

Question ID 769dc33f

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 769dc33f

x	$g(x)$
1	54
2	51
3	48
4	45

For the linear function g , the table shows four values of x and their corresponding values of $g(x)$. The function can be written as $g(x) = mx + b$, where m and b are constants. What is the value of b ?

- A. 3
- B. 27
- C. 54
- D. 57

ID: 769dc33f Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that for the linear function g , the table shows four values of x and their corresponding values of $g(x)$. It's also given that the function can be written as $g(x) = mx + b$, where m and b are constants. The table shows that when the value of x is 1, the corresponding value of $g(x)$ is 54. Substituting 1 for x and 54 for $g(x)$ in $g(x) = mx + b$ yields $54 = m(1) + b$ or, $54 = m + b$. Subtracting b from both sides of this equation yields $54 - b = m$. The table also shows that when the value of x is 2, the corresponding value of $g(x)$ is 51. Substituting 2 for x and 51 for $g(x)$ in $g(x) = mx + b$ yields $51 = m(2) + b$, or $51 = 2m + b$. Substituting $54 - b$ for m in this equation yields $51 = 2(54 - b) + b$. Applying the distributive property to the right-hand side of this equation yields $51 = 108 - 2b + b$, or $51 = 108 - b$. Subtracting 108 from both sides of this equation yields $-57 = -b$. Dividing both sides of this equation by -1 yields $57 = b$.

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 260c8cc7

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 260c8cc7

$$g(m) = -0.05m + 12.1$$

The given function g models the number of gallons of gasoline that remains from a full gas tank in a car after driving m miles. According to the model, about how many gallons of gasoline are used to drive each mile?

- A. 0.05
- B. 12.1
- C. 20
- D. 242.0

ID: 260c8cc7 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the function g models the number of gallons that remain from a full gas tank in a car after driving m miles. In the given function $g(m) = -0.05m + 12.1$, the coefficient of m is -0.05 . This means that for every increase in the value of m by 1, the value of $g(m)$ decreases by 0.05. It follows that for each mile driven, there is a decrease of 0.05 gallons of gasoline. Therefore, 0.05 gallons of gasoline are used to drive each mile.

Choice B is incorrect and represents the number of gallons of gasoline in a full gas tank.

Choice C is incorrect and may result from conceptual errors.

Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Hard

Question ID cf175155

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: cf175155

Caleb used juice to make popsicles. The function $f(x) = -5x + 30$ approximates the volume, in fluid ounces, of juice Caleb had remaining after making x popsicles. Which statement is the best interpretation of the y -intercept of the graph of $y = f(x)$ in the xy -plane in this context?

- A. Caleb used approximately 5 fluid ounces of juice for each popsicle.
- B. Caleb had approximately 5 fluid ounces of juice when he began to make the popsicles.
- C. Caleb had approximately 30 fluid ounces of juice when he began to make the popsicles.
- D. Caleb used approximately 30 fluid ounces of juice for each popsicle.

ID: cf175155 Answer

Correct Answer: C

Rationale

Choice C is correct. An equation that defines a linear function f can be written in the form $f(x) = mx + b$, where m represents the slope and b represents the y -intercept, $(0, b)$, of the line of $y = f(x)$ in the xy -plane. The function $f(x) = -5x + 30$ is linear. Therefore, the graph of the given function $y = f(x)$ in the xy -plane has a y -intercept of $(0, 30)$. It's given that $f(x)$ gives the approximate volume, in fluid ounces, of juice Caleb had remaining after making x popsicles. It follows that the y -intercept of $(0, 30)$ means that Caleb had approximately 30 fluid ounces of juice remaining after making 0 popsicles. In other words, Caleb had approximately 30 fluid ounces of juice when he began to make the popsicles.

Choice A is incorrect. This is an interpretation of the slope, rather than the y -intercept, of the graph of $y = f(x)$ in the xy -plane.

Choice B is incorrect and may result from conceptual errors.

Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Hard

Question ID 087283ab

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 087283ab

In the xy -plane, the graph of the linear function f contains the points $(0, 2)$ and $(8, 34)$. Which equation defines f , where $y = f(x)$?

- A. $f(x) = 2x + 42$
- B. $f(x) = 32x + 36$
- C. $f(x) = 4x + 2$
- D. $f(x) = 8x + 2$

ID: 087283ab Answer

Correct Answer: C

Rationale

Choice C is correct. In the xy -plane, the graph of a linear function can be written in the form $f(x) = mx + b$, where m represents the slope and $(0, b)$ represents the y -intercept of the graph of $y = f(x)$. It's given that the graph of the linear function f , where $y = f(x)$, in the xy -plane contains the point $(0, 2)$. Thus, $b = 2$. The slope of the graph of a line containing any two points (x_1, y_1) and (x_2, y_2) can be found using the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$. Since it's given that the graph of the linear function f contains the points $(0, 2)$ and $(8, 34)$, it follows that the slope of the graph of the line containing these points is $m = \frac{34 - 2}{8 - 0}$, or $m = 4$. Substituting 4 for m and 2 for b in $f(x) = mx + b$ yields $f(x) = 4x + 2$.

Choice A is incorrect. This function represents a graph with a slope of 2 and a y -intercept of $(0, 42)$.

Choice B is incorrect. This function represents a graph with a slope of 32 and a y -intercept of $(0, 36)$.

Choice D is incorrect. This function represents a graph with a slope of 8 and a y -intercept of $(0, 2)$.

Question Difficulty: Hard

Question ID 88de8eeb

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 88de8eeb

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: 88de8eeb 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 ec1ee886

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: ec1ee886

The function f is defined by $f(x) = -9x + 9$. What is the y -coordinate of the y -intercept of the graph of $y = f(x)$ in the xy -plane?

ID: ec1ee886 Answer

Correct Answer: 9

Rationale

The correct answer is **9**. The y -intercept of the graph of $y = f(x)$ in the xy -plane is the point where the graph of $y = f(x)$ crosses the y -axis, which occurs at $x = 0$. It's given that the function f is defined by $f(x) = -9x + 9$. Substituting **0** for x and y for $f(x)$ in this equation yields $y = -9(0) + 9$, or $y = 9$. It follows that $y = 9$ when $x = 0$ and that the y -intercept of the graph of $y = f(x)$ in the xy -plane is **(0, 9)**. Therefore, the y -coordinate of the y -intercept of the graph of $y = f(x)$ in the xy -plane is **9**.

Question Difficulty: Hard

Question ID 60ae7d59

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 60ae7d59

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: 60ae7d59 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 523437f0

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 523437f0

The function h is defined by $h(x) = 4x + 28$. The graph of $y = h(x)$ 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 $a + b$?

- A. 21
- B. 28
- C. 32
- D. 35

ID: 523437f0 Answer

Correct Answer: A

Rationale

Choice A is correct. The x -intercept of a graph in the xy -plane is the point on the graph where $y = 0$. It's given that function h is defined by $h(x) = 4x + 28$. Therefore, the equation representing the graph of $y = h(x)$ is $y = 4x + 28$. Substituting 0 for y in the equation $y = 4x + 28$ yields $0 = 4x + 28$. Subtracting 28 from both sides of this equation yields $-28 = 4x$. Dividing both sides of this equation by 4 yields $-7 = x$. Therefore, the x -intercept of the graph of $y = h(x)$ in the xy -plane is $(-7, 0)$. It's given that the x -intercept of the graph of $y = h(x)$ is $(a, 0)$. Therefore, $a = -7$. The y -intercept of a graph in the xy -plane is the point on the graph where $x = 0$. Substituting 0 for x in the equation $y = 4x + 28$ yields $y = 4(0) + 28$, or $y = 28$. Therefore, the y -intercept of the graph of $y = h(x)$ in the xy -plane is $(0, 28)$. It's given that the y -intercept of the graph of $y = h(x)$ is $(0, b)$. Therefore, $b = 28$. If $a = -7$ and $b = 28$, then the value of $a + b$ is $-7 + 28$, or 21 .

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

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

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

Question Difficulty: Hard

Question ID 110d5a9a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 110d5a9a

x	10	15	20	25
$f(x)$	82	137	192	247

The table shows four values of x and their corresponding values of $f(x)$. There is a linear relationship between x and $f(x)$ that is defined by the equation $f(x) = mx - 28$, where m is a constant. What is the value of m ?

ID: 110d5a9a Answer

Correct Answer: 11

Rationale

The correct answer is **11**. It's given that $f(x)$ is defined by the equation $f(x) = mx - 28$, where m is a constant. It's also given in the table that when $x = 10$, $f(x) = 82$. Substituting **10** for x and **82** for $f(x)$ in the equation $f(x) = mx - 28$ yields, $82 = m(10) - 28$. Adding **28** to both sides of this equation yields $110 = 10m$. Dividing both sides of this equation by **10** yields $11 = m$. Therefore, the value of m is **11**.

