Question Bank

Math

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Linear Function (key)

MockSATExam.online

Question ID 84664a7c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 84664a7c

The front of a roller-coaster car is at the bottom of a hill and is 15 feet above the ground. If the front of the roller-coaster car rises at a constant rate of 8 feet per second, which of the following equations gives the height h, in feet, of the front of the roller-coaster car s seconds after it starts up the hill?

A. $h = 8s + 15$

B. $h = 15s + \frac{335}{8}$

C. $h = 8s + \frac{335}{15}$

D. $h = 15s + 8$

ID: 84664a7c Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the front of the roller-coaster car starts rising when it's 15 feet above the ground. This initial height of 15 feet can be represented by a constant term, 15, in an equation. Each second, the front of the roller-coaster car rises 8 feet, which can be represented by 8s. Thus, the equation $h = 8s + 15$ gives the height, in feet, of the front of the roller-coaster car s seconds after it starts up the hill.

Choices B and C are incorrect and may result from conceptual errors in creating a linear equation. Choice D is incorrect and may result from switching the rate at which the roller-coaster car rises with its initial height.

Question Difficulty: Easy

Question ID 06fc1726

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 06fc1726

If *f* is the function defined by $f(x)=\frac{2x-1}{3}$,

what is the value of $f(5)$?

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

B. $\frac{7}{3}$

C. 3

D. 9

ID: 06fc1726 Answer

Correct Answer: C

Rationale

Choice C is correct. If $f(x)=\frac{2x-1}{3}$, then $f(5)=\frac{2(5)-1}{3}=\frac{10-1}{3}=\frac{9}{3}=3$.

Choice A is incorrect and may result from not multiplying x by 2 in the numerator. Choice B is incorrect and may result from dividing 2x by 3 and then subtracting 1. Choice D is incorrect and may result from evaluating only the numerator 2x − 1.

Question Difficulty: Easy

Question ID 6863c7ce

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 6863c7ce

$$d = 16t$$

The given equation represents the distance d, in inches, where t represents the number of seconds since an object started moving. Which of the following is the best interpretation of 16 in this context?

A. The object moved a total of 16 inches.

B. The object moved a total of $16t$ inches.

C. The object is moving at a rate of 16 inches per second.

D. The object is moving at a rate of $\frac{1}{16}$ inches per second.

ID: 6863c7ce Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that in the equation $d = 16t$, d represents the distance, in inches, and t represents the number of seconds since an object started moving. In this equation, t is being multiplied by 16. This means that the object's distance increases by 16 inches each second. Therefore, the best interpretation of 16 in this context is that the object is moving at a rate of 16 inches per second.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect. This is the best interpretation of $16t$, rather than 16, in this context.

Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Easy

Question ID bf36c815

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: bf36c815

The function g is defined by $g(x) = -x + 8$.

What is the value of $g(0)$?

A. -8

B. 0

C. 4

D. 8

ID: bf36c815 Answer

Correct Answer: D

Rationale

Choice D is correct. The value of $g(0)$ is found by substituting 0 for x in the function g. This yields $g(0) = -0 + 8$, which can be rewritten as $g(0) = 8$.

Choice A is incorrect and may result from misinterpreting the equation as $g(x) = x + (-8)$ instead of $g(x) = -x + 8$. Choice B is incorrect. This is the value of x, not $g(x)$. Choice C is incorrect and may result from calculation errors.

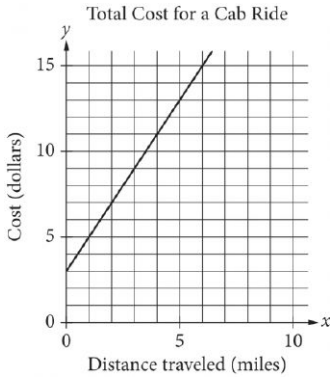
Question Difficulty: Easy

Question ID 3f5375d9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 3f5375d9

The line graphed in the *xy*-plane below models the total cost, in dollars, for a cab ride, *y*, in a certain city during nonpeak hours based on the number of miles traveled, *x*.



According to the graph, what is the cost for each additional mile traveled, in dollars, of a cab ride?

A. $2.00

B. $2.60

C. $3.00

D. $5.00

ID: 3f5375d9 Answer

Correct Answer: A

Rationale

Choice A is correct. The cost of each additional mile traveled is represented by the slope of the given line. The slope of the line can be calculated by identifying two points on the line and then calculating the ratio of the change in y to the change in x between the two points. Using the points $(1,5)$ and $(2,7)$, the slope is equal to $\frac{7-5}{2-1}$, or 2. Therefore, the cost for each additional mile traveled of the cab ride is $2.00.

Choice B is incorrect and may result from calculating the slope of the line that passes through the points $(5,13)$ and $(0,0)$. However, $(0,0)$ does not lie on the line shown. Choice C is incorrect. This is the y-coordinate of the y-intercept of the graph and represents the flat fee for a cab ride before the charge for any miles traveled is added. Choice D is incorrect. This value represents the total cost of a 1-mile cab ride.

