

Question ID 2434c419

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 2434c419

The y -intercept of the graph of $y = x^2 + 31$ in the xy -plane is $(0, y)$. What is the value of y ?

ID: 2434c419 Answer

Correct Answer: 31

Rationale

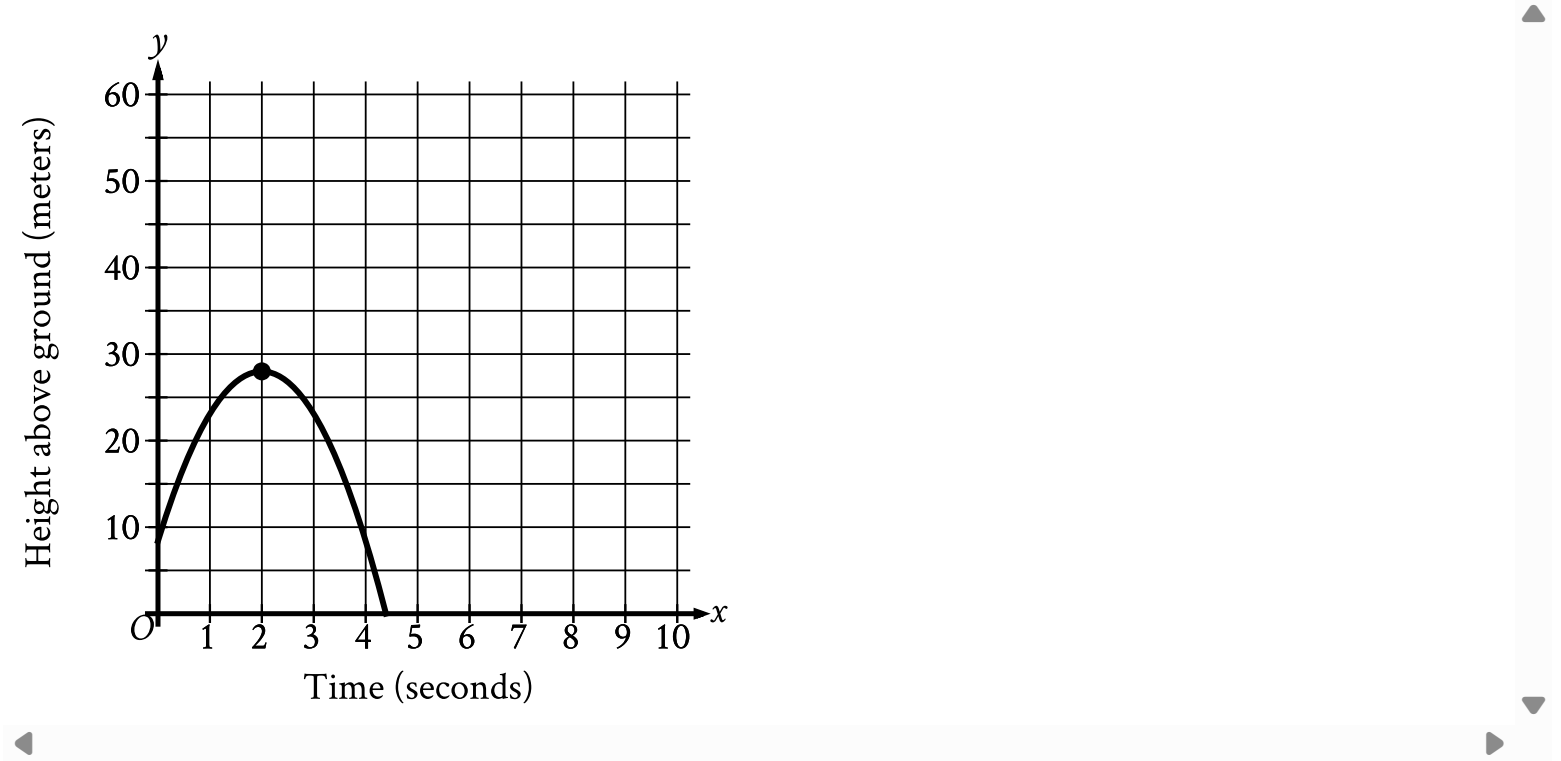
The correct answer is 31. It's given that the y -intercept of the graph of $y = x^2 + 31$ in the xy -plane is $0, y$. Substituting 0 for x in the given equation yields $y = 0^2 + 31$, or $y = 31$. Thus, the value of y is 31.

Question Difficulty: Medium

Question ID 98579160

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 98579160



An object was launched upward from a platform. The graph shown models the height above ground, y , in meters, of the object x seconds after it was launched. For which of the following intervals of time was the height of the object increasing for the entire interval?

- A. From $x = 0$ to $x = 2$
- B. From $x = 0$ to $x = 4$
- C. From $x = 2$ to $x = 3$
- D. From $x = 3$ to $x = 4$

ID: 98579160 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the variable y represents the height, in meters, of the object above the ground. The graph shows that the height of the object was increasing from $x = 0$ to $x = 2$, and decreasing from $x = 2$ to $x = 4$. Therefore, the height of the object was increasing for the entire interval of time from $x = 0$ to $x = 2$.

Choice B is incorrect. The height of the object wasn't increasing for this entire interval of time, as it was decreasing from $x = 2$ to $x = 4$.

Choice C is incorrect. The height of the object was decreasing, not increasing, for this entire interval of time.

Choice D is incorrect. The height of the object was decreasing, not increasing, for this entire interval of time.

Question Difficulty: Medium

Question ID 319cb885

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 319cb885

The function h is defined by $h(x) = \frac{8}{5x+6}$. What is the value of $h(2)$?

ID: 319cb885 Answer

Correct Answer: .5, 1/2

Rationale

The correct answer is $\frac{1}{2}$. The value of $h2$ is the value of hx when $x = 2$. Substituting 2 for x in the given equation yields $h2 = \frac{8}{5 \cdot 2 + 6}$, which is equivalent to $h2 = \frac{8}{16}$, or $h2 = \frac{1}{2}$. Therefore, the value of $h2$ is $\frac{1}{2}$. Note that 1/2 and .5 are examples of ways to enter a correct answer.