Question Difficulty: Hard

Question ID c88c8eeb

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: c88c8eeb

$f(x) = 39$

For the given linear function f , which table gives three values of x and their corresponding values of $f(x)$?

A.

x	$f(x)$
0	0
1	0
2	0

B.

x	$f(x)$
0	39
1	39
2	39

C.

x	$f(x)$
0	0
1	39
2	78

D.

x	$f(x)$
0	39
1	0
2	-39

ID: c88c8eeb Answer

Correct Answer: B

Rationale

Choice B is correct. For the given linear function f , $f(x)$ must equal **39** for all values of x . Of the given choices, only choice B gives three values of x and their corresponding values of $f(x)$ for the given linear function f .

Choice A is incorrect and may result from conceptual errors.

Choice C is incorrect and may result from conceptual errors.

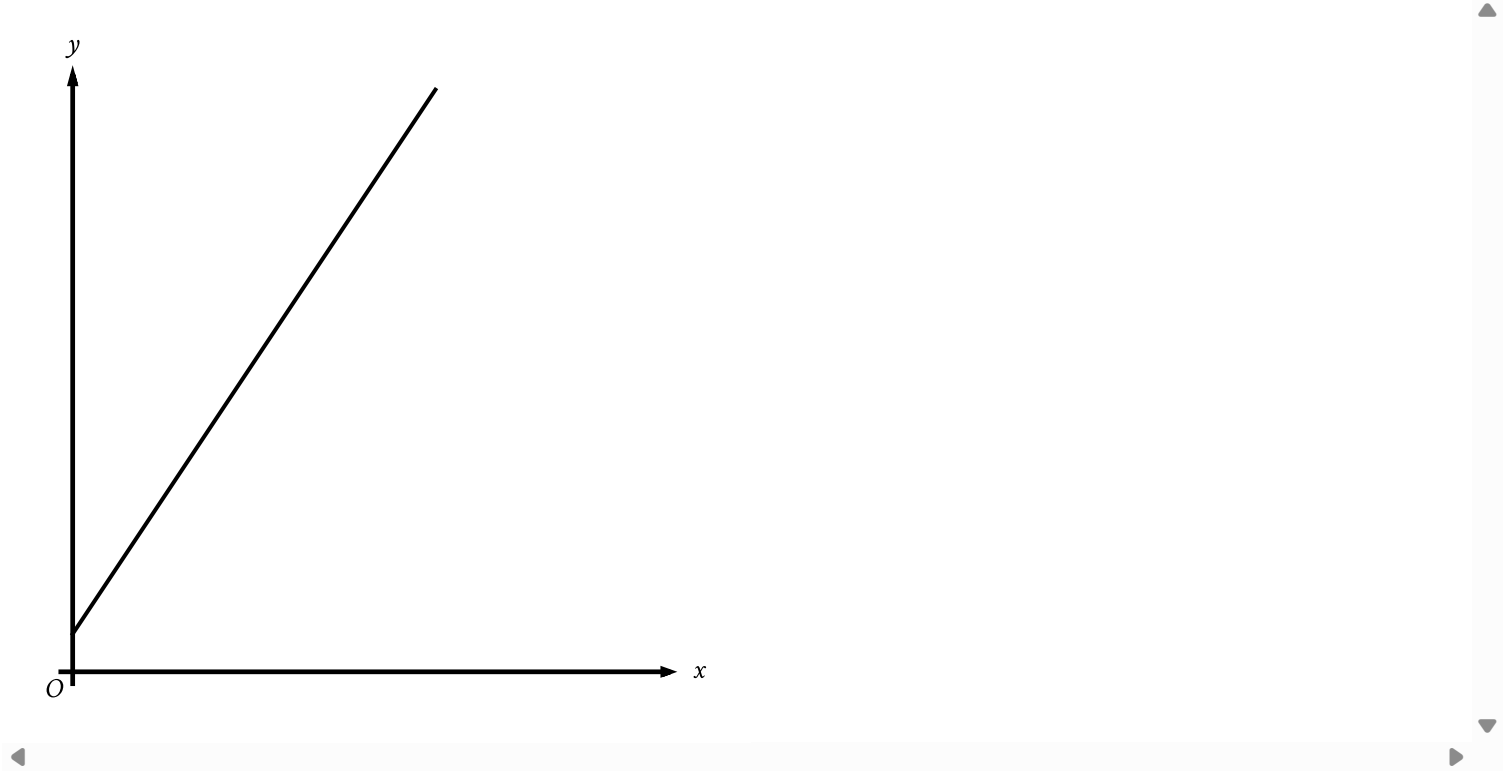
Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Hard

Question ID 6c6d3af5

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 6c6d3af5



The graph represents the total charge, in dollars, by an electrician for x hours of work. The electrician charges a onetime fee plus an hourly rate. What is the best interpretation of the slope of the graph?

- A. The electrician’s hourly rate
- B. The electrician’s onetime fee
- C. The maximum amount that the electrician charges
- D. The total amount that the electrician charges

ID: 6c6d3af5 Answer

Correct Answer: A

Rationale

Choice A is correct. It’s given that the electrician charges a onetime fee plus an hourly rate. It’s also given that the graph represents the total charge, in dollars, for x hours of work. This graph shows a linear relationship in the xy -plane. Thus, the total charge y , in dollars, for x hours of work can be represented as $y = mx + b$, where m is the slope and $(0, b)$ is the y -intercept of the graph of the equation in the xy -plane. Since the given graph represents the total charge, in dollars, by an electrician for x hours of work, it follows that its slope is m , or the electrician’s hourly rate.

Choice B is incorrect. The electrician's onetime fee is represented by the y -coordinate of the y -intercept, not the slope, of the graph.

Choice C is incorrect and may result from conceptual errors.

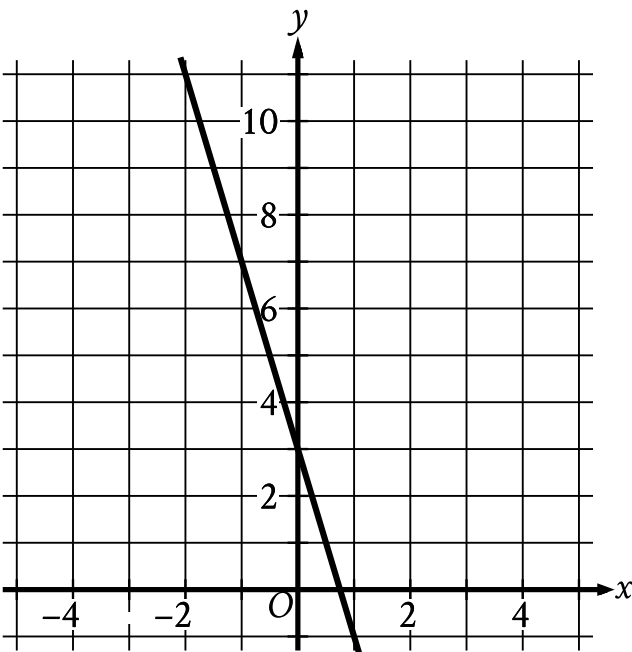
Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Hard

Question ID 82b33e31

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 82b33e31



The graph of the linear function $y = f(x) + 19$ is shown. If c and d are positive constants, which equation could define f ?

- A. $f(x) = -d - cx$
- B. $f(x) = d - cx$
- C. $f(x) = -d + cx$
- D. $f(x) = d + cx$

ID: 82b33e31 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the graph of the linear function $y = f(x) + 19$ is shown. This means that the graph of $y = f(x) + 19$ can be translated down 19 units to create the graph of $y = f(x)$ and the y -coordinate of every point on the graph of $y = f(x) + 19$ can be decreased by 19 to find the resulting point on the graph of $y = f(x)$. The y -intercept of the graph of $y = f(x) + 19$ is $(0, 3)$. Translating the graph of $y = f(x) + 19$ down 19 units results in a y -intercept of the graph of $y = f(x)$ at the point $(0, 3 - 19)$, or $(0, -16)$. The graph of $y = f(x) + 19$ slants down from left to right, so the slope of the graph is negative. The translation of a linear graph changes its position, but does not change its slope. It follows that the slope of the graph of $y = f(x)$ is also negative. The equation of a linear function f can be written in the form $f(x) = b + mx$, where b is the y -coordinate of the y -intercept and m is the slope of the graph of $y = f(x)$. It's given that c and d are positive constants. Since the y -coordinate of the y -intercept and the slope of the graph of $y = f(x)$ are both negative, it follows that $f(x) = -d - cx$ could define f .

Choice B is incorrect. This could define a linear function where its graph has a positive, not negative, y -intercept.