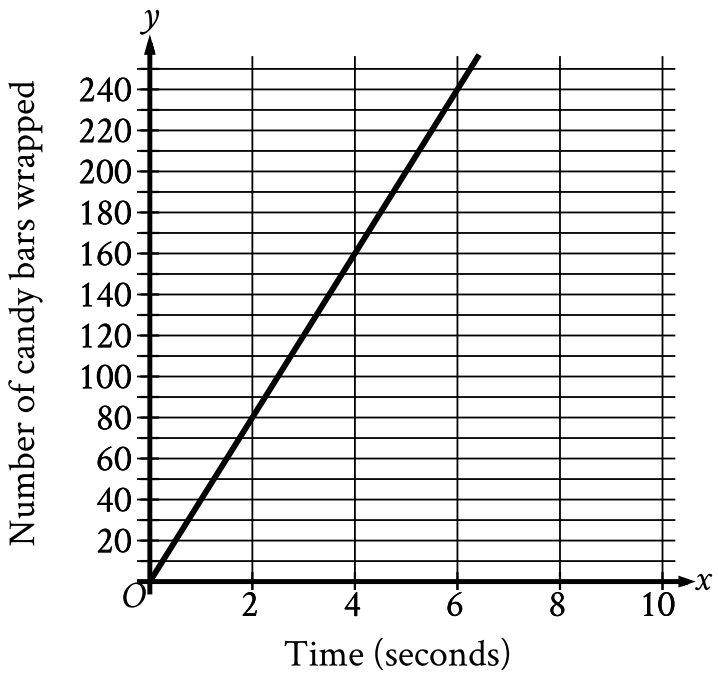
Question Difficulty: Easy

Question ID 13294295

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 13294295

The graph shown models the number of candy bars a certain machine wraps with a label in x seconds.



According to the graph, what is the estimated number of candy bars the machine wraps with a label per second?

A. 2

B. 40

C. 78

D. 80

ID: 13294295 Answer

Correct Answer: B

Rationale

Choice B is correct. For the graph shown, the x-axis represents time, in seconds, and the y-axis represents the number of candy bars wrapped. The slope of a line in the xy-plane is the change in y for each 1-unit increase in x. It follows that the slope of the graph shown represents the estimated number of candy bars the machine wraps with a label per second. The slope, m, of a line in the xy-plane can be found using any two points, (x_1, y_1) and (x_2, y_2), on the line and the slope formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. The graph shown passes through the points $(0, 0)$ and $(2, 80)$. Substituting these points for (x_1, y_1) and (x_2, y_2), respectively, in the slope formula

yields $m = \frac{80-0}{2-0}$, which is equivalent to $m = \frac{80}{2}$, or $m = 40$. Therefore, the estimated number of candy bars the machine wraps with a label per second is 40.

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: Easy

Question ID 12983c1e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 12983c1e

x	$f(x)$
1	5
3	13
5	21

Some values of the linear function *f* are shown in the table above.
Which of the following defines *f* ?

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

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

C. $f(x)=4x+1$

D. $f(x)=5x$

ID: 12983c1e Answer

Correct Answer: C

Rationale

Choice C is correct. Because f is a linear function of x, the equation $f(x)=mx+b$, where m and b are constants, can be used to define the relationship between x and f (*x*). In this equation, m represents the increase in the value of f (x) for every increase in the value of x by 1. From the table, it can be determined that the value of f (x) increases by 8 for every increase in the value of x by 2. In other words, for the function *f* the value of m is $\frac{8}{2}$, or 4. The value of b can be found by substituting the values of x and f (x) from any row of the table and the value of m into the equation $f(x)=mx+b$ and solving for b. For example, using $x=1$, $f(x)=5$, and $m=4$ yields $5=4(1)+b$. Solving for b yields $b=1$. Therefore, the equation defining the function f can be written in the form $f(x)=4x+1$.

Choices A, B, and D are incorrect. Any equation defining the linear function f must give values of f (x) for corresponding values of x, as shown in each row of the table. According to the table, if $x=3$, $f(x)=13$. However, substituting $x=3$ into the equation given in choice A gives $f(3)=2(3)+3$, or $f(3)=9$, not 13. Similarly, substituting $x=3$ into the equation given in choice B gives $f(3)=3(3)+2$, or $f(3)=11$, not 13.

Lastly, substituting $x=3$ into the equation given in choice D gives $f(3)=5(3)$, or $f(3)=15$, not 13. Therefore, the equations in choices A, B, and D cannot define f.

Question ID f79fffba

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: f79fffba

The function h is defined by $h(x) = 3x - 7$. What is the value of $h(-2)$?

A. -13

B. -10

C. 10

D. 13

ID: f79fffba Answer

Correct Answer: A

Rationale

Choice A is correct. The value of $h(-2)$ can be found by substituting -2 for x in the equation defining h. Substituting -2 for x in $h(x) = 3x - 7$ yields $h(-2) = 3(-2) - 7$, or $h(-2) = -13$. Therefore, the value of $h(-2)$ is -13.

Choice B is incorrect. This is the value of $h(-1)$, not $h(-2)$.

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: Easy

Question ID 3462d850

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 3462d850

Marisol drove 3 hours from City A to City B. The equation below estimates the distance d, in miles, Marisol traveled after driving for t hours.

$d = 45t$

Which of the following does 45 represent in the equation?

A. Marisol took 45 trips from City A to City B.

B. The distance between City A and City B is 45 miles.

C. Marisol drove at an average speed of about 45 miles per hour.

D. It took Marisol 45 hours to drive from City A to City B.

ID: 3462d850 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that d is the distance, in miles, Marisol traveled after driving for t hours. Therefore, 45 represents the distance in miles traveled per hour, which is the speed she drove in miles per hour.

Choice A is incorrect and may result from misidentifying speed as the number of trips. Choice B is incorrect and may result from misidentifying speed as the total distance. Choice D is incorrect and may result from misidentifying the speed as the time, in hours.