Question Difficulty: Medium

Question ID 81ebd1e5

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 81ebd1e5

$q(x) = 32(2^x)$

Which table gives three values of x and their corresponding values of $q(x)$ for function q ?

- A.

x	-1	0	1
$q(x)$	-64	0	64
- B.

x	-1	0	1
$q(x)$	$\frac{1}{16}$	2	64
- C.

x	-1	0	1
$q(x)$	$\frac{1}{16}$	32	64
- D.

x	-1	0	1
$q(x)$	16	32	64

ID: 81ebd1e5 Answer

Correct Answer: D

Rationale

Choice D is correct. Substituting -1 for x in the given function yields $q(-1) = 32 \cdot 2^{-1}$, which is equivalent to $q(-1) = 32 \cdot \frac{1}{2}$, or $q(-1) = 16$. Therefore, when $x = -1$, the corresponding value of $q(x)$ for function q is 16. Substituting 0 for x in the given function yields $q(0) = 32 \cdot 2^0$, which is equivalent to $q(0) = 32 \cdot 1$, or $q(0) = 32$. Therefore, when $x = 0$, the corresponding value of $q(x)$ for function q is 32. Substituting 1 for x in the given function yields $q(1) = 32 \cdot 2^1$, which is equivalent to $q(1) = 32 \cdot 2$, or $q(1) = 64$. Therefore, when $x = 1$, the corresponding value of $q(x)$ for function q is 64. Of the choices given, only the table in choice D gives these three values of x and their corresponding values of $q(x)$ for function q .

Choice A is incorrect. This table gives three values of x and their corresponding values of $q(x)$ for the function $q(x) = 32 \cdot 2^x$.

Choice B is incorrect. This table gives three values of x and their corresponding values of $q(x)$ for the function $q(x) = 2 \cdot 32^x$.

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

Question Difficulty: Medium

Question ID 9f4b5268

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 9f4b5268

The function f is defined by $f(x) = 8\sqrt{x}$. For what value of x does $f(x) = 48$?

- A. 6
- B. 8
- C. 36
- D. 64

ID: 9f4b5268 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that $fx = 8\sqrt{x}$. Substituting 48 for fx in this equation yields $48 = 8\sqrt{x}$. Dividing both sides of this equation by 8 yields $6 = \sqrt{x}$. This can be rewritten as $\sqrt{x} = 6$. Squaring both sides of this equation yields $x = 36$. Therefore, the value of x for which $fx = 48$ is 36.

Choice A is incorrect. If $x = 6$, $fx = 8\sqrt{6}$, not 48.

Choice B is incorrect. If $x = 8$, $fx = 8\sqrt{8}$, not 48.

Choice D is incorrect. If $x = 64$, $fx = 8\sqrt{64}$, which is equivalent to 64, not 48.

Question Difficulty: Medium

Question ID 2ebe1df5

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 2ebe1df5

$h(x) = x^2 - 3$

Which table gives three values of x and their corresponding values of $h(x)$ for the given function h ?

A.

x	1	2	3
$h(x)$	4	5	6

B.

x	1	2	3
$h(x)$	-2	1	6

C.

x	1	2	3
$h(x)$	-1	1	3

D.

x	1	2	3
$h(x)$	-2	1	3

ID: 2ebe1df5 Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that $hx = x^2 - 3$. Each table gives 1, 2, and 3 as the three given values of x . Substituting 1 for x in the equation $hx = x^2 - 3$ yields $h1 = 1^2 - 3$, or $h1 = -2$. Substituting 2 for x in the equation $hx = x^2 - 3$ yields $h2 = 2^2 - 3$, or $h2 = 1$. Finally, substituting 3 for x in the equation $hx = x^2 - 3$ yields $h3 = 3^2 - 3$, or $h3 = 6$. Therefore, hx is -2 when x is 1, hx is 1 when x is 2, and hx is 6 when x is 3. Choice B is a table with these values of x and their corresponding values of hx .

Choice A is incorrect. This is a table of values for the function $hx = x + 3$, not $hx = x^2 - 3$.

Choice C is incorrect. This is a table of values for the function $hx = 2x - 3$, not $hx = x^2 - 3$.

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

Question ID 7904edea

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 7904edea

The function f is defined by $f(x) = 4x^{-1}$. What is the value of $f(21)$?

- A. -84
- B. $\frac{1}{84}$
- C. $\frac{4}{21}$
- D. $\frac{21}{4}$

ID: 7904edea Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that function f is defined by the equation $fx = 4x^{-1}$. The value of $f21$ is the value of fx when $x = 21$. Substituting 21 for x in the given equation yields $f21 = 421^{-1}$, which is equivalent to $f21 = 4\frac{1}{21}$, or $f21 = \frac{4}{21}$.

Choice A is incorrect. This is the value of $f21$ when $fx = -4x$, rather than $fx = 4x^{-1}$.

Choice B is incorrect. This is the value of $f21$ when $fx = 4x^{-1}$, rather than $fx = 4x^{-1}$.

Choice D is incorrect. This is the value of $f21$ when $fx = 4^{-1}x$, rather than $fx = 4x^{-1}$.

Question Difficulty: Medium

Question ID 45962172

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 45962172

The area A , in square centimeters, of a rectangular painting can be represented by the expression $w(w + 29)$, where w is the width, in centimeters, of the painting. Which expression represents the length, in centimeters, of the painting?

- A. w
- B. 29
- C. $(w + 29)$
- D. $w(w + 29)$

ID: 45962172 Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that the expression $ww + 29$ represents the area, in square centimeters, of a rectangular painting, where w is the width, in centimeters, of the painting. The area of a rectangle can be calculated by multiplying its length by its width. It follows that the length, in centimeters, of the painting is represented by the expression $w + 29$.

Choice A is incorrect. This expression represents the width, in centimeters, of the painting, not its length, in centimeters.

Choice B is incorrect. This is the difference between the length, in centimeters, and the width, in centimeters, of the painting, not its length, in centimeters.

Choice D is incorrect. This expression represents the area, in square centimeters, of the painting, not its length, in centimeters.

Question Difficulty: Medium

Question ID 8eec350c

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 8eec350c

$$f(t) = 500(0.5)^{\frac{t}{12}}$$

The function f models the intensity of an X-ray beam, in number of particles in the X-ray beam, t millimeters below the surface of a sample of iron. According to the model, what is the estimated number of particles in the X-ray beam when it is at the surface of the sample of iron?