Choice C is incorrect. This could define a linear function where its graph has a positive, not negative, slope.

Choice D is incorrect. This could define a linear function where its graph has a positive, not negative, y -intercept and a positive, not negative, slope.

Question Difficulty: Hard

Question ID 7d304f81

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 7d304f81

If $f(x) = x + 7$ and $g(x) = 7x$, what is the value of $4f(2) - g(2)$?

- A. -5
- B. 1
- C. 22
- D. 28

ID: 7d304f81 Answer

Correct Answer: C

Rationale

Choice C is correct. The value of $f(2)$ can be found by substituting 2 for x in the given equation $f(x) = x + 7$, which yields $f(2) = 2 + 7$, or $f(2) = 9$. The value of $g(2)$ can be found by substituting 2 for x in the given equation $g(x) = 7x$, which yields $g(2) = 7(2)$, or $g(2) = 14$. The value of the expression $4f(2) - g(2)$ can be found by substituting the corresponding values into the expression, which gives $4(9) - 14$. This expression is equivalent to $36 - 14$, or 22 .

Choice A is incorrect. This is the value of $f(2) - g(2)$, not $4f(2) - g(2)$.

Choice B is incorrect and may result from calculating $4f(2)$ as $4(2) + 7$, rather than $4(2 + 7)$.

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

Question Difficulty: Hard

Question ID 9bbbda63

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 9bbbda63

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: 9bbbda63 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 19312a4a

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 19312a4a

In the linear function f , $f(0) = 8$ and $f(1) = 12$. Which equation defines f ?

- A. $f(x) = 12x + 8$
- B. $f(x) = 4x$
- C. $f(x) = 4x + 12$
- D. $f(x) = 4x + 8$

ID: 19312a4a Answer

Correct Answer: D

Rationale

Choice D is correct. Since f is a linear function, it can be defined by an equation of the form $f(x) = ax + b$, where a and b are constants. It's given that $f(0) = 8$. Substituting 0 for x and 8 for $f(x)$ in the equation $f(x) = ax + b$ yields $8 = a(0) + b$, or $8 = b$. Substituting 8 for b in the equation $f(x) = ax + b$ yields $f(x) = ax + 8$. It's given that $f(1) = 12$. Substituting 1 for x and 12 for $f(x)$ in the equation $f(x) = ax + 8$ yields $12 = a(1) + 8$, or $12 = a + 8$. Subtracting 8 from both sides of this equation yields $a = 4$. Substituting 4 for a in the equation $f(x) = ax + 8$ yields $f(x) = 4x + 8$. Therefore, an equation that defines f is $f(x) = 4x + 8$.

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 0fd74d8c

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 0fd74d8c

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

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: 0fd74d8c 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 48399aad

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 48399aad

Kaylani used fabric measuring **5** yards in length to make each suit for a men's choir. The relationship between the number of suits that Kaylani made, x , and the total length of fabric that she purchased y , in yards, is represented by the equation $y - 5x = 6$. What is the best interpretation of **6** in this context?

- A. Kaylani made **6** suits.
- B. Kaylani purchased a total of **6** yards of fabric.
- C. Kaylani used a total of **6** yards of fabric to make the suits.
- D. Kaylani purchased **6** yards more fabric than she used to make the suits.

ID: 48399aad Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the equation $y - 5x = 6$ represents the relationship between the number of suits that Kaylani made, x , and the total length of fabric she purchased, y , in yards. Adding $5x$ to both sides of the given equation yields $y = 5x + 6$. Since Kaylani made x suits and used **5** yards of fabric to make each suit, the expression $5x$ represents the total amount of fabric she used to make the suits. Since y represents the total length of fabric Kaylani purchased, in yards, it follows from the equation $y = 5x + 6$ that Kaylani purchased $5x$ yards of fabric to make the suits, plus an additional **6** yards of fabric. Therefore, the best interpretation of **6** in this context is that Kaylani purchased **6** yards more fabric than she used to make the suits.

Choice A is incorrect. Kaylani made a total of x suits, not **6** suits.

Choice B is incorrect. Kaylani purchased a total of y yards of fabric, not a total of **6** yards of fabric.

Choice C is incorrect. Kaylani used a total of $5x$ yards of fabric to make the suits, not a total of **6** yards of fabric.

Question Difficulty: Hard

Question ID fed23a76

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: fed23a76

The function f is defined by $f(x) = \frac{9}{7}x + \frac{8}{7}$. For what value of x does $f(x) = 5$?

ID: fed23a76 Answer

Correct Answer: 3

Rationale

The correct answer is **3**. Substituting **5** for $f(x)$ in the given function yields $5 = \frac{9}{7}x + \frac{8}{7}$. Multiplying each side of this equation by **7** yields $7(5) = 7(\frac{9}{7}x + \frac{8}{7})$, or $35 = 9x + 8$. Subtracting **8** from each side of this equation yields $27 = 9x$. Dividing each side of this equation by **9** yields $3 = x$. Therefore, $f(x) = 5$ when the value of x is **3**.

Question Difficulty: Hard

Question ID 106a2e0d

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 106a2e0d

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: 106a2e0d 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 c82bbc3c

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: c82bbc3c

The function f is defined by $f(x) = 7x - 84$. What is the x-intercept of the graph of $y = f(x)$ in the xy-plane?

- A. $(-12, 0)$
- B. $(-7, 0)$
- C. $(7, 0)$
- D. $(12, 0)$

ID: c82bbc3c Answer

Correct Answer: D

Rationale

Choice D is correct. The given function f is a linear function. Therefore, the graph of $y = f(x)$ in the xy-plane has one x-intercept at the point $(k, 0)$, where k is a constant. Substituting 0 for $f(x)$ and k for x in the given function yields $0 = 7k - 84$. Adding 84 to both sides of this equation yields $84 = 7k$. Dividing both sides of this equation by 7 yields $12 = k$. Therefore, the x-intercept of the graph of $y = f(x)$ in the xy-plane is $(12, 0)$.

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 48a16149

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 48a16149

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: 48a16149 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 54a26a52

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 54a26a52

$$f(x) = 2x + 3$$

For the given function f , the graph of $y = f(x)$ in the xy -plane is parallel to line j . What is the slope of line j ?

ID: 54a26a52 Answer

Correct Answer: 2

Rationale

The correct answer is **2**. It's given that function f is defined by $f(x) = 2x + 3$. Therefore, the equation representing the graph of $y = f(x)$ in the xy -plane is $y = 2x + 3$, and the graph is a line. For a linear equation in the form $y = mx + b$, m represents the slope of the line. Since the value of m in the equation $y = 2x + 3$ is **2**, the slope of the line defined by function f is **2**. It's given that line j is parallel to the line defined by function f . The slopes of parallel lines are equal. Therefore, the slope of line j is also **2**.

Question Difficulty: Hard

Question ID 7231c6a5

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 7231c6a5

$$j(x) = mx + 144$$

For the linear function j , m is a constant and $j(12) = 18$. What is the value of $j(10)$?

ID: 7231c6a5 Answer

Correct Answer: 39

Rationale

The correct answer is **39**. It's given that for the linear function j , m is a constant and $j(12) = 18$. Substituting **12** for x and **18** for $j(x)$ in the given equation yields $18 = m(12) + 144$. Subtracting **144** from both sides of this equation yields $-126 = m(12)$. Dividing both sides of this equation by **12** yields $-10.5 = m$. Substituting -10.5 for m in the given equation, $j(x) = mx + 144$, yields $j(x) = -10.5x + 144$. Substituting **10** for x in this equation yields $j(10) = (-10.5)(10) + 144$, or $j(10) = 39$. Therefore, the value of $j(10)$ is **39**.

Question Difficulty: Hard

Question ID 9125e98c

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 9125e98c

$$f(x) = 2x + 244$$

The given function f represents the perimeter, in **centimeters (cm)**, of a rectangle with a length of x **cm** and a fixed width. What is the width, in **cm**, of the rectangle?

- A. 2
- B. 122
- C. 244
- D. 488

ID: 9125e98c Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that $f(x) = 2x + 244$ represents the perimeter, in **centimeters (cm)**, of a rectangle with a length of x **cm** and a fixed width. If w represents a fixed width, in **cm**, then the perimeter, in **cm**, of a rectangle with a length of x **cm** and a fixed width of w **cm** can be given by the function $f(x) = 2x + 2w$. Therefore, $2x + 2w = 2x + 244$. Subtracting $2x$ from both sides of this equation yields $2w = 244$. Dividing both sides of this equation by 2 yields $w = 122$. Therefore, the width, in **cm**, of the rectangle is **122**.