Question Difficulty: Easy

Question ID 255996a6

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 255996a6

$T = 1{,}000 + 18h$

In the equation above, T represents Brittany's total take-home pay, in dollars, for her first week of work, where h represents the number of hours she worked that week and 1,000 represents a sign-on bonus. If Brittany's total take-home pay was $1,576, for how many hours was Brittany paid for her first week of work?

A. 16

B. 32

C. 55

D. 88

ID: 255996a6 Answer

Correct Answer: B

Rationale

Choice B is correct. Since Brittany's total take-home pay was $1,576, the value 1,576 can be substituted for T in the given equation $T = 1{,}000 + 18h$ to give $1{,}576 = 1{,}000 + 18h$. Subtracting 1,000 from both sides of this equation gives $576 = 18h$. Dividing both sides of this equation by 18 gives $32 = h$. Therefore, Brittany was paid for 32 hours for her first week of work.

Choice A is incorrect. This is half the number of hours Brittany was paid for. Choice C is incorrect and may result from dividing 1,000 by 18. Choice D is incorrect and may result from dividing 1,576 by 18.

Question Difficulty: Easy

Question ID a1696f3e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: a1696f3e

The function g is defined as $g(x) = 5x + a$, where a is a constant. If $g(4) = 31$, what is the value of a ?

A. 30

B. 22

C. 11

D. -23

ID: a1696f3e Answer

Correct Answer: C

Rationale

Choice C is correct. Substituting 4 for x in g(x) = 5x + a gives g(4) = 5(4) + a. Since g(4) = 31, the equation g(4) = 5(4) + a simplifies to 31 = 20 + a. It follows that a = 11.

Choices A, B, and D are incorrect and may result from arithmetic errors.

Question Difficulty: Easy

Question ID 13909d78

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 13909d78

The function f is defined by the equation $f(x) = 100x + 2$. What is the value of $f(x)$ when $x = 9$?

A. 111

B. 118

C. 900

D. 902

ID: 13909d78 Answer

Correct Answer: D

Rationale

Choice D is correct. Substituting 9 for x in the given equation yields $f(9) = 100(9) + 2$, or $f(9) = 902$. Therefore, the value of $f(x)$ when $x = 9$ is 902.

Choice A is incorrect. This is the value of $f(x)$ when $x = 1.09$.

Choice B is incorrect. This is the value of $f(x)$ when $x = 1.16$.

Choice C is incorrect. This is the value of $f(x)$ when $x = 8.98$.

Question Difficulty: Easy

Question ID de6fe450

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: de6fe450

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

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

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

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

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

ID: de6fe450 Answer

Correct Answer: C

Rationale

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

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

Question Difficulty: Easy

Question ID cee5b352

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: cee5b352

The length, y, of a white whale was 162 centimeters (cm) when it was born and increased an average of 4.8 cm per month for the first 12 months after it was born. Which equation best represents this situation, where x is the number of months after the whale was born and y is the length, in cm, of the whale?

A. $y = 162x$

B. $y = 162x + 162$

C. $y = 4.8x + 4.8$

D. $y = 4.8x + 162$

ID: cee5b352 Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the length of the whale was 162 cm when it was born and that its length increased an average of 4.8 cm per month for the first 12 months after it was born. Since x represents the number of months after the whale was born, the total increase in the whale's length, in cm, is 4.8 times x, or $4.8x$. The length of the whale y, in cm, can be found by adding the whale's length at birth, 162 cm, to the total increase in length, $4.8x$ cm. Therefore, the equation that best represents this situation is $y = 4.8x + 162$.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice C is incorrect and may result from conceptual errors.

Question Difficulty: Easy

Question ID 81390d6c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 81390d6c

The function h is defined by $h(x) = x + 200$. What is the value of $h(50)$?

A. 200

B. 250

C. $10{,}000$

D. $50{,}200$

ID: 81390d6c Answer

Correct Answer: B

Rationale

Choice B is correct. Substituting 50 for x in the given function yields $h(50) = 50 + 200$, or $h(50) = 250$. Therefore, the value of $h(50)$ is 250.

Choice A is incorrect. This is the value of $h(0)$.

Choice C is incorrect. This is the value of $h(9{,}800)$.

Choice D is incorrect. This is the value of $h(50{,}000)$.

Question Difficulty: Easy

Question ID 2eef7e61

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 2eef7e61

The graph of the function *f* is a line in the *xy*-plane. If the line has slope $\frac{3}{4}$ and $f(0)=3$, which of the following defines *f*?

A. $f(x)=\frac{3}{4}x-3$

B. $f(x)=\frac{3}{4}x+3$

C. $f(x)=4x-3$

D. $f(x)=4x+3$

ID: 2eef7e61 Answer

Correct Answer: B

Rationale

Choice B is correct. The equation for the function f in the xy-plane can be represented by $f(x)=mx+b$, where m is the slope and b is the y-coordinate of the y-intercept. Since it's given that the line has a slope of $\frac{3}{4}$, it follows that $m=\frac{3}{4}$ in $f(x)=mx+b$, which yields $y=\frac{3}{4}x+b$. It's given that $f(0)=3$. This implies that the graph of the function f in the xy-plane passes through the point $(0,3)$. Thus, the y-coordinate of the y-intercept of the graph is 3, so $b=3$ in $f(x)=\frac{3}{4}x+b$, which yields $f(x)=\frac{3}{4}x+3$. Therefore, the equation $f(x)=\frac{3}{4}x+3$ defines the function f.