- A. 500
- B. 12
- C. 5
- D. 2

ID: 8eec350c Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the function f models the intensity of an X-ray beam, in number of particles in the X-ray beam, t millimeters below the surface of a sample of iron. When the X-ray beam is at the surface of the sample of iron, it is 0 millimeters below the surface, so the value of t is 0. Substituting 0 for t in the function $f(t) = 500(0.5)^{\frac{t}{12}}$ yields $f(0) = 500(0.5)^{\frac{0}{12}}$. Since any positive number raised to the power of 0 is equal to 1, it follows that $f(0) = 500(1)$, or $f(0) = 500$. Therefore, the estimated number of particles in the X-ray beam at the surface of the sample of iron is 500.

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

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

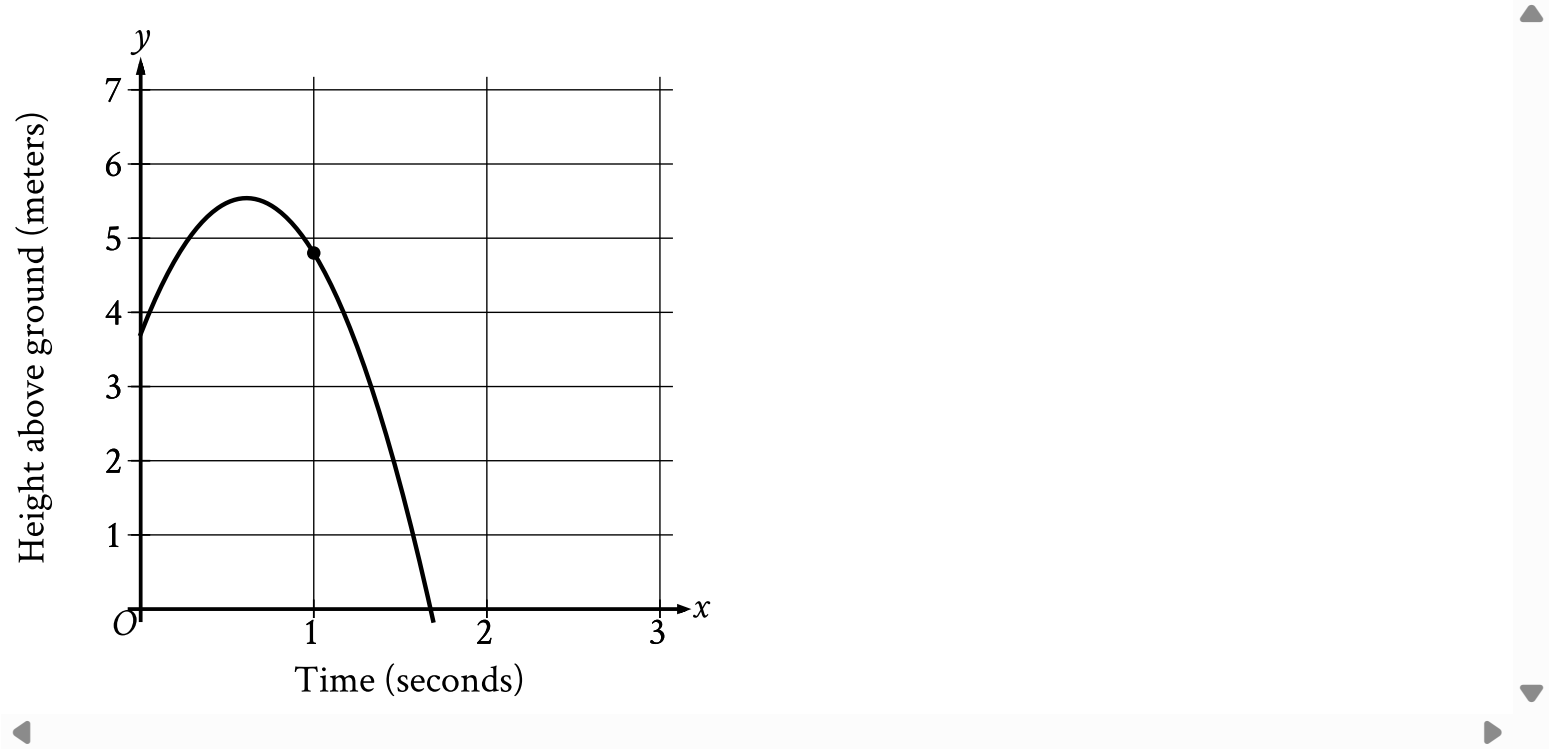
Choice D is incorrect and may result from conceptual or calculation errors.

Question Difficulty: Medium

Question ID 75a64b6b

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 75a64b6b



The graph shows the height above ground, in meters, of a ball x seconds after the ball was launched upward from a platform. Which statement is the best interpretation of the marked point $(1.0, 4.8)$ in this context?

- A. 1.0 second after being launched, the ball's height above ground is 4.8 meters.
- B. 4.8 seconds after being launched, the ball's height above ground is 1.0 meter.
- C. The ball was launched from an initial height of 1.0 meter with an initial velocity of 4.8 meters per second.
- D. The ball was launched from an initial height of 4.8 meters with an initial velocity of 1.0 meter per second.

ID: 75a64b6b Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the graph shows the height above ground, in meters, of a ball x seconds after the ball was launched upward from a platform. In the graph shown, the x -axis represents time, in seconds, and the y -axis represents the height of the ball above ground, in meters. It follows that for the marked point 1.0, 4.8, 1.00 represents the time, in seconds, after the ball was launched upward from a platform and 4.80 represents the height of the ball above ground, in meters. Therefore, the best interpretation of the marked point 1.0, 4.8 is 1.00 second after being launched, the ball's height above ground is 4.80 meters.

Choice B 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: Medium

Question ID 7e46fa03

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 7e46fa03

The function f is defined by $f(x) = 6 + \sqrt{x}$. What is the value of $f(36)$?