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 d2c01cfd

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: d2c01cfd

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: d2c01cfd 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 9bf6ba98

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 9bf6ba98

A model predicts that a certain animal weighed **241** pounds when it was born and that the animal gained **3** pounds per day in its first year of life. This model is defined by an equation in the form $f(x) = a + bx$, where $f(x)$ is the predicted weight, in pounds, of the animal x days after it was born, and a and b are constants. What is the value of a ?

ID: 9bf6ba98 Answer

Correct Answer: 241

Rationale

The correct answer is **241**. For a certain animal, it's given that a model predicts the animal weighed **241** pounds when it was born and gained **3** pounds per day in its first year of life. It's also given that this model is defined by an equation in the form $f(x) = a + bx$, where $f(x)$ is the predicted weight, in pounds, of the animal x days after it was born, and a and b are constants. It follows that a represents the predicted weight, in pounds, of the animal when it was born and b represents the predicted rate of weight gain, in pounds per day, in its first year of life. Thus, the value of a is **241**.

Question Difficulty: Hard

Question ID 0d38cc32

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 0d38cc32

The function f is defined by $f(x) = \frac{x+15}{5}$, and $f(a) = 10$, where a is a constant. What is the value of a ?

- A. 5
- B. 10
- C. 35
- D. 65

ID: 0d38cc32 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that $f(x) = \frac{x+15}{5}$ and $f(a) = 10$, where a is a constant. Therefore, for the given function f , when $x = a$, $f(x) = 10$. Substituting a for x and 10 for $f(x)$ in the given function f yields $10 = \frac{a+15}{5}$. Multiplying both sides of this equation by 5 yields $50 = a + 15$. Subtracting 15 from both sides of this equation yields $35 = a$. Therefore, the value of a is 35.

Choice A is incorrect. This is the value of a if $f(a) = 4$.

Choice B is incorrect. This is the value of a if $f(a) = 5$.

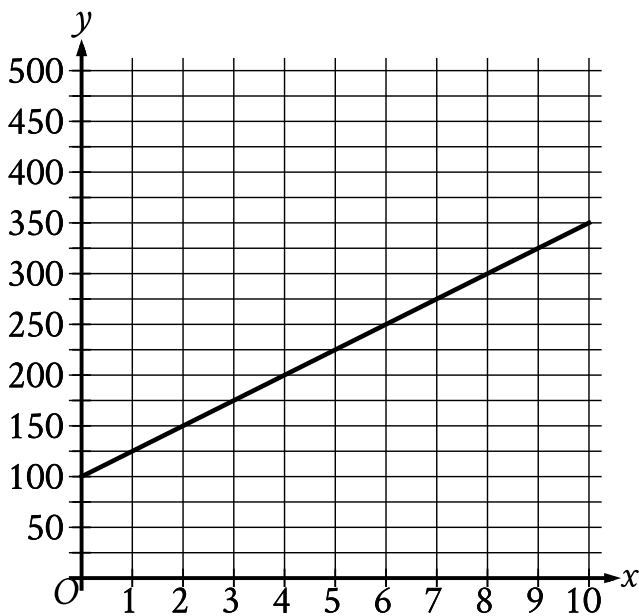
Choice D is incorrect. This is the value of a if $f(a) = 16$.

Question Difficulty: Hard

Question ID 0e08f8e9

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 0e08f8e9



The graph of the function f , where $y = f(x)$, gives the total cost y , in dollars, for a certain video game system and x games. What is the best interpretation of the slope of the graph in this context?

- A. Each game costs \$25.
- B. The video game system costs \$100.
- C. The video game system costs \$25.
- D. Each game costs \$100.

ID: 0e08f8e9 Answer

Correct Answer: A

Rationale

Choice A is correct. The given graph is a line, and the slope of a line is defined as the change in the value of y for each increase in the value of x by 1. It's given that y represents the total cost, in dollars, and that x represents the number of games. Therefore, the change in the value of y for each increase in the value of x by 1 represents the change in total cost, in dollars, for each increase in the number of games by 1. In other words, the slope represents the cost, in dollars, per game. The graph shows that when the value of x increases from 0 to 1, the value of y increases from 100 to 125. It follows that the slope is 25, or the cost per game is \$25. Thus, the best interpretation of the slope of the graph is that each game costs \$25.

Choice B is incorrect. This is an interpretation of the y-intercept of the graph rather than the slope of the graph.

Choice C is incorrect. The slope of the graph is the cost per game, not the cost of the video game system.

Choice D is incorrect. Each game costs **\$25**, not **\$100**.

Question Difficulty: Hard

Question ID 3b65a247

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 3b65a247

$$f(x) = 45x + 600$$

The function f gives the monthly fee $f(x)$, in dollars, a facility charges to keep x crates in storage. What is the monthly fee, in dollars, the facility charges to keep 50 crates in storage?

ID: 3b65a247 Answer

Correct Answer: 2850

Rationale

The correct answer is **2,850**. It's given that the function $f(x) = 45x + 600$ gives the monthly fee, in dollars, a facility charges to keep x crates in storage. Substituting **50** for x in this function yields $f(50) = 45(50) + 600$, or $f(50) = 2,850$. Therefore, the monthly fee, in dollars, the facility charges to keep **50** crates in storage is **2,850**.

Question Difficulty: Hard

Question ID edbc90e5

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: edbc90e5

The pressure exerted on a scuba diver at sea level is **14.70 pounds per square inch (psi)**. For each foot the scuba diver descends below sea level, the pressure exerted on the scuba diver increases by **0.44 psi**. What is the total pressure, in **psi**, exerted on the scuba diver at **105** feet below sea level?

- A. **60.90**
- B. **31.50**
- C. **14.70**
- D. **0.44**

ID: edbc90e5 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the pressure exerted on a scuba diver at sea level is **14.70 pounds per square inch (psi)**. It's also given that for each foot the scuba diver descends below sea level, the pressure exerted on the scuba diver increases by **0.44 psi**. The total pressure, in **psi**, exerted on the scuba diver at x feet below sea level can be represented by the expression $0.44x + 14.70$. Substituting **105** for x in this expression yields $0.44(105) + 14.70$, or **60.90**. Therefore, the total pressure exerted on the scuba diver at **105** feet below sea level is **60.90 psi**.

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

Choice C is incorrect. This is the pressure, in **psi**, exerted on the scuba diver at sea level, not at **105** feet below sea level.

Choice D is incorrect. This is the rate by which the pressure, in **psi**, exerted on the scuba diver increases for each foot the scuba diver descends below sea level.

Question Difficulty: Hard

Question ID 7e946c43

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 7e946c43

In the linear function h , $h(28) = 15$ and $h(26) = 22$. Which equation defines h ?

- A. $h(x) = -\frac{2}{7}x + 23$
- B. $h(x) = -\frac{2}{7}x + 113$
- C. $h(x) = -\frac{7}{2}x + 23$
- D. $h(x) = -\frac{7}{2}x + 113$

ID: 7e946c43 Answer

Correct Answer: D

Rationale

Choice D is correct. An equation defining h can be written in the form $y = mx + b$, where $y = h(x)$, m represents the slope of the graph of $y = h(x)$ in the xy -plane, and b represents the y -coordinate of the y -intercept of the graph. It's given that $h(28) = 15$ and $h(26) = 22$. It follows that the points $(28, 15)$ and $(26, 22)$ are on the graph of $y = h(x)$ in the xy -plane. The slope can be found by using any two points, (x_1, y_1) and (x_2, y_2) , and the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting $(28, 15)$ and $(26, 22)$ for (x_1, y_1) and (x_2, y_2) , respectively, in the slope formula yields $m = \frac{22 - 15}{26 - 28}$, or $m = -\frac{7}{2}$. Substituting $-\frac{7}{2}$ for m and $(28, 15)$ for (x, y) in the equation $y = mx + b$ yields $15 = (-\frac{7}{2})(28) + b$, or $15 = -98 + b$. Adding 98 to both sides of this equation yields $113 = b$. Substituting $-\frac{7}{2}$ for m and 113 for b in the equation $y = mx + b$ yields $y = -\frac{7}{2}x + 113$. Since $y = h(x)$, it follows that the equation that defines h is $h(x) = -\frac{7}{2}x + 113$.

Choice A is incorrect. For this function, $h(26) = \frac{109}{7}$, not $h(26) = 22$.

Choice B is incorrect. For this function, $h(28) = 105$, not $h(28) = 15$, and $h(26) = \frac{739}{7}$, not $h(26) = 22$.

Choice C is incorrect. For this function, $h(28) = -75$, not $h(28) = 15$, and $h(26) = -68$, not $h(26) = 22$.

Question Difficulty: Hard

Question ID c31c23f7

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: c31c23f7

The table gives the number of hours, h , of labor and a plumber’s total charge $f(h)$, in dollars, for two different jobs.

h	$f(h)$
1	155
3	285

There is a linear relationship between h and $f(h)$. Which equation represents this relationship?