Choice A is incorrect and may result from a sign error for the y-intercept. Choice C is incorrect and may result from using the denominator of the given slope as m in $f(x)=mx+b$, in addition to a sign error for the y-intercept. Choice D is incorrect and may result from using the denominator of the given slope as m in $f(x)=mx+b$.

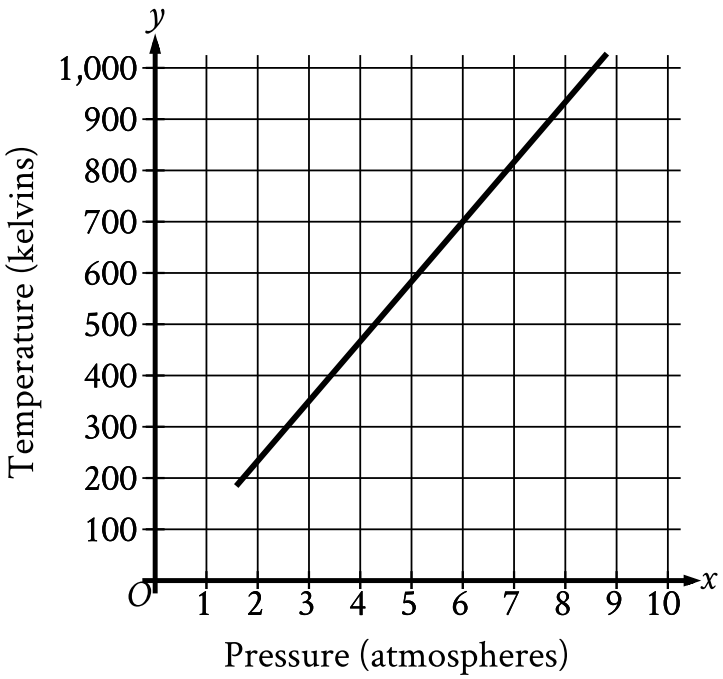
Question Difficulty: Easy

Question ID 0ea7ef01

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 0ea7ef01

Oxygen gas is placed inside a tank with a constant volume. The graph shows the estimated temperature y, in kelvins, of the oxygen gas when its pressure is x atmospheres.



What is the estimated temperature, in kelvins, of the oxygen gas when its pressure is 6 atmospheres?

A. 6

B. 60

C. 700

D. 760

ID: 0ea7ef01 Answer

Correct Answer: C

Rationale

Choice C is correct. For the graph shown, the x-axis represents pressure, in atmospheres, and the y-axis represents temperature, in kelvins. Therefore, the estimated temperature, in kelvins, of the oxygen gas when its pressure is 6 atmospheres is represented by the y-coordinate of the point on the graph that has an x-coordinate of 6. The point on the graph with an x-coordinate of 6 has a y-coordinate of approximately 700. Therefore, the estimated temperature, in kelvins, of the oxygen gas when its pressure is 6 atmospheres is 700.

Choice A is incorrect. This is the pressure, in atmospheres, not the estimated temperature, in kelvins, of the oxygen gas when its pressure is 6 atmospheres.

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: Easy

Question ID 1ecaa9c0

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 1ecaa9c0

Robert rented a truck to transport materials he purchased from a hardware store. He was charged an initial fee of $20.00 plus an additional $0.70 per mile driven. If the truck was driven 38 miles, what was the total amount Robert was charged?

A. $46.60

B. $52.90

C. $66.90

D. $86.50

ID: 1ecaa9c0 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that Robert was charged an initial fee of $20.00 to rent the truck plus an additional $0.70 per mile driven. Let m represent the number of miles the truck was driven. Since the rental charge is $0.70 per mile driven, $0.70m$ represents the amount Robert was charged for m miles driven. Let c equal the total amount, in dollars, Robert was charged to rent the truck. The total amount can be represented by the equation $c = 20.00 + 0.70m$. It's given that the truck was driven 38 miles, thus $m = 38$. Substituting 38 into the equation gives $c = 20.00 + 0.70(38)$. Multiplying $0.70(38)$ gives $c = 20.00 + 26.60$. Adding these values gives $c = 46.60$, so the total amount Robert was charged is $46.60.

Choices B, C, and D are incorrect and may result from setting up the equation incorrectly or from making calculation errors.

Question Difficulty: Easy

Question ID 8643d906

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

ID: 8643d906

$P(t) = 250 + 10t$

The population of snow leopards in a certain area can be modeled by the function P defined above, where $P(t)$ is the population t years after 1990.

Of the following, which is the best interpretation of the equation $P(30) = 550$?

A. The snow leopard population in this area is predicted to be 30 in the year 2020.

B. The snow leopard population in this area is predicted to be 30 in the year 2030.

C. The snow leopard population in this area is predicted to be 550 in the year 2020.

D. The snow leopard population in this area is predicted to be 550 in the year 2030.

ID: 8643d906 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that $P(t)$ represents the population of snow leopards t years after 1990. $P(30) = 550$ corresponds to $t = 30$ and $P(t) = 550$. It follows that $t = 30$ corresponds to 30 years after 1990, or 2020. Thus, the best interpretation of $P(30) = 550$ is that the snow leopard population in this area is predicted to be 550 in the year 2020.

Choices A and B are incorrect and may result from reversing the interpretations of t and $P(t)$. Choice D is incorrect and may result from determining that 30 years after 1990 is 2030, not 2020.

