or 25.0, grams. It's also given that the first piece was 30.0% silicon by mass and the second piece was 80.0% silicon by mass. Therefore, the masses, in grams, of the silicon in the first and second pieces can be represented by the expressions $0.300x$ and $0.800y$, respectively. Since the sample was created by combining the first and second pieces, and the total mass of the silicon in the sample is 25.0 grams, the equation $0.300x + 0.800y = 25.0$ represents this situation. Subtracting y from both sides of the equation $x + y = 50.0$ yields $x = 50.0 - y$. Substituting $50.0 - y$ for x in the equation $0.300x + 0.800y = 25.0$ yields $0.300(50.0 - y) + 0.800y = 25.0$. Distributing 0.300 on the left-hand side of this equation yields $15.0 - 0.300y + 0.800y = 25.0$. Combining like terms on the left-hand side of this equation yields $15.0 + 0.500y = 25.0$. Subtracting 15.0 from both sides of this equation yields $0.500y = 10.0$. Dividing both sides of this equation by 0.500 yields $y = 20.0$. Substituting 20.0 for y in the expression representing the mass, in grams, of the silicon in the second piece, $0.800y$, yields $0.800(20.0)$, or 16.0. Therefore, the mass, in grams, of the silicon in the second piece is 16.0.

Choice A is incorrect. This is the mass, in grams, of the silicon in the first piece, not the second piece.

Choice C is incorrect. This is the total mass, in grams, of the second piece, not the mass, in grams, of the silicon in the second piece.

Choice D is incorrect. This is the total mass, in grams, of the first piece, not the mass, in grams, of the silicon in the second piece.

Question Difficulty: Hard

Question ID b781b8cc

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: b781b8cc

$$\begin{aligned} 4x - 9y &= 9y + 5 \\ hy &= 2 + 4x \end{aligned}$$

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

- A. -9
- B. 0
- C. 9
- D. 18

ID: b781b8cc Answer

Correct Answer: D

Rationale

Choice D is correct. 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 distinct and parallel. The graphs of two lines in the xy -plane represented by equations in the form $Ax + By = C$, where A , B , and C are constants, are parallel if the coefficients for x and y in one equation are proportional to the corresponding coefficients in the other equation. The first equation in the given system can be written in the form $Ax + By = C$ by subtracting $9y$ from both sides of the equation to yield $4x - 18y = 5$. The second equation in the given system can be written in the form $Ax + By = C$ by subtracting $4x$ from both sides of the equation to yield $-4x + hy = 2$. The coefficient of x in this second equation, -4 , is -1 times the coefficient of x in the first equation, 4 . For the lines to be parallel, the coefficient of y in the second equation, h , must also be -1 times the coefficient of y in the first equation, -18 . Thus, $h = -1 (- 18)$, or $h = 18$. Therefore, if the given system has no solution, the value of h is 18 .

Choice A is incorrect. If the value of h is -9 , then the given system would have one solution, rather than no solution.

Choice B is incorrect. If the value of h is 0 , then the given system would have one solution, rather than no solution.

Choice C is incorrect. If the value of h is 9 , then the given system would have one solution, rather than no solution.

Question Difficulty: Hard

Question ID 8d0a9044

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 8d0a9044

Two customers purchased the same kind of bread and eggs at a store. The first customer paid **12.45** dollars for **1** loaf of bread and **2** dozen eggs. The second customer paid **19.42** dollars for **4** loaves of bread and **1** dozen eggs. What is the cost, in dollars, of **1** dozen eggs?

- A. **3.77**
- B. **3.88**
- C. **4.15**
- D. **4.34**

ID: 8d0a9044 Answer

Correct Answer: D

Rationale

Choice D is correct. Let l represent the cost, in dollars, of 1 loaf of bread, and let d represent the cost, in dollars, of 1 dozen eggs. It's given that the first customer paid 12.45 dollars for 1 loaf of bread and 2 dozen eggs. Therefore, the first customer's purchase can be represented by the equation $l + 2d = 12.45$. It's also given that the second customer paid 19.42 dollars for 4 loaves of bread and 1 dozen eggs. Therefore, the second customer's purchase can be represented by the equation $4l + d = 19.42$. The equations $l + 2d = 12.45$ and $4l + d = 19.42$ form a system of linear equations, which can be solved by elimination to find the value of d . Multiplying the first equation in the system by -4 yields $-4l - 8d = -49.8$. Adding $-4l - 8d = -49.8$ to the second equation, $4l + d = 19.42$, yields $-4l + 4l + -8d + d = -49.8 + 19.42$, which is equivalent to $-7d = -30.38$. Dividing both sides of this equation by -7 yields $d = 4.34$. Therefore, the cost, in dollars, of 1 dozen eggs is 4.34.