ID: 7e46fa03 Answer

Correct Answer: 12

Rationale

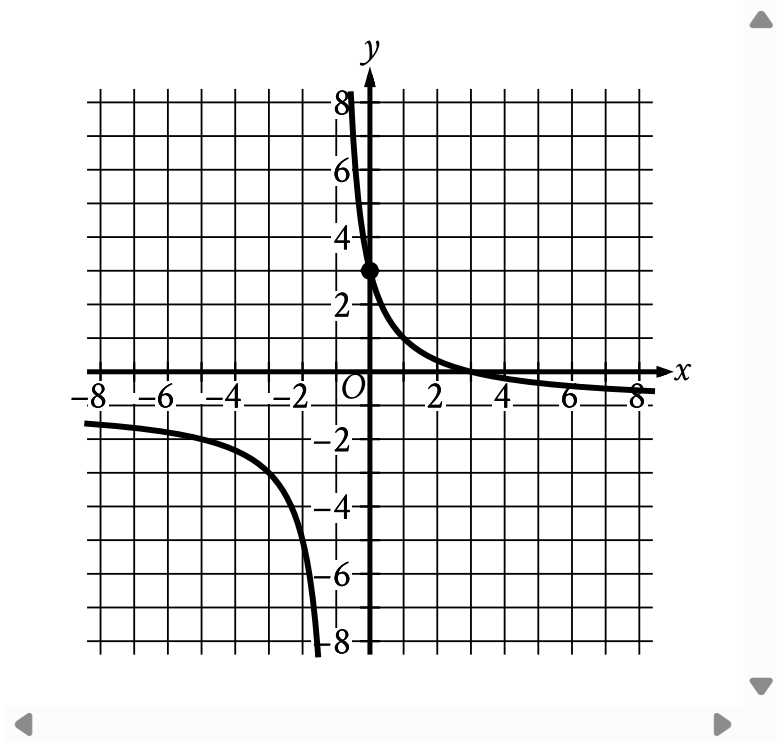
The correct answer is 12. The value of $f36$ is the value of fx when $x = 36$. Substituting 36 for x in the given equation yields $f36 = 6 + \sqrt{36}$, which is equivalent to $f36 = 6 + 6$, or $f36 = 12$. Thus, the value of $f36$ is 12.

Question Difficulty: Medium

Question ID e10502ca

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: e10502ca



What is the y -coordinate of the y -intercept of the graph shown?

ID: e10502ca Answer

Correct Answer: 3

Rationale

The correct answer is 3. A y -intercept of a graph in the xy -plane is a point x, y on the graph where $x = 0$. For the graph shown, at $x = 0$, the corresponding value of y is 3. Therefore, the y -coordinate of the y -intercept of the graph shown is 3.

Question Difficulty: Medium

Question ID c359c731

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: c359c731

- The kinetic energy, in joules, of an object with mass **9** kilograms traveling at a speed of v meters per second is given by the function K , where $K(v) = \frac{9}{2}v^2$. Which of the following is the best interpretation of $K(34) = 5,202$ in this context?
- A. The object traveling at **34** meters per second has a kinetic energy of **5,202** joules.
 - B. The object traveling at **340** meters per second has a kinetic energy of **5,202** joules.
 - C. The object traveling at **5,202** meters per second has a kinetic energy of **34** joules.
 - D. The object traveling at **23,409** meters per second has a kinetic energy of **34** joules.

ID: c359c731 Answer

Correct Answer: A

Rationale

- Choice A is correct. It's given that the kinetic energy, in joules, of an object with a mass of 9 kilograms traveling at a speed of v meters per second is given by the function K , where $Kv = \frac{9}{2}v^2$. It follows that in the equation $K34 = 5,202$, 34 is the value of v , or the speed of the object, in meters per second, and 5,202 is the kinetic energy, in joules, of the object at that speed. Therefore, the best interpretation of $K34 = 5,202$ in this context is the object traveling at 34 meters per second has a kinetic energy of 5,202 joules.
- Choice B is incorrect. The object traveling at 340 meters per second has a kinetic energy of 520,200 joules.
- Choice C is incorrect. The object traveling at 5,202 meters per second has a kinetic energy of 121,773,618 joules.
- Choice D is incorrect. The object traveling at 23,409 meters per second has a kinetic energy of 2,465,915,764.5 joules.

Question Difficulty: Medium

Question ID 45ed2e6b

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 45ed2e6b

Time (years)	Total amount (dollars)
0	604.00
1	606.42
2	608.84

Rosa opened a savings account at a bank. The table shows the exponential relationship between the time t , in years, since Rosa opened the account and the total amount n , in dollars, in the account. If Rosa made no additional deposits or withdrawals, which of the following equations best represents the relationship between t and n ?

- A. $n = (1 + 604)^t$
- B. $n = (1 + 0.004)^t$
- C. $n = 604(1 + 0.004)^t$
- D. $n = 0.004(1 + 604)^t$

ID: 45ed2e6b Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that the relationship between t and n is exponential. The table shows that the value of n increases as the value of t increases. Therefore, the relationship between t and n can be represented by an increasing exponential equation of the form $n = a1 + b^t$, where a and b are positive constants. The table shows that when $t = 0$, $n = 604$. Substituting 0 for t and 604 for n in the equation $n = a1 + b^t$ yields $604 = a1 + b^0$, which is equivalent to $604 = a1$, or $604 = a$. Substituting 604 for a in the equation $n = a1 + b^t$ yields $n = 6041 + b^t$. The table also shows that when $t = 1$, $n = 606.42$. Substituting 1 for t and 606.42 for n in the equation $n = 6041 + b^t$ yields $606.42 = 6041 + b^1$, or $606.42 = 6041 + b$. Dividing both sides of this equation by 604 yields approximately $1.004 = 1 + b$. Subtracting 1 from both sides of this equation yields that the value of b is approximately 0.004 . Substituting 0.004 for b in the equation $n = 6041 + b^t$ yields $n = 6041 + 0.004^t$. Therefore, of the choices, choice C best represents the relationship between t and n .

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: Medium

Question ID a1a27006

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: a1a27006

The function $f(x) = 200,000(1.21)^x$ gives a company's predicted annual revenue, in dollars, x years after the company started selling light bulbs online, where $0 < x \leq 10$. What is the best interpretation of the statement " $f(5)$ is approximately equal to 518,748" in this context?