Question Difficulty: Easy

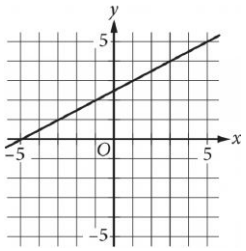
Question ID a8e6bd75

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■□□

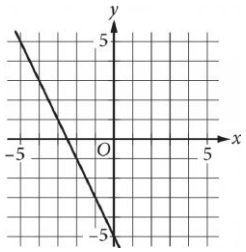
ID: a8e6bd75

Which of the following is the graph of the equation $y = 2x - 5$ in the *xy*-plane?

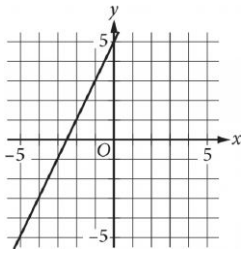
A.



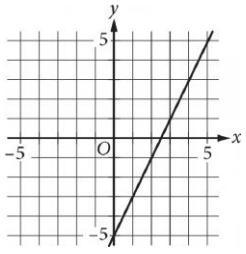
B.



C.



D.



ID: a8e6bd75 Answer

Correct Answer: D

Rationale

Choice D is correct. In the xy-plane, the graph of the equation $y = mx + b$, where m and b are constants, is a line with slope m and y-intercept $(0,b)$. Therefore, the graph of $y = 2x - 5$ in the xy-plane is a line with slope 2 and a y-intercept $(0, -5)$. Having a slope of 2 means that for each increase in x by 1, the value of y increases by 2. Only the graph in choice D has a slope of 2 and crosses the y-axis at $(0, -5)$. Therefore, the graph shown in choice D must be the correct answer.

Choices A, B, and C are incorrect. The graph of $y = 2x - 5$ in the xy-plane is a line with slope 2 and a y-intercept at $(0, -5)$. The graph in choice A crosses the y-axis at the point $(0,2.5)$, not $(0, -5)$, and it has a slope of $\frac{1}{2}$, not 2. The graph in choice B crosses the y-axis at $(0, -5)$; however, the slope of this line is -2, not 2. The graph in choice C has a slope of 2; however, the graph crosses the y-axis at $(0,5)$, not $(0, -5)$.

Question Difficulty: Easy

Question ID e62cfe5f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: e62cfe5f

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

ID: e62cfe5f Answer

Rationale

The correct answer is 2.6. According to the model, the head width, in millimeters, of a worker bumblebee can be estimated by adding 0.6 to 4 times the body weight, in grams, of the bee. Let x represent the body weight, in grams, of a worker bumblebee and let y represent the head width, in millimeters. Translating the verbal description of the model into an equation yields $y = 0.6 + 4x$. Substituting 0.5 grams for x in this equation yields $y = 0.6 + 4(0.5)$, or $y = 2.6$. Therefore, a worker bumblebee with a body weight of 0.5 grams has an estimated head width of 2.6 millimeters. Note that 2.6 and 13/5 are examples of ways to enter a correct answer.

Question Difficulty: Medium

Question ID 7e3f8363

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 7e3f8363

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: 7e3f8363 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: Medium

Question ID 620fe971

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 620fe971

A team of workers has been moving cargo off of a ship. The equation below models the approximate number of tons of cargo, y, that remains to be moved x hours after the team started working.

$y = 120 - 25x$

The graph of this equation in the xy-plane is a line. What is the best interpretation of the x-intercept in this context?

A. The team will have moved all the cargo in about 4.8 hours.

B. The team has been moving about 4.8 tons of cargo per hour.

C. The team has been moving about 25 tons of cargo per hour.

D. The team started with 120 tons of cargo to move.

ID: 620fe971 Answer

Correct Answer: A

Rationale

Choice A is correct. The x-intercept of the line with equation y = 120 – 25x can be found by substituting 0 for y and finding the value of x. When y = 0, x = 4.8, so the x-intercept is at (4.8, 0). Since y represents the number of tons of cargo remaining to be moved x hours after the team started working, it follows that the x-intercept refers to the team having no cargo remaining to be moved after 4.8 hours. In other words, the team will have moved all of the cargo after about 4.8 hours.

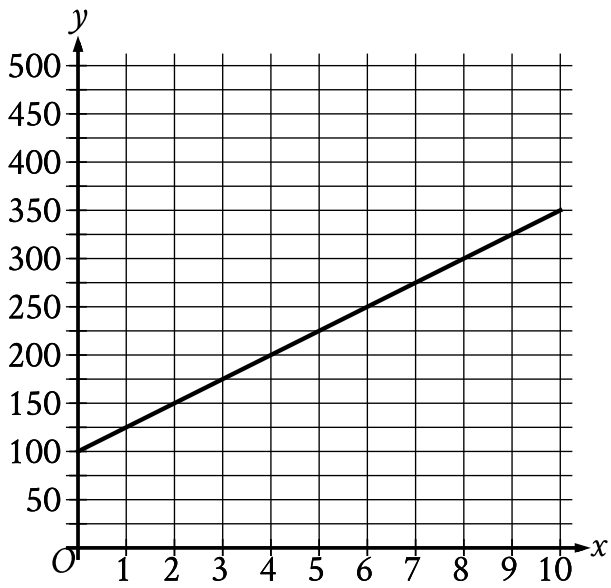
Choice B is incorrect and may result from incorrectly interpreting the value 4.8. Choices C and D are incorrect and may result from misunderstanding the x-intercept. These statements are accurate but not directly relevant to the x-intercept.