- A. $f(h) = 25h + 130$
- B. $f(h) = 130h + 25$
- C. $f(h) = 65h + 90$
- D. $f(h) = 90h + 65$

ID: c31c23f7 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that there is a linear relationship between a plumber's hours of labor, h , and the plumber's total charge $f(h)$, in dollars. It follows that the relationship can be represented by an equation of the form $f(h) = mh + b$, where m is the rate of change of the function f and b is a constant. The rate of change of f can be calculated by dividing the difference in two values of $f(h)$ by the difference in the corresponding values of h . Based on the values given in the table, the rate of change of f is $\frac{285-155}{3-1}$, or **65**. Substituting **65** for m in the equation $f(h) = mh + b$ yields $f(h) = 65h + b$. The value of b can be found by substituting any value of h and its corresponding value of $f(h)$ for h and $f(h)$, respectively, in this equation. Substituting **1** for h and **155** for $f(h)$ yields $155 = 65(1) + b$, or $155 = 65 + b$. Subtracting **65** from both sides of this equation yields $90 = b$. Substituting **90** for b in the equation $f(h) = 65h + b$ yields $f(h) = 65h + 90$.

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 7e74c4fb

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 7e74c4fb

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: 7e74c4fb 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 936b2fd4

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 936b2fd4

A linear function f gives a company's profit, in dollars, for selling x items. The company's profit is \$220 when it sells 8 items, and its profit is \$320 when it sells 10 items. Which equation defines f ?

- A. $f(x) = 150x - 320$
- B. $f(x) = 32x$
- C. $f(x) = 50x - 10x$
- D. $f(x) = 50x - 180$

ID: 936b2fd4 Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the relationship between x and $f(x)$ is linear. A linear function can be written in the form $f(x) = mx + b$, where m is the slope and b is the y -coordinate of the y -intercept of the graph of $y = f(x)$ in the xy -plane. Given two points on a line, (x_1, y_1) and (x_2, y_2) , the slope of the line can be found using the slope formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. It's given that the company's profit is \$220 when it sells 8 items and the profit is \$320 when it sells 10 items. Since $f(x)$ represents the company's profit, in dollars, for selling x items, the graph of $y = f(x)$ in the xy -plane passes through the points $(8, 220)$ and $(10, 320)$. Substituting $(8, 220)$ and $(10, 320)$ for (x_1, y_1) and (x_2, y_2) , respectively, in the slope formula yields $m = \frac{320 - 220}{10 - 8}$, which gives $m = \frac{100}{2}$, or $m = 50$. Substituting 50 for m , 8 for x , and 220 for $f(x)$ in $f(x) = mx + b$ yields $220 = (50)(8) + b$, or $220 = 400 + b$. Subtracting 400 from each side of this equation yields $-180 = b$. Substituting 50 for m and -180 for b in $f(x) = mx + b$ yields $f(x) = 50x - 180$. Therefore, the equation that defines f is $f(x) = 50x - 180$.

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 88e60b4c

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 88e60b4c

The relationship between two variables, x and y , is linear. For every increase in the value of x by 1, the value of y increases by 8. When the value of x is 2, the value of y is 18. Which equation represents this relationship?

- A. $y = 2x + 18$
- B. $y = 2x + 8$
- C. $y = 8x + 2$
- D. $y = 3x + 26$

ID: 88e60b4c Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that the relationship between x and y is linear. An equation representing a linear relationship can be written in the form $y = mx + b$, where m is the slope and b is the y -coordinate of the y -intercept of the graph of the relationship in the xy -plane. It's given that for every increase in the value of x by 1, the value of y increases by 8. The slope of a line can be expressed as the change in y over the change in x . Thus, the slope, m , of the line representing this relationship can be expressed as $\frac{8}{1}$, or 8. Substituting 8 for m in the equation $y = mx + b$ yields $y = 8x + b$. It's also given that when the value of x is 2, the value of y is 18. Substituting 2 for x and 18 for y in the equation $y = 8x + b$ yields $18 = 8(2) + b$, or $18 = 16 + b$. Subtracting 16 from each side of this equation yields $2 = b$. Substituting 2 for b in the equation $y = 8x + b$ yields $y = 8x + 2$. Therefore, the equation $y = 8x + 2$ represents this relationship.

Choice A is incorrect. This equation represents a relationship where for every increase in the value of x by 1, the value of y increases by 2, not 8, and when the value of x is 2, the value of y is 22, not 18.

Choice B is incorrect. This equation represents a relationship where for every increase in the value of x by 1, the value of y increases by 2, not 8, and when the value of x is 2, the value of y is 12, not 18.

Choice D is incorrect. This equation represents a relationship where for every increase in the value of x by 1, the value of y increases by 3, not 8, and when the value of x is 2, the value of y is 32, not 18.

Question Difficulty: Hard

Question ID c1aad368

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: c1aad368

The cost of renting a carpet cleaner is **\$52** for the first day and **\$26** for each additional day. Which of the following functions gives the cost $C(d)$, in dollars, of renting the carpet cleaner for d days, where d is a positive integer?

- A. $C(d) = 26d + 26$
- B. $C(d) = 26d + 52$
- C. $C(d) = 52d - 26$
- D. $C(d) = 52d + 78$

ID: c1aad368 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the cost of renting a carpet cleaner is **\$52** for the first day and **\$26** for each additional day. Therefore, the cost $C(d)$, in dollars, of renting the carpet cleaner for d days is the sum of the cost for the first day, **\$52**, and the cost for the additional $d - 1$ days, $\text{\$}26(d - 1)$. It follows that $C(d) = 52 + 26(d - 1)$, which is equivalent to $C(d) = 52 + 26d - 26$, or $C(d) = 26d + 26$.

Choice B is incorrect. This function gives the cost of renting a carpet cleaner for d days if the cost is **\$78**, not **\$52**, for the first day and **\$26** for each additional day.

Choice C is incorrect. This function gives the cost of renting a carpet cleaner for d days if the cost is **\$26**, not **\$52**, for the first day and **\$52**, not **\$26**, for each additional day.

Choice D is incorrect. This function gives the cost of renting a carpet cleaner for d days if the cost is **\$130**, not **\$52**, for the first day and **\$52**, not **\$26**, for each additional day.

Question Difficulty: Hard

Question ID 7d6cb142

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 7d6cb142

For the linear function g , the graph of $y = g(x)$ in the xy -plane has a slope of 2 and passes through the point $(1, 14)$. Which equation defines g ?

- A. $g(x) = 2x$
- B. $g(x) = 2x + 2$
- C. $g(x) = 2x + 12$
- D. $g(x) = 2x + 14$

ID: 7d6cb142 Answer

Correct Answer: C

Rationale

Choice C is correct. An equation defining a linear function can be written in the form $g(x) = mx + b$, where m is the slope and $(0, b)$ is the y -intercept of the graph of $y = g(x)$ in the xy -plane. It's given that the graph of $y = g(x)$ has a slope of 2 . Therefore, $m = 2$. It's also given that the graph of $y = g(x)$ passes through the point $(1, 14)$. It follows that when $x = 1$, $g(x) = 14$. Substituting 1 for x , 14 for $g(x)$, and 2 for m in the equation $g(x) = mx + b$ yields $14 = 2(1) + b$, or $14 = 2 + b$. Subtracting 2 from each side of this equation yields $12 = b$. Therefore, $b = 12$. Substituting 2 for m and 12 for b in the equation $g(x) = mx + b$ yields $g(x) = 2x + 12$. Therefore, the equation that defines g is $g(x) = 2x + 12$.

Choice A is incorrect. For this function, the graph of $y = g(x)$ in the xy -plane passes through the point $(1, 2)$, not $(1, 14)$.

Choice B is incorrect. For this function, the graph of $y = g(x)$ in the xy -plane passes through the point $(1, 4)$, not $(1, 14)$.

Choice D is incorrect. For this function, the graph of $y = g(x)$ in the xy -plane passes through the point $(1, 16)$, not $(1, 14)$.

Question Difficulty: Hard

Question ID d0fc9d47

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: d0fc9d47

Distance (kilometers)	Average time (minutes)
0.32	8
0.56	14
0.68	17

The table gives the average time t , in minutes, it takes Carly to travel a certain distance d , in kilometers. Which equation could represent this linear relationship?