- A. 5 years after the company started selling light bulbs online, its predicted annual revenue is approximately 518,748 dollars.
- B. 5 years after the company started selling light bulbs online, its predicted annual revenue will have increased by a total of approximately 518,748 dollars.
- C. When the company's predicted annual revenue is approximately 518,748 dollars, it is 5 times the predicted annual revenue for the previous year.
- D. When the company's predicted annual revenue is approximately 518,748 dollars, it is 5% greater than the predicted annual revenue for the previous year.

ID: a1a27006 Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that the function $f(x) = 200,000(1.21)^x$ gives a company's predicted annual revenue, in dollars, x years after the company started selling light bulbs online. It follows that $f(x)$ represents the company's predicted annual revenue, in dollars, x years after the company started selling light bulbs online. Since the value of $f(5)$ is the value of $f(x)$ when $x = 5$, it follows that " $f(5)$ is approximately equal to 518,748" means that $f(x)$ is approximately equal to 518,748 when $x = 5$. Therefore, the best interpretation of the statement " $f(5)$ is approximately equal to 518,748" in this context is 5 years after the company started selling light bulbs online, its predicted annual revenue is approximately 518,748 dollars.

Choice B is incorrect and may result from conceptual errors.

Choice C is incorrect and may result from conceptual errors.

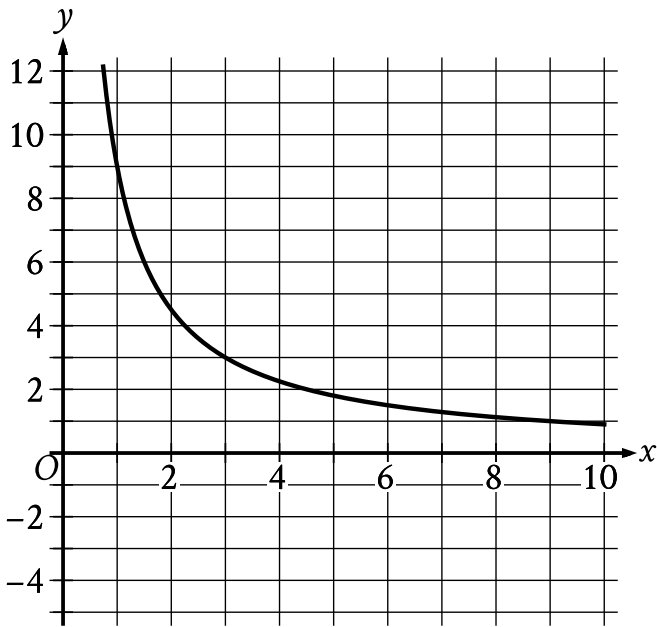
Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Medium

Question ID f8c4065f

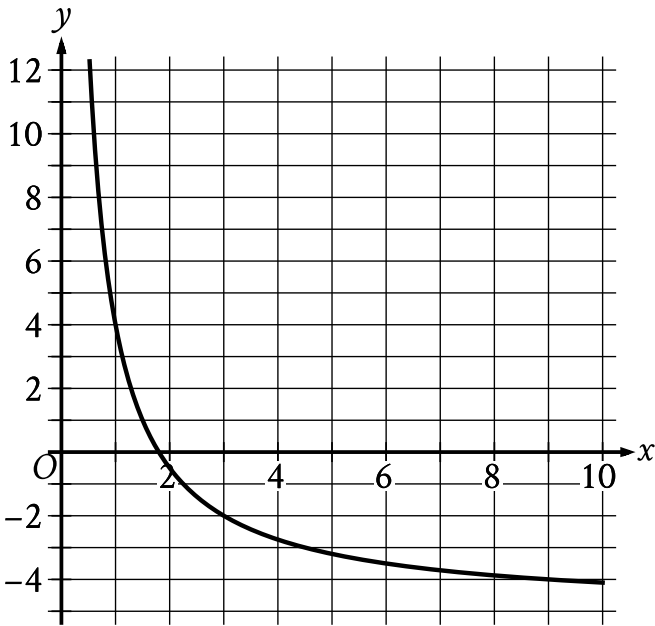
Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: f8c4065f

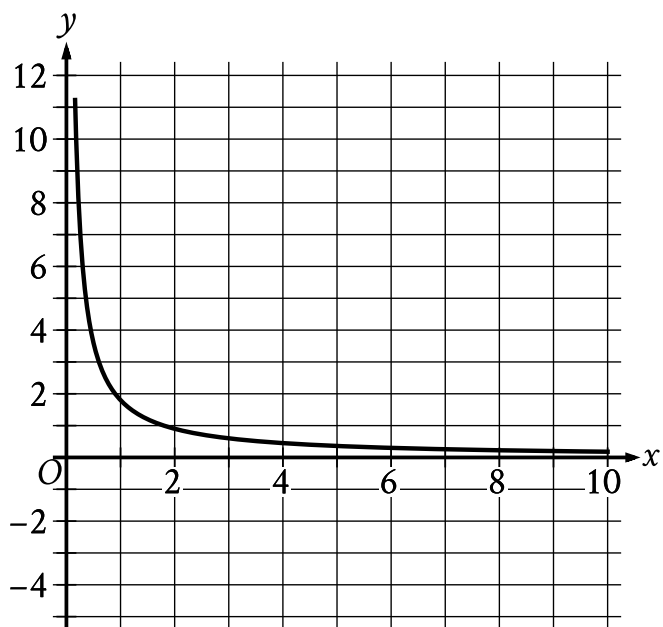


The graph of the rational function f is shown, where $y = f(x)$ and $x \geq 0$. Which of the following is the graph of $y = f(x) + 5$, where $x \geq 0$?