Question Difficulty: Medium

Question ID 5cf1bbc9

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 5cf1bbc9



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: 5cf1bbc9 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: Medium

Question ID dae126d7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: dae126d7

The boiling point of water at sea level is 212 degrees Fahrenheit $(°F)$. For every 550 feet above sea level, the boiling point of water is lowered by about $1°F$. Which of the following equations can be used to find the boiling point B of water, in $°F$, x feet above sea level?

A. $B = 550 + \frac{x}{212}$

B. $B = 550 - \frac{x}{212}$

C. $B = 212 + \frac{x}{550}$

D. $B = 212 - \frac{x}{550}$

ID: dae126d7 Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the boiling point of water at sea level is 212°F and that for every 550 feet above sea level, the boiling point of water is lowered by about 1°F. Therefore, the change in the boiling point of water x feet above sea level is represented by the expression $-\frac{x}{550}$. Adding this expression to the boiling point of water at sea level gives the equation for the boiling point B of water, in °F, x feet above sea level: $B = -\frac{x}{550} + 212$, or $B = 212 - \frac{x}{550}$.

Choices A and B are incorrect and may result from using the boiling point of water at sea level as the rate of change and the rate of change as the initial boiling point of water at sea level. Choice C is incorrect and may result from representing the change in the boiling point of water as an increase rather than a decrease.

Question Difficulty: Medium

Question ID 271f7e3f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 271f7e3f

$$f(x)=\frac{(x+7)}{4}$$

For the function f defined above, what is the value of $f(9)-f(1)$?

A. 1

B. 2

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

D. $\frac{9}{4}$

ID: 271f7e3f Answer

Correct Answer: B

Rationale

Choice B is correct. The value of $f(9)-f(1)$ can be calculated by finding the values of $f(9)$ and $f(1)$. The value of $f(9)$ can be found by substituting 9 for x in the given function: $f(9)=\frac{(9+7)}{4}$. This equation can be rewritten as $f(9)=\frac{16}{4}$, or 4. Then, the value of $f(1)$ can be found by substituting 1 for x in the given function: $f(1)=\frac{(1+7)}{4}$. This equation can be rewritten as $f(1)=\frac{8}{4}$, or 2. Therefore, $f(9)-f(1)=4-2$, which is equivalent to 2.

Choices A, C, and D are incorrect and may result from incorrectly substituting values of x in the given function or making computational errors.

Question Difficulty: Medium

Question ID c651cc56

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: c651cc56

x	$f(x)$
0	−2
2	4
6	16

Some values of the linear function *f* are shown in the table above. What is the value of $f(3)$?

A. 6

B. 7

C. 8

D. 9

ID: c651cc56 Answer

Correct Answer: B

Rationale

Choice B is correct. A linear function has a constant rate of change, and any two rows of the table shown can be used to calculate this rate. From the first row to the second, the value of x is increased by 2 and the value of $f(x)$ is increased by $6=4-(-2)$. So the values of $f(x)$ increase by 3 for every increase by 1 in the value of x. Since $f(2)=4$, it follows that $f(2+1)=4+3=7$. Therefore, $f(3)=7$.

Choice A is incorrect. This is the third x-value in the table, not $f(3)$. Choices C and D are incorrect and may result from errors when calculating the function's rate of change.

Question Difficulty: Medium

Question ID c22b5f25

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: c22b5f25

In the *xy*-plane, the points $(-2,3)$ and $(4,-5)$ lie on the graph of which of the following linear functions?

A. $f(x)=x+5$

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

C. $f(x)=-\frac{4}{3}x+\frac{1}{3}$

D. $f(x)=-\frac{3}{2}x+1$

ID: c22b5f25 Answer

Correct Answer: C

Rationale

Choice C is correct. 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 line. The slope of the graph can be found using the formula $m=\frac{y_2-y_1}{x_2-x_1}$. Substituting the values of the given points into this formula yields $m=\frac{-5-3}{4-(-2)}$ or $m=\frac{-8}{6}$, which simplifies to $m=-\frac{4}{3}$. Only choice C shows an equation with this slope.

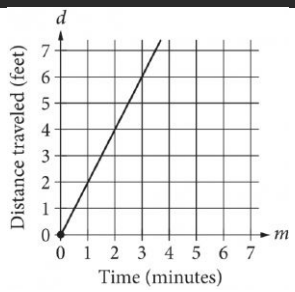
Choices A, B, and D are incorrect and may result from computation errors or misinterpreting the given information.

Question Difficulty: Medium

Question ID 11e1ab81

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 11e1ab81



The graph above shows the distance traveled *d*, in feet, by a product on a conveyor belt *m* minutes after the product is placed on the belt. Which of the following equations correctly relates *d* and *m* ?

A. $d = 2m$

B. $d = \frac{1}{2}m$

C. $d = m + 2$

D. $d = 2m + 2$

ID: 11e1ab81 Answer

Correct Answer: A

Rationale

Choice A is correct. The line passes through the origin. Therefore, this is a relationship of the form $d = km$, where k is a constant representing the slope of the graph. To find the value of k, choose a point (m,d) on the graph of the line other than the origin and substitute the values of m and d into the equation. For example, if the point $(2,4)$ is chosen, then $4 = k(2)$, and $k = 2$. Therefore, the equation of the line is $d = 2m$.