Choice A is incorrect. This is the cost, in dollars, of 1 loaf of bread.

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 fb272309

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: fb272309

$$\begin{aligned}ax + by &= 72 \\ 6x + 2by &= 56\end{aligned}$$

In the given system of equations, a and b are constants. The graphs of these equations in the xy -plane intersect at the point $(4, y)$. What is the value of a ?

- A. 3
- B. 4
- C. 6
- D. 14

ID: fb272309 Answer

Correct Answer: D

Rationale

Choice D is correct. It’s given that the graphs of the given system of equations intersect at the point $4, y$. Therefore, $4, y$ is the solution to the given system. Multiplying the first equation in the given system by -2 yields $-2ax - 2by = -144$. Adding this equation to the second equation in the system yields $-2a + 6x + -2b + 2by = -144 + 56$, or $-2a + 6x = -88$. Since $4, y$ is the solution to the system, the value of a can be found by substituting 4 for x in this equation, which yields $-2a + 64 = -88$. Dividing both sides of this equation by 4 yields $-2a + 6 = -22$. Subtracting 6 from both sides of this equation yields $-2a = -28$. Dividing both sides of this equation by -2 yields $a = 14$.

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 a8c506d4

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: a8c506d4

$y = 6x + 18$

One of the equations in a system of two linear equations is given. The system has no solution. Which equation could be the second equation in the system?

- A. $-6x + y = 18$
- B. $-6x + y = 22$
- C. $-12x + y = 36$
- D. $-12x + y = 18$

ID: a8c506d4 Answer

Correct Answer: B

Rationale

Choice B is correct. 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 given equation, $y = 6x + 18$, can be written in standard form by subtracting $6x$ from both sides of the equation to yield $-6x + y = 18$. Therefore, the given equation can be written in the form $Ax + By = C$, where $A = -6$, $B = 1$, and $C = 18$. The equation in choice B, $-6x + y = 22$, is written in the form $Dx + Ey = F$, where $D = -6$, $E = 1$, and $F = 22$. Therefore, $\frac{D}{A} = \frac{-6}{-6} = 1$, $\frac{E}{B} = \frac{1}{1} = 1$, which can be rewritten as $\frac{D}{A} = 1$; $\frac{E}{B} = 1$, which can be rewritten as $\frac{F}{C} = \frac{22}{18}$, which can be rewritten as $\frac{F}{C} = \frac{11}{9}$. Since $\frac{D}{A} = 1$, $\frac{E}{B} = 1$, and $\frac{F}{C}$ is not equal to 1, it follows that the given equation and the equation $-6x + y = 22$ are parallel and distinct. Therefore, a system of two linear equations consisting of the given equation and the equation $-6x + y = 22$ has no solution. Thus, the equation in choice B could be the second equation in the system.

Choice A is incorrect. The equation $-6x + y = 18$ and the given equation represent the same line in the xy -plane. Therefore, a system of these linear equations would have infinitely many solutions, rather than no solution.

Choice C is incorrect. The equation $-12x + y = 36$ and the given equation represent lines in the xy -plane that are distinct and not parallel. Therefore, a system of these linear equations would have exactly one solution, rather than no solution.

Choice D is incorrect. The equation $-12x + y = 18$ and the given equation represent lines in the xy -plane that are distinct and not parallel. Therefore, a system of these linear equations would have exactly one solution, rather than no solution.

Question Difficulty: Hard

Question ID 73d572f1

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Algebra	Systems of two linear equations in two variables	<div><div></div><div></div><div></div></div>

ID: 73d572f1

$$(x - 2) - 4(y + 7) = 117$$
$$(x - 2) + 4(y + 7) = 442$$

The solution to the given system of equations is (x, y) . What is the value of $6(x - 2)$?

ID: 73d572f1 Answer

Correct Answer: 1677

Rationale

The correct answer is 1,677. Adding the first equation to the second equation in the given system yields $x - 2 + x - 2 + -4y + 7 + 4y + 7 = 117 + 442$, or $2x - 2 = 559$. Multiplying both sides of this equation by 3 yields $6x - 2 = 1,677$. Therefore, the value of $6x - 2$ is 1,677.

Question Difficulty: Hard