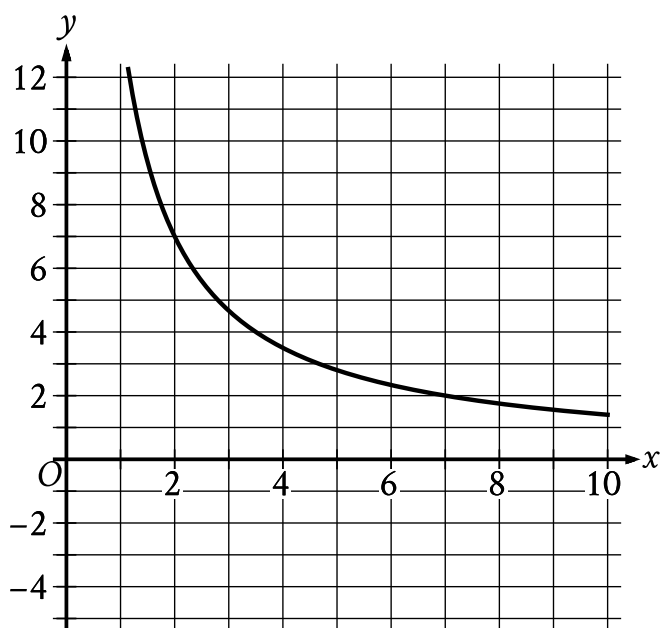
A.



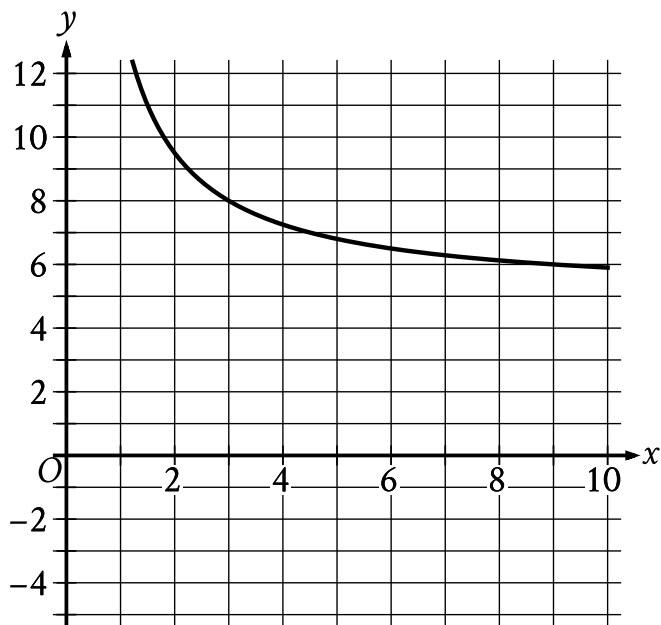
B.



C.



D.



ID: f8c4065f Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the graph of the rational function f is shown, where $y = f(x)$ and $x \geq 0$. The graph shown passes through the point $(3, 3)$. It follows that when the value of x is 3, the value of $f(x)$ is 3. When the value of $f(x)$ is 3, the value of $f(x) + 5$ is $3 + 5$, or 8. Therefore, the graph of $y = f(x) + 5$ passes through the point $(3, 8)$. Of the given choices, choice D is the only graph that passes through the point $(3, 8)$ and is therefore the graph of $y = f(x) + 5$.

Choice A is incorrect. This is the graph of $y = f(x) - 5$, rather than $y = f(x) + 5$.

Choice B is incorrect. This is the graph of $y = \frac{f(x)}{5}$, rather than $y = f(x) + 5$.

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

Question Difficulty: Medium

Question ID e3571ba2

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: e3571ba2

The number of bacteria in a liquid medium doubles every day. There are **44,000** bacteria in the liquid medium at the start of an observation. Which represents the number of bacteria, ***y***, in the liquid medium ***t*** days after the start of the observation?

- A. $y = \frac{1}{2}(44,000)^t$
- B. $y = 2(44,000)^t$
- C. $y = 44,000\left(\frac{1}{2}\right)^t$
- D. $y = 44,000(2)^t$

ID: e3571ba2 Answer

Correct Answer: D

Rationale

Choice D is correct. Since the number of bacteria doubles every day, the relationship between *t* and *y* can be represented by an exponential equation of the form $y = ab^t$, where *a* is the number of bacteria at the start of the observation and the number of bacteria increases by a factor of *b* every day. It's given that there are 44,000 bacteria at the start of the observation. Therefore, *a* = 44,000. It's also given that the number of bacteria doubles, or increases by a factor of 2, every day. Therefore, *b* = 2. Substituting 44,000 for *a* and 2 for *b* in the equation $y = ab^t$ yields $y = 44,0002^t$.

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

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

Choice C is incorrect. This equation represents a situation where the number of bacteria is decreasing by half, not doubling, every day.

Question Difficulty: Medium

Question ID 52bceaab

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 52bceaab

An object is kicked from a platform. The equation $h = -4.9t^2 + 7t + 9$ represents this situation, where h is the height of the object above the ground, in meters, t seconds after it is kicked. Which number represents the height, in meters, from which the object was kicked?

- A. 0
- B. 4.9
- C. 7
- D. 9

ID: 52bceaab Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the equation $h = -4.9t^2 + 7t + 9$ represents this situation, where h is the height, in meters, of the object t seconds after it is kicked. It follows that the height, in meters, from which the object was kicked is the value of h when $t = 0$. Substituting 0 for t in the equation $h = -4.9t^2 + 7t + 9$ yields $h = -4.9(0)^2 + 7(0) + 9$, or $h = 9$. Therefore, the object was kicked from a height of 9 meters.

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: Medium

Question ID db85220f

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: db85220f

Time (years)	Total amount (dollars)
0	670.00
1	674.02
2	678.06

Sara opened a savings account at a bank. The table shows the exponential relationship between the time t , in years, since Sara opened the account and the total amount d , in dollars, in the account. If Sara made no additional deposits or withdrawals, which of the following equations best represents the relationship between t and d ?

- A. $d = 0.006(1 + 670)^t$
- B. $d = 670(1 + 0.006)^t$
- C. $d = (1 + 0.006)^t$
- D. $d = (1 + 670)^t$

ID: db85220f Answer

Correct Answer: B

Rationale

Choice B is correct. It’s given that the relationship between t and d is exponential. The table shows that the value of d increases as the value of t increases. Therefore, the relationship between t and d can be represented by an increasing exponential equation of the form $d = a1 + b^t$, where a and b are positive constants. The table shows that when $t = 0$, $d = 670$. Substituting 0 for t and 670 for d in the equation $d = a1 + b^t$ yields $670 = a1 + b^0$, which is equivalent to $670 = a1$, or $670 = a$. Substituting 670 for a in the equation $d = a1 + b^t$ yields $d = 6701 + b^t$. The table also shows that when $t = 1$, $d = 674.02$. Substituting 1 for t and 674.02 for d in the equation $d = 6701 + b^t$ yields $674.02 = 6701 + b^1$, or $674.02 = 6701 + b$. Dividing both sides of this equation by 670 yields $1.006 = 1 + b$. Subtracting 1 from both sides of this equation yields $b = 0.006$. Substituting 0.006 for b in the equation $d = 6701 + b^t$ yields $d = 6701 + 0.006^t$. Therefore, of the choices, choice B best represents the relationship between t and d .