Choice B is incorrect and may result from calculating the slope of the line as the change in time over the change in distance traveled instead of the change in distance traveled over the change in time. Choices C and D are incorrect because each of these equations represents a line with a d-intercept of 2. However, the graph shows a line with a d-intercept of 0.

Question Difficulty: Medium

Question ID 4fe4fd7c

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 4fe4fd7c

$c(x) = mx + 500$

A company's total cost $c(x)$, in dollars, to produce x shirts is given by the function above, where m is a constant and $x > 0$. The total cost to produce 100 shirts is \$800. What is the total cost, in dollars, to produce 1000 shirts? (Disregard the \$ sign when gridding your answer.)

ID: 4fe4fd7c Answer

Rationale

The correct answer is 3500. The given information includes a cost, \$800, to produce 100 shirts. Substituting $c(x) = 800$ and $x = 100$ into the given equation yields $800 = m \cdot 100 + 500$. Subtracting 500 from both sides of the equation yields $300 = m \cdot 100$. Dividing both sides of this equation by 100 yields $3 = m$. Substituting the value of m into the given equation yields $c(x) = 3x + 500$. Substituting 1000 for x in this equation and solving for $c(x)$ gives the cost of 1000 shirts: $3(1000) + 500$, or 3500.

Question Difficulty: Medium

Question ID 3122fc7b

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 3122fc7b

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: 3122fc7b 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: Medium

Question ID c01f4a95

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: c01f4a95

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

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

ID: c01f4a95 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: Medium

Question ID 868fc236

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 868fc236

Energy per Gram of Typical Macronutrients

Macronutrient	Food calories	Kilojoules
Protein	4.0	16.7
Fat	9.0	37.7
Carbohydrate	4.0	16.7

The table above gives the typical amounts of energy per gram, expressed in both food calories and kilojoules, of the three macronutrients in food. If *x* food calories is equivalent to *k* kilojoules, of the following, which best represents the relationship between *x* and *k* ?

A. $k = 0.24x$

B. $k = 4.2x$

C. $x = 4.2k$

D. $xk = 4.2$

ID: 868fc236 Answer

Correct Answer: B

Rationale

Choice B is correct. The relationship between x food calories and k kilojoules can be modeled as a proportional relationship. Let (x_1, k_1) and (x_2, k_2) represent the values in the first two rows in the table: $(4.0, 16.7)$ and $(9.0, 37.7)$. The rate of change, or $\frac{(k_2 - k_1)}{(x_2 - x_1)}$, is $\frac{21}{5} = 4.2$; therefore, the equation that best represents the relationship between x and k is $k = 4.2x$.

Choice A is incorrect and may be the result of calculating the rate of change using $\frac{(x_2 - x_1)}{(k_2 - k_1)}$. Choice C is incorrect because the number of kilojoules is greater than the number of food calories. Choice D is incorrect and may be the result of an error when setting up the equation.

Question Difficulty: Medium

Question ID 042aa429

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 042aa429

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: 042aa429 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: Medium

Question ID 113b938e

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 113b938e

$y = 18 - 5x$

The equation above represents the speed y, in feet per second, of Sheila's bicycle x seconds after she applied the brakes at the end of a ride. If the equation is graphed in the xy-plane, which of the following is the best interpretation of the x-coordinate of the line's x-intercept in the context of the problem?

A. The speed of Sheila's bicycle, in feet per second, before Sheila applied the brakes

B. The number of feet per second the speed of Sheila's bicycle decreased each second after Sheila applied the brakes

C. The number of seconds it took from the time Sheila began applying the brakes until the bicycle came to a complete stop

D. The number of feet Sheila's bicycle traveled from the time she began applying the brakes until the bicycle came to a complete stop

ID: 113b938e Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that for each point (x, y) on the graph of the given equation, the x-coordinate represents the number of seconds after Sheila applied the brakes, and the y-coordinate represents the speed of Sheila's bicycle at that moment in time. For the graph of the equation, the y-coordinate of the x-intercept is 0. Therefore, the x-coordinate of the x-intercept of the graph of the given equation represents the number of seconds it took from the time Sheila began applying the brakes until the bicycle came to a complete stop.

Choice A is incorrect. The speed of Sheila's bicycle before she applied the brakes is represented by the y-coordinate of the y-intercept of the graph of the given equation, not the x-coordinate of the x-intercept. Choice B is incorrect. The number of feet per second the speed of Sheila's bicycle decreased each second after Sheila applied the brakes is represented by the slope of the graph of the given equation, not the x-coordinate of the x-intercept. Choice D is incorrect and may result from misinterpreting x as the distance, in feet, traveled after applying the brakes, rather than the time, in seconds, after applying the brakes.

Question Difficulty: Medium

Question ID 441558e7

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 441558e7

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: 441558e7 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: Medium

Question ID 8a6de407

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 8a6de407

The function *f* is defined by $f(x) = mx + b$, where *m* and *b* are constants. If $f(0) = 18$ and $f(1) = 20$, what is the value of *m* ?

ID: 8a6de407 Answer

Rationale

The correct answer is 2. The slope-intercept form of an equation for a line is $y = mx + b$, where m is the slope and b is the y-coordinate of the y-intercept. Two ordered pairs, (x_1, y_1) and (x_2, y_2), can be used to compute the slope using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. It's given that $f(0) = 18$ and $f(1) = 20$; therefore, the two ordered pairs for this line are $(0, 18)$ and $(1, 20)$. Substituting these values for (x_1, y_1) and (x_2, y_2) gives $\frac{20 - 18}{1 - 0} = \frac{2}{1}$, or 2.