- A. $t = 4d$
- B. $t = \frac{1}{25}d$
- C. $t = 25d$
- D. $t = \frac{1}{4}d$

ID: d0fc9d47 Answer

Correct Answer: C

Rationale

Choice C is correct. The average time t , in minutes, it takes Carly to travel a certain distance d , in kilometers, is given in the table. This linear relationship can be represented by an equation in the form $t = ad + b$, where a and b are constants. The table shows that it takes Carly an average time of 8 minutes to travel 0.32 kilometers. Substituting 8 for t and 0.32 for d in the equation $t = ad + b$ yields $8 = 0.32a + b$. Subtracting $0.32a$ from both sides of this equation yields $8 - 0.32a = b$. The table also shows that it takes Carly an average time of 14 minutes to travel 0.56 kilometers. Substituting 14 for t and 0.56 for d in the equation $t = ad + b$ yields $14 = 0.56a + b$. Subtracting $0.56a$ from both sides of this equation yields $14 - 0.56a = b$. Substituting $8 - 0.32a$ for b in this equation yields $14 - 0.56a = 8 - 0.32a$. Subtracting 8 from both sides of this equation yields $6 - 0.56a = -0.32a$. Adding $0.56a$ to both sides of this equation yields $6 = 0.24a$. Dividing both sides of this equation by 0.24 yields $25 = a$. Substituting 25 for a in the equation $8 = 0.32a + b$ yields $8 = 0.32(25) + b$, or $8 = 8 + b$. Subtracting 8 from both sides of this equation yields $0 = b$. Substituting 25 for a and 0 for b in the equation $t = ad + b$ yields $t = 25d + 0$, or $t = 25d$.

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 da874bf4

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: da874bf4

Number of cars	Maximum number of passengers and crew
3	174
5	284
10	559

The table shows the linear relationship between the number of cars, c , on a commuter train and the maximum number of passengers and crew, p , that the train can carry. Which equation represents the linear relationship between c and p ?

- A. $55c - p = -9$
- B. $55c - p = 9$
- C. $55p - c = -9$
- D. $55p - c = 9$

ID: da874bf4 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that there is a linear relationship between the number of cars, c , on a commuter train and the maximum number of passengers and crew, p , that the train can carry. It follows that this relationship can be represented by an equation of the form $p = mc + b$, where m is the rate of change of p in this relationship and b is a constant. The rate of change of p in this relationship can be calculated by dividing the difference in any two values of p by the difference in the corresponding values of c . Using two pairs of values given in the table, the rate of change of p in this relationship is $\frac{284-174}{5-3}$, or 55 . Substituting 55 for m in the equation $p = mc + b$ yields $p = 55c + b$. The value of b can be found by substituting any value of c and its corresponding value of p for c and p , respectively, in this equation. Substituting 10 for c and 559 for p yields $559 = 55(10) + b$, or $559 = 550 + b$. Subtracting 550 from both sides of this equation yields $9 = b$. Substituting 9 for b in the equation $p = 55c + b$ yields $p = 55c + 9$. Subtracting 9 from both sides of this equation yields $p - 9 = 55c$. Subtracting p from both sides of this equation yields $-9 = 55c - p$, or $55c - p = -9$.

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 dd3cc86f

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: dd3cc86f

x	$f(x)$
-4	0
$-\frac{19}{5}$	1
$-\frac{18}{5}$	2

For the linear function f , the table shows three values of x and their corresponding values of $f(x)$. If $h(x) = f(x) - 13$, which equation defines h ?

- A. $h(x) = 5x - 4$
- B. $h(x) = 5x + 7$
- C. $h(x) = 5x + 9$
- D. $h(x) = 5x + 20$

ID: dd3cc86f Answer

Correct Answer: B

Rationale

Choice B is correct. An equation that defines a linear function f can be written in the form $f(x) = mx + b$, where m and b are constants. It's given in the table that when $x = -4$, $f(x) = 0$. Substituting -4 for x and 0 for $f(x)$ in the equation $f(x) = mx + b$ yields $0 = m(-4) + b$, or $0 = -4m + b$. Adding $4m$ to both sides of this equation yields $4m = b$. Substituting $4m$ for b in the equation $f(x) = mx + b$ yields $f(x) = mx + 4m$. It's also given in the table that when $x = -\frac{19}{5}$, $f(x) = 1$. Substituting $-\frac{19}{5}$ for x and 1 for $f(x)$ in the equation $f(x) = mx + 4m$ yields $1 = m(-\frac{19}{5}) + 4m$, or $1 = \frac{1}{5}m$. Multiplying both sides of this equation by 5 yields $m = 5$. Substituting 5 for m in the equation $f(x) = mx + 4m$ yields $f(x) = 5x + 4(5)$, or $f(x) = 5x + 20$. If $h(x) = f(x) - 13$, substituting $5x + 20$ for $f(x)$ in this equation yields $h(x) = (5x + 20) - 13$, or $h(x) = 5x + 7$.

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. This is an equation that defines the linear function f , not h .

Question Difficulty: Hard

Question ID 4b88cf78

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 4b88cf78

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: 4b88cf78 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 $f(\frac{2c}{c}) = \frac{2}{c} - 8$, 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 04f7e802

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 04f7e802

The function f is defined by $f(x) = 4x + k(x - 1)$, where k is a constant, and $f(5) = 32$. What is the value of $f(10)$?

ID: 04f7e802 Answer

Correct Answer: 67

Rationale

The correct answer is **67**. It's given that $f(5) = 32$. Therefore, for the given function f , when $x = 5$, $f(x) = 32$. Substituting **5** for x and **32** for $f(x)$ in the given function $f(x) = 4x + k(x - 1)$ yields $32 = 4(5) + k(5 - 1)$, or $32 = 20 + 4k$. Subtracting **20** from each side of this equation yields $12 = 4k$. Dividing each side of this equation by **4** yields $k = 3$. Substituting **3** for k in the given function $f(x) = 4x + k(x - 1)$ yields $f(x) = 4x + 3(x - 1)$, which is equivalent to $f(x) = 4x + 3x - 3$, or $f(x) = 7x - 3$. Substituting **10** for x into this equation yields $f(10) = 7(10) - 3$, or $f(10) = 67$. Therefore, the value of $f(10)$ is **67**.

Question Difficulty: Hard

Question ID 9c322a51

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 9c322a51

$$h(x) = x + b$$

For the linear function h , b is a constant and $h(0) = 45$. What is the value of b ?

ID: 9c322a51 Answer

Correct Answer: 45

Rationale

The correct answer is **45**. It's given that $h(0) = 45$. Therefore, for the given function h , when $x = 0$, $h(x) = 45$. Substituting **0** for x and **45** for $h(x)$ in the given function, $h(x) = x + b$, yields $45 = 0 + b$, or $45 = b$. Therefore, the value of b is **45**.

Question Difficulty: Hard

Question ID 58bb1320

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 58bb1320

Scientists collected fallen acorns that each housed a colony of the ant species *P. ohioensis* and analyzed each colony's structure. For any of these colonies, if the colony has x worker ants, the equation $y = 0.67x + 2.6$, where $20 \leq x \leq 110$, gives the predicted number of larvae, y , in the colony. If one of these colonies has 58 worker ants, which of the following is closest to the predicted number of larvae in the colony?

- A. 41
- B. 61
- C. 83
- D. 190

ID: 58bb1320 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the equation $y = 0.67x + 2.6$, where $20 \leq x \leq 110$, gives the predicted number of larvae, y , in a colony of ants if the colony has x worker ants. If one of these colonies has 58 worker ants, the predicted number of larvae in that colony can be found by substituting 58 for x in the given equation. Substituting 58 for x in the given equation yields $y = 0.67(58) + 2.6$, or $y = 41.46$. Of the given choices, 41 is closest to the predicted number of larvae in the colony.

Choice B is incorrect. This is closest to the predicted number of larvae in a colony with 87 worker ants.

Choice C is incorrect. This is closest to the number of worker ants for which the predicted number of larvae in a colony is 58.

Choice D is incorrect. This is closest to the predicted number of larvae in a colony with 280 worker ants.

Question Difficulty: Hard

Question ID 7a1be251

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 7a1be251

The function $f(x)$ is defined as 19 more than 4 times a number x . If $y = f(x)$ is graphed in the xy -plane, what is the best interpretation of the x -intercept?

- A. When $f(x) = 0$, the number is $-\frac{19}{4}$.
- B. When the number is 0, $f(x) = 19$.
- C. The value of $f(x)$ increases by 1 for each increase of 4 in the value of the number.
- D. For each increase of 1 in the value of the number, $f(x)$ increases by 4.

ID: 7a1be251 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the function $f(x)$ is defined as 19 more than 4 times a number x . This can be represented by the equation $f(x) = 4x + 19$. The x -intercept of the graph of $y = f(x)$ in the xy -plane is the point where the graph intersects the x -axis, or the point on the graph where the value of $f(x)$ is equal to 0. Substituting 0 for $f(x)$ in the equation $f(x) = 4x + 19$ yields $0 = 4x + 19$. Subtracting 19 from each side of this equation yields $-19 = 4x$. Dividing each side of this equation by 4 yields $x = -\frac{19}{4}$. Therefore, when $f(x) = 0$, the number is $-\frac{19}{4}$.