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: Medium

Question ID 0eced2ad

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 0eced2ad

A function p estimates that there were 2,000 animals in a population in 1998. Each year from 1998 to 2010, the function estimates that the number of animals in this population increased by 3% of the number of animals in the population the previous year. Which equation defines this function, where $p(x)$ is the estimated number of animals in the population x years after 1998?

- A. $p(x) = 2,000(3)^x$
- B. $p(x) = 2,000(1.97)^x$
- C. $p(x) = 2,000(1.03)^x$
- D. $p(x) = 2,000(0.97)^x$

ID: 0eced2ad Answer

Correct Answer: C

Rationale

Choice C is correct. It's given that a function p estimates that there were 2,000 animals in a population in 1998 and that each year from 1998 to 2010, the number of animals in this population increased by 3% of the number of animals in the population the previous year. It follows that this situation can be represented by the function $px = a1 + \frac{r}{100}^x$, where px is the estimated number of animals in the population x years after 1998, a is the estimated number of animals in the population in 1998, and each year the estimated number of animals increased by $r\%$. Substituting 2,000 for a and 3 for r in this function yields $px = 2,0001 + \frac{3}{100}^x$, or $px = 2,0001.03^x$.

Choice A is incorrect. This function represents a population in which each year the number of animals increased by 200%, not 3%, of the number of animals in the population the previous year.

Choice B is incorrect. This function represents a population in which each year the number of animals increased by 97%, not 3%, of the number of animals in the population the previous year.

Choice D is incorrect. This function represents a population in which each year the number of animals decreased, rather than increased, by 3% of the number of animals in the population the previous year.

Question Difficulty: Medium

Question ID 6d84ee10

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 6d84ee10

An egg is thrown from a rooftop. The equation $h = -4.9t^2 + 9t + 18$ represents this situation, where h is the height of the egg above the ground, in meters, t seconds after it is thrown. According to the equation, what is the height, in meters, from which the egg was thrown?

ID: 6d84ee10 Answer

Correct Answer: 18

Rationale

The correct answer is 18. It's given that an egg is thrown from a rooftop and that the equation $h = -4.9t^2 + 9t + 18$ represents this situation, where h is the height of the egg above the ground, in meters, t seconds after it is thrown. It follows that the height, in meters, from which the egg was thrown is the value of h when $t = 0$. Substituting 0 for t in the equation $h = -4.9t^2 + 9t + 18$ yields $h_0 = -4.9(0)^2 + 9(0) + 18$, or $h = 18$. Therefore, according to the equation, the height, in meters, from which the egg was thrown is 18.

Question Difficulty: Medium

Question ID db14a20c

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: db14a20c

The function f is defined by $f(x) = 270(0.1)^x$. What is the value of $f(0)$?

- A. 0
- B. 1
- C. 27
- D. 270

ID: db14a20c Answer

Correct Answer: D

Rationale

Choice D is correct. The value of $f0$ is the value of f_x when $x = 0$. Substituting 0 for x in the given function yields $f0 = 2700.1^0$, or $f0 = 2701$, which is equivalent to $f0 = 270$. Therefore, the value of $f0$ is 270.

Choice A is incorrect. This is the value of x , not f_x .

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

Choice C is incorrect. This is the value of $f1$, not $f0$.

Question Difficulty: Medium

Question ID 0fb16f2f

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 0fb16f2f

A model predicts that the population of Bergen was **15,000** in **2005**. The model also predicts that each year for the next **5** years, the population p increased by **4%** of the previous year's population. Which equation best represents this model, where x is the number of years after **2005**, for $x \leq 5$?

- A. $p = 0.96(15,000)^x$
- B. $p = 1.04(15,000)^x$
- C. $p = 15,000(0.96)^x$
- D. $p = 15,000(1.04)^x$

ID: 0fb16f2f Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that a model predicts the population of Bergen in 2005 was 15,000. The model also predicts that each year for the next 5 years, the population increased by 4% of the previous year's population. The predicted population in one of these years can be found by multiplying the predicted population from the previous year by 1.04. Since the predicted population in 2005 was 15,000, the predicted population 1 year later is $15,000 (1.04)$. The predicted population 2 years later is this value times 1.04, which is $15,000 1.04 1.04$, or $15,000 1.04^2$. The predicted population 3 years later is this value times 1.04, or $15,000 1.04^3$. More generally, the predicted population, p , x years after 2005 is represented by the equation $p = 15,000 1.04^x$.

Choice A is incorrect. Substituting 0 for x in this equation indicates the predicted population in 2005 was 0.96 rather than 15,000.

Choice B is incorrect. Substituting 0 for x in this equation indicates the predicted population in 2005 was 1.04 rather than 15,000.

Choice C is incorrect. This equation indicates the predicted population is decreasing, rather than increasing, by 4% each year.

Question Difficulty: Medium

Question ID 4690d45d

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 4690d45d

$$P(t) = 1,800(1.02)^t$$

The function P gives the estimated number of marine mammals in a certain area, where t is the number of years since a study began. What is the best interpretation of $P(0) = 1,800$ in this context?

- A. The estimated number of marine mammals in the area was **102** when the study began.
- B. The estimated number of marine mammals in the area was **1,800** when the study began.
- C. The estimated number of marine mammals in the area increased by **102** each year during the study.
- D. The estimated number of marine mammals in the area increased by **1,800** each year during the study.

ID: 4690d45d Answer

Correct Answer: B

Rationale

Choice B is correct. The function P gives the estimated number of marine mammals in a certain area, where t is the number of years since a study began. Since the value of $P0$ is the value of Pt when $t = 0$, it follows that $P0 = 1,800$ means that the value of Pt is 1,800 when $t = 0$. Since t is the number of years since the study began, it follows that $t = 0$ is 0 years since the study began, or when the study began. Therefore, the best interpretation of $P0 = 1,800$ in this context is the estimated number of marine mammals in the area was 1,800 when the study began.