Question Difficulty: Medium

Question ID 41fdc0b8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■□

ID: 41fdc0b8

Population of Greenleaf, Idaho

Year	Population
2000	862
2010	846

The table above shows the population of Greenleaf, Idaho, for the years 2000 and 2010. If the relationship between population and year is linear, which of the following functions *P* models the population of Greenleaf *t* years after 2000?

A. $P(t) = 862 - 1.6t$

B. $P(t) = 862 - 16t$

C. $P(t) = 862 + 16(t - 2{,}000)$

D. $P(t) = 862 - 1.6(t - 2{,}000)$

ID: 41fdc0b8 Answer

Correct Answer: A

Rationale

Choice A is correct. It is given that the relationship between population and year is linear; therefore, the function that models the population t years after 2000 is of the form $P(t) = mt + b$, where m is the slope and b is the population when $t = 0$. In the year 2000, $t = 0$. Therefore, $b = 862$. The slope is given by $m = \frac{P(10) - P(0)}{10 - 0} = \frac{846 - 862}{10 - 0} = \frac{-16}{10} = -1.6$. Therefore, $P(t) = -1.6t + 862$, which is equivalent to the equation in choice A.

Choice B is incorrect and may be the result of incorrectly calculating the slope as just the change in the value of P. Choice C is incorrect and may be the result of the same error as in choice B, in addition to incorrectly using t to represent the year, instead of the number of years after 2000. Choice D is incorrect and may be the result of incorrectly using t to represent the year instead of the number of years after 2000.

Question Difficulty: Medium

Question ID 2b15d65f

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: 2b15d65f

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

A. 16,250

B. 16,500

C. 16,750

D. 17,500

ID: 2b15d65f Answer

Correct Answer: A

Rationale

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

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

Question Difficulty: Hard

Question ID be9cb6a2

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: be9cb6a2

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

A. $y = 270x - 135$

B. $y = 270x + 135$

C. $y = 135x + 270$

D. $y = 135x + 135$

ID: be9cb6a2 Answer

Correct Answer: D

Rationale

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

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

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

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

Question Difficulty: Hard

Question ID b988eeec

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: b988eeec

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

ID: b988eeec Answer

Correct Answer: -12

Rationale

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

Question Difficulty: Hard

Question ID af2ba762

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: af2ba762

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

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

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

A. The average monthly decrease in the price per gallon

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

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

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

ID: af2ba762 Answer

Correct Answer: D

Rationale

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

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

Question Difficulty: Hard

Question ID 16889ef3

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: 16889ef3

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

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

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

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

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

ID: 16889ef3 Answer

Correct Answer: C

Rationale

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

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

Question Difficulty: Hard

Question ID 6989c80a

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: 6989c80a

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

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

A. 3.78

B. 35.78

C. 487.89

D. 519.89

ID: 6989c80a Answer

Correct Answer: A

Rationale

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

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

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

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

Question Difficulty: Hard

Question ID 78391fcc

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: 78391fcc

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

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

A. $(-3,0)$

B. $(-4,0)$

C. $(-9,0)$

D. $(-12,0)$

ID: 78391fcc Answer

Correct Answer: B

Rationale

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

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

Question Difficulty: Hard

Question ID a04050d8

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: a04050d8

Energy per Gram of Typical Macronutrients

Macronutrient	Food calories	Kilojoules
Protein	4.0	16.7
Fat	9.0	37.7
Carbohydrate	4.0	16.7

The table above gives the typical amounts of energy per gram, expressed in both food calories and kilojoules, of the three macronutrients in food. If the 180 food calories in a granola bar come entirely from p grams of protein, f grams of fat, and c grams of carbohydrate, which of the following expresses f in terms of p and c ?

A. $f = 20 + \frac{4}{9}(p + c)$

B. $f = 20 - \frac{4}{9}(p + c)$

C. $f = 20 - \frac{4}{9}(p - c)$

D. $f = 20 + \frac{9}{4}(p + c)$

ID: a04050d8 Answer

Correct Answer: B

Rationale

Choice B is correct. It is given that there are 4.0 food calories per gram of protein, 9.0 food calories per gram of fat, and 4.0 food calories per gram of carbohydrate. If 180 food calories in a granola bar came from p grams of protein, f grams of fat, and c grams of carbohydrate, then the situation can be represented by the equation $180 = 4p + 9f + 4c$. The equation can then be rewritten in terms of f by subtracting 4p and 4c from both sides of the equation and then dividing both sides of the equation by 9. The result is the equation $f = 20 - \frac{4}{9}(p + c)$.

Choices A, C, and D are incorrect and may be the result of not representing the situation with the correct equation or incorrectly rewriting the equation in terms of f.

Question Difficulty: Hard

Question ID daad7c32

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: daad7c32

An object hangs from a spring. The formula $\ell = 30 + 2w$ relates the length ℓ, in centimeters, of the spring to the weight w, in newtons, of the object.

Which of the following describes the meaning of the 2 in this context?

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

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

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

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

ID: daad7c32 Answer

Correct Answer: D

Rationale

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

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

Question Difficulty: Hard

Question ID 023c0a8d

Assessment	Test	Domain	Skill	Difficulty
SAT	Math	Algebra	Linear functions	■■■

ID: 023c0a8d

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

what is the value of $f(6)$?

A. -6

B. -4

C. 0

D. 2

ID: 023c0a8d Answer

Correct Answer: B

Rationale

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

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

Question Difficulty: Hard