Choice B is incorrect. This is the best interpretation of the y -intercept, not the x -intercept, of the graph of the function.

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

Choice D is incorrect. This is the best interpretation of the slope, not the x -intercept, of the graph of the function.

Question Difficulty: Hard

Question ID e8bf6ee9

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: e8bf6ee9

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 $(\frac{1}{4}, a)$. What is the value of a ?

ID: e8bf6ee9 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 $(\frac{1}{4}, a)$. Substituting $\frac{1}{4}$ for x and a for y in the equation $y = 5x + 15$ yields $a = 5(\frac{1}{4}) + 15$, 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 26447f61

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 26447f61

The linear function g is defined by $g(x) = b - 15x$, where b is a constant. If $g(c + 7) = \frac{c}{4}$, where c is a constant, which of the following expressions represents the value of b ?

- A. $\frac{15c}{4}$
- B. $\frac{19c}{4} + 7$
- C. $\frac{61c}{4} + 105$
- D. $15c + 105$

ID: 26447f61 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that $g(c + 7) = \frac{c}{4}$. Therefore, for the given linear function g , when $x = c + 7$, $g(x) = \frac{c}{4}$. Substituting $c + 7$ for x and $\frac{c}{4}$ for $g(x)$ in $g(x) = b - 15x$ yields $\frac{c}{4} = b - 15(c + 7)$. Applying the distributive property to the right-hand side of this equation yields $\frac{c}{4} = b - 15c - 105$. Adding $15c$ to both sides of this equation yields $\frac{c}{4} + 15c = b - 105$. Adding 105 to both sides of this equation yields $\frac{c}{4} + 15c + 105 = b$, or $\frac{61c}{4} + 105 = b$. Therefore, the expression that represents the value of b is $\frac{61c}{4} + 105$.

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 707ab9fc

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 707ab9fc

The function $f(x) = 55.20 - 0.16x$ gives the estimated surface water temperature $f(x)$, in degrees Celsius, of a body of water on the x th day of the year, where $220 \leq x \leq 360$. Based on the model, what is the estimated surface water temperature, in degrees Celsius, of this body of water on the **326th** day of the year?

- A. **55.20**
- B. **3.04**
- C. **-0.16**
- D. **-52.16**

ID: 707ab9fc Answer

Correct Answer: B

Rationale

Choice B is correct. It’s given that the function $f(x) = 55.20 - 0.16x$ gives the estimated surface water temperature, in degrees Celsius, of a body of water on the x th day of the year. Substituting **326** for x in the given function yields $f(326) = 55.20 - 0.16(326)$, which is equivalent to $f(326) = 55.20 - 52.16$, or $f(326) = 3.04$. Therefore, the estimated surface water temperature, in degrees Celsius, of this body of water on the **326th** day of the year is **3.04**.

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

Choice C is incorrect. This is the rate of change, in degrees Celsius per day, of the estimated surface water temperature.

Choice D is incorrect. This is the change, in degrees Celsius, in the estimated surface water temperature over **326** days.

Question Difficulty: Hard

Question ID 203cc508

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 203cc508

In the xy -plane, the graph of the linear function f contains the points $(0, 3)$ and $(7, 31)$. Which equation defines f , where $y = f(x)$?

- A. $f(x) = 28x + 34$
- B. $f(x) = 3x + 38$
- C. $f(x) = 4x + 3$
- D. $f(x) = 7x + 3$

ID: 203cc508 Answer

Correct Answer: C

Rationale

Choice C is correct. In the xy -plane, an equation of the graph of a linear function can be written in the form $f(x) = mx + b$, where m represents the slope and $(0, b)$ represents the y -intercept of the graph of $y = f(x)$. It's given that the graph of the linear function f , where $y = f(x)$, in the xy -plane contains the point $(0, 3)$. Thus, $b = 3$. The slope of the graph of a line containing any two points (x_1, y_1) and (x_2, y_2) can be found using the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$. Since it's given that the graph of the linear function f contains the points $(0, 3)$ and $(7, 31)$, it follows that the slope of the graph of the line containing these points is $m = \frac{31 - 3}{7 - 0}$, or $m = 4$. Substituting 4 for m and 3 for b in $f(x) = mx + b$ yields $f(x) = 4x + 3$.

Choice A is incorrect. This function represents a graph with a slope of 28 and a y -intercept of $(0, 34)$.

Choice B is incorrect. This function represents a graph with a slope of 3 and a y -intercept of $(0, 38)$.

Choice D is incorrect. This function represents a graph with a slope of 7 and a y -intercept of $(0, 3)$.

Question Difficulty: Hard

Question ID 531fb5d2

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 531fb5d2

One gallon of stain will cover **170** square feet of a surface. A yard has a total fence area of w square feet. Which equation represents the total amount of stain S , in gallons, needed to stain the fence in this yard twice?

- A. $S = \frac{w}{170}$
- B. $S = 170w$
- C. $S = 340w$
- D. $S = \frac{w}{85}$

ID: 531fb5d2 Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that w represents the total fence area, in square feet. Since the fence will be stained twice, the amount of stain, in gallons, will need to cover $2w$ square feet. It's also given that one gallon of stain will cover **170** square feet. Dividing the total area, in square feet, of the surface to be stained by the number of square feet covered by one gallon of stain gives the number of gallons of stain that will be needed. Dividing $2w$ by **170** yields $\frac{2w}{170}$, or $\frac{w}{85}$. Therefore, the equation that represents the total amount of stain S , in gallons, needed to stain the fence of the yard twice is $S = \frac{w}{85}$.

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 ec7acab0

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: ec7acab0

For the linear function h , the graph of $y = h(x)$ in the xy -plane passes through the points $(7, 21)$ and $(9, 25)$. Which equation defines h ?

- A. $h(x) = \frac{1}{2}x - \frac{7}{2}$
- B. $h(x) = 2x + 7$
- C. $h(x) = 7x + 21$
- D. $h(x) = 9x + 25$

ID: ec7acab0 Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that the graph of the linear function h , where $y = h(x)$, passes through the points $(7, 21)$ and $(9, 25)$ in the xy -plane. An equation defining h can be written in the form $y = mx + b$, where $y = h(x)$, m represents the slope of the graph in the xy -plane, and b represents the y -coordinate of the y -intercept of the graph. The slope can be found using any two points, (x_1, y_1) and (x_2, y_2) , and the formula $m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$. Substituting $(7, 21)$ and $(9, 25)$ for (x_1, y_1) and (x_2, y_2) , respectively, in the slope formula yields $m = \frac{25 - 21}{9 - 7}$, which is equivalent to $m = \frac{4}{2}$, or $m = 2$. Substituting 2 for m and $(7, 21)$ for (x, y) in the equation $y = mx + b$ yields $21 = (2)(7) + b$, or $21 = 14 + b$. Subtracting 14 from each side of this equation yields $7 = b$. Substituting 2 for m and 7 for b in the equation $y = mx + b$ yields $y = 2x + 7$. Since $y = h(x)$, it follows that the equation that defines h is $h(x) = 2x + 7$.

Choice A is incorrect. For this function, the graph of $y = h(x)$ in the xy -plane would pass through $(7, 0)$, not $(7, 21)$, and $(9, 1)$, not $(9, 25)$.

Choice C is incorrect. For this function, the graph of $y = h(x)$ in the xy -plane would pass through $(7, 70)$, not $(7, 21)$, and $(9, 84)$, not $(9, 25)$.

Choice D is incorrect. For this function, the graph of $y = h(x)$ in the xy -plane would pass through $(7, 88)$, not $(7, 21)$, and $(9, 106)$, not $(9, 25)$.

Question Difficulty: Hard

Question ID 8504aff2

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 8504aff2

$$w(t) = 300 - 4t$$

The function w models the volume of liquid, in milliliters, in a container t seconds after it begins draining from a hole at the bottom. According to the model, what is the predicted volume, in milliliters, draining from the container each second?

- A. 300
- B. 296
- C. 75
- D. 4

ID: 8504aff2 Answer

Correct Answer: D

Rationale

Choice D is correct. It’s given that the function w models the volume of liquid, in milliliters, in a container t seconds after it begins draining from a hole at the bottom. The given function $w(t) = 300 - 4t$ can be rewritten as $w(t) = -4t + 300$. Thus, for each increase of t by 1, the value of $w(t)$ decreases by $4(1)$, or 4. Therefore, the predicted volume, in milliliters, draining from the container each second is 4 milliliters.

Choice A is incorrect. This is the amount of liquid, in milliliters, in the container before the liquid begins draining.

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 815e56ab

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 815e56ab

In the xy -plane, line k has a slope of 5 and a y -intercept of $(0, -35)$. What is the x -coordinate of the x -intercept of line k ?

ID: 815e56ab Answer

Correct Answer: 7

Rationale

The correct answer is 7 . An equation of a line in the xy -plane can be written in the 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 k has a slope of 5 and a y -intercept of $(0, -35)$. Therefore, $m = 5$ and $b = -35$. Substituting 5 for m and -35 for b in the equation $y = mx + b$ yields $y = 5x - 35$. The x -intercept of a line in the xy -plane is the point where the line intersects the x -axis, which is a point with a y -coordinate of 0 . Substituting 0 for y in the equation $y = 5x - 35$ yields $0 = 5x - 35$. Adding 35 to both sides of this equation yields $35 = 5x$. Dividing both sides of this equation by 5 yields $7 = x$. Therefore, the x -coordinate of the x -intercept of line k is 7 .

Question Difficulty: Hard

Question ID c8f5a3c2

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: c8f5a3c2

A linear model estimates the population of a city from **1991** to **2015**. The model estimates the population was **57** thousand in **1991**, **224** thousand in **2011**, and x thousand in **2015**. To the nearest whole number, what is the value of x ?

ID: c8f5a3c2 Answer

Correct Answer: 257

Rationale

The correct answer is **257**. It's given that a linear model estimates the population of a city from **1991** to **2015**. Since the population can be estimated using a linear model, it follows that there is a constant rate of change for the model. It's also given that the model estimates the population was **57** thousand in **1991**, **224** thousand in **2011**, and x thousand in **2015**. The change in the population between **2011** and **1991** is $224 - 57$, or **167**, thousand. The change in the number of years between **2011** and **1991** is $2011 - 1991$, or **20**, years. Dividing **167** by **20** gives $167/20$, or **8.35**, thousand per year. Thus, the change in population per year from **1991** to **2015** estimated by the model is **8.35** thousand. The change in the number of years between **2015** and **2011** is $2015 - 2011$, or **4**, years. Multiplying the change in population per year by the change in number of years yields the increase in population from **2011** to **2015** estimated by the model: $(8.35)(4)$, or **33.4**, thousand. Adding the change in population from **2011** to **2015** estimated by the model to the estimated population in **2011** yields the estimated population in **2015**. Thus, the estimated population in **2015** is $33.4 + 224$, or **257.4**, thousand. Therefore to the nearest whole number, the value of x is **257**.

Question Difficulty: Hard

Question ID 82bfd550

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 82bfd550

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

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: 82bfd550 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 0522e6f0

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 0522e6f0

Brian saves $\frac{2}{5}$ of the **\$215** he earns each week from his job. If Brian continues to save at this rate, how much money, in dollars, will Brian save in **9** weeks?

ID: 0522e6f0 Answer

Correct Answer: 774

Rationale

The correct answer is **774**. It's given that Brian saves $\frac{2}{5}$ of the **\$215** he earns each week from his job. Therefore, Brian saves $(\frac{2}{5})(\$215)$, or **\$86**, per week. If Brian continues to save at this rate of **\$86** per week for **9** weeks, then he will save a total of $(9)(86)$, or **774**, dollars.

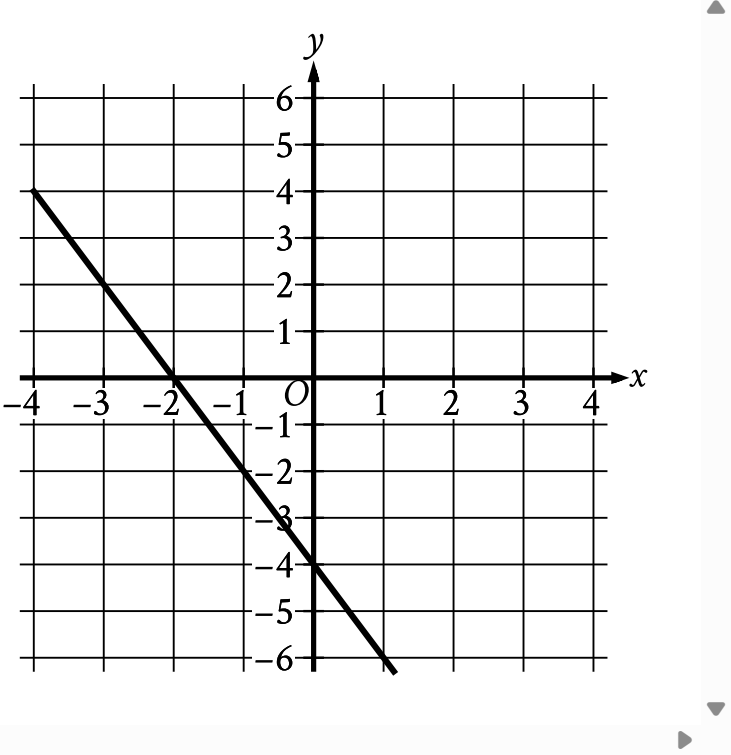
Question Difficulty: Hard

Question ID 3608a9d6

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 3608a9d6

The graph of $y = f(x) - 11$ is shown.



Which equation defines the linear function f ?

- A. $f(x) = -13x - 11$
- B. $f(x) = -2x + 7$
- C. $f(x) = -13x + 7$
- D. $f(x) = -2x - 11$

ID: 3608a9d6 Answer

Correct Answer: B

Rationale

Choice B is correct. The graph of a line in the xy -plane can be represented by the equation $y = mx + b$, where m is the slope of the line and $(0, b)$ is the y -intercept. The slope of a line that passes through the points (x_1, y_1) and (x_2, y_2) can be calculated using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. The line shown passes through the points $(-1, -2)$ and $(0, -4)$. Substituting $(-1, -2)$ and $(0, -4)$ for (x_1, y_1) and (x_2, y_2) , respectively, in the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$ yields $m = \frac{-4 - (-2)}{0 - (-1)}$, which is equivalent to $m = \frac{-2}{1}$, or $m = -2$. Since the line shown passes through the point $(0, -4)$, it follows that $b = -4$. Substituting -2 for m and -4 for b in the equation $y = mx + b$ yields $y = -2x - 4$. It's given that the graph shown is the graph of $y = f(x) - 11$. Substituting $-2x - 4$ for y in the equation $y = f(x) - 11$ yields $-2x - 4 = f(x) - 11$. Adding 11 to both sides of this equation yields $-2x + 7 = f(x)$. Therefore, the equation $f(x) = -2x + 7$ defines the linear function f .

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 4c602c2e

Assessment	Test	Domain	Skill	Difficulty
PSAT 8/9	Math	Algebra	Linear functions	Hard

ID: 4c602c2e

A window repair specialist charges \$220 for the first two hours of repair plus an hourly fee for each additional hour. The total cost for 5 hours of repair is \$400. Which function f gives the total cost, in dollars, for x hours of repair, where $x \geq 2$?

- A. $f(x) = 60x + 100$
- B. $f(x) = 60x + 220$
- C. $f(x) = 80x$
- D. $f(x) = 80x + 220$

ID: 4c602c2e Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the window repair specialist charges \$220 for the first two hours of repair plus an hourly fee for each additional hour. Let n represent the hourly fee for each additional hour after the first two hours. Since it's given that x is the number of hours of repair, it follows that the charge generated by the hourly fee after the first two hours can be represented by the expression $n(x - 2)$. Therefore, the total cost, in dollars, for x hours of repair is $f(x) = 220 + n(x - 2)$. It's given that the total cost for 5 hours of repair is \$400. Substituting 5 for x and 400 for $f(x)$ into the equation $f(x) = 220 + n(x - 2)$ yields $400 = 220 + n(5 - 2)$, or $400 = 220 + 3n$. Subtracting 220 from both sides of this equation yields $180 = 3n$. Dividing both sides of this equation by 3 yields $n = 60$. Substituting 60 for n in the equation $f(x) = 220 + n(x - 2)$ yields $f(x) = 220 + 60(x - 2)$, which is equivalent to $f(x) = 220 + 60x - 120$, or $f(x) = 60x + 100$. Therefore, the total cost, in dollars, for x hours of repair is $f(x) = 60x + 100$.

Choice B is incorrect. This function represents the total cost, in dollars, for x hours of repair where the specialist charges \$340, rather than \$220, for the first two hours of repair.

Choice C is incorrect. This function represents the total cost, in dollars, for x hours of repair where the specialist charges \$160, rather than \$220, for the first two hours of repair, and an hourly fee of \$80, rather than \$60, after the first two hours.

Choice D is incorrect. This function represents the total cost, in dollars, for x hours of repair where the specialist charges \$380, rather than \$220, for the first two hours of repair, and an hourly fee of \$80, rather than \$60, after the first two hours.

Question Difficulty: Hard