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: Medium

Question ID b3f03f6a

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: b3f03f6a

A rectangle has a length that is **15** times its width. The function $y = (15w)(w)$ represents this situation, where y is the area, in square feet, of the rectangle and $y > 0$. Which of the following is the best interpretation of **15w** in this context?

- A. The length of the rectangle, in feet
- B. The area of the rectangle, in square feet
- C. The difference between the length and the width of the rectangle, in feet
- D. The width of the rectangle, in feet

ID: b3f03f6a Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that a rectangle has a length that is 15 times its width. It's also given that the function $y = 15ww$ represents this situation, where y is the area, in square feet, of the rectangle and $y > 0$. The area of a rectangle can be calculated by multiplying the rectangle's length by its width. Since the rectangle has a length that is 15 times its width, it follows that w represents the width of the rectangle, in feet, and $15w$ represents the length of the rectangle, in feet. Therefore, the best interpretation of $15w$ in this context is that it's the length of the rectangle, in feet.

Choice B is incorrect. This is the best interpretation of y , not $15w$, in the given function.

Choice C is incorrect and may result from conceptual errors.

Choice D is incorrect. This is the best interpretation of w , not $15w$, in the given function.

Question Difficulty: Medium

Question ID 155d1adf

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 155d1adf

A rectangle has a length of x units and a width of $(x - 15)$ units. If the rectangle has an area of **76** square units, what is the value of x ?

- A. 4
- B. 19
- C. 23
- D. 76

ID: 155d1adf Answer

Correct Answer: B

Rationale

Choice B is correct. The area of a rectangle is equal to its length multiplied by its width. Multiplying the given length, x units, by the given width, $x - 15$ units, yields $xx - 15$ square units. If the rectangle has an area of 76 square units, it follows that $xx - 15 = 76$, or $x^2 - 15x = 76$. Subtracting 76 from both sides of this equation yields $x^2 - 15x - 76 = 0$. Factoring the left-hand side of this equation yields $x - 19x + 4 = 0$. Applying the zero product property to this equation yields two solutions: $x = 19$ and $x = -4$. Since x is the rectangle's length, in units, which must be positive, the value of x is 19.

Choice A is incorrect. This is the width, in units, of the rectangle, not the value of x .

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

Choice D is incorrect. This is the area, in square units, of the rectangle, not the value of x .

Question Difficulty: Medium

Question ID 2b8f11e6

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 2b8f11e6

The function f is defined by $f(x) = 7x^3$. In the xy -plane, the graph of $y = g(x)$ is the result of shifting the graph of $y = f(x)$ down 2 units. Which equation defines function g ?

- A. $g(x) = \frac{7}{2}x^3$
- B. $g(x) = 7x^{\frac{3}{2}}$
- C. $g(x) = 7x^3 + 2$
- D. $g(x) = 7x^3 - 2$

ID: 2b8f11e6 Answer

Correct Answer: D

Rationale

Choice D is correct. If the graph of $y = gx$ is the result of shifting the graph of $y = fx$ down k units in the xy -plane, the function g can be defined by an equation of the form $gx = fx - k$. It's given that $fx = 7x^3$ and the graph of $y = gx$ is the result of shifting the graph of $y = fx$ down 2 units. Substituting $7x^3$ for fx and 2 for k in the equation $gx = fx - k$ yields $gx = 7x^3 - 2$.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice C is incorrect. This equation defines a function g for which the graph of $y = gx$ is the result of shifting the graph of $y = fx$ up, not down, 2 units.

Question Difficulty: Medium

Question ID b35afde7

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: b35afde7

The area A , in square centimeters, of a rectangular cutting board can be represented by the expression $w(w + 9)$, where w is the width, in centimeters, of the cutting board. Which expression represents the length, in centimeters, of the cutting board?

- A. $w(w + 9)$
- B. w
- C. 9
- D. $(w + 9)$

ID: b35afde7 Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that the expression $ww + 9$ represents the area, in square centimeters, of a rectangular cutting board, where w is the width, in centimeters, of the cutting board. The area of a rectangle can be calculated by multiplying its length by its width. It follows that the length, in centimeters, of the cutting board is represented by the expression $w + 9$.

Choice A is incorrect. This expression represents the area, in square centimeters, of the cutting board, not its length, in centimeters.

Choice B is incorrect. This expression represents the width, in centimeters, of the cutting board, not its length.

Choice C is incorrect. This is the difference between the length, in centimeters, and the width, in centimeters, of the cutting board, not its length, in centimeters.

Question Difficulty: Medium

Question ID 38bdfb69

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 38bdfb69

$$y = 0.25x^2 - 7.5x + 90.25$$

The equation gives the estimated stock price y , in dollars, for a certain company x days after a new product launched, where $0 \leq x \leq 20$. Which statement is the best interpretation of $(x, y) = (1, 83)$ in this context?

- A. The company's estimated stock price increased **\$83** every day after the new product launched.
- B. The company's estimated stock price increased **\$1** every **83** days after the new product launched.
- C. **1** day after the new product launched, the company's estimated stock price is **\$83**.
- D. **83** days after the new product launched, the company's estimated stock price is **\$1**.

ID: 38bdfb69 Answer

Correct Answer: C

Rationale

Choice C is correct. In the given equation, x represents the number of days after a new product launched, where $0 \leq x \leq 20$, and y represents the estimated stock price, in dollars, for a certain company. Therefore, the best interpretation of $x, y = 1, 83$ in this context is that 1 day after the new product launched, the company's estimated stock price is \$ 83.

Choice A is incorrect and may result from conceptual errors.

Choice B is incorrect and may result from conceptual errors.

Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Medium

Question ID db9e8c54

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: db9e8c54

A ball is dropped from an initial height of **22** feet and bounces off the ground repeatedly. The function h estimates that the maximum height reached after each time the ball hits the ground is **85%** of the maximum height reached after the previous time the ball hit the ground. Which equation defines h , where $h(n)$ is the estimated maximum height of the ball after it has hit the ground n times and n is a whole number greater than **1** and less than **10**?

- A. $h(n) = 22(0.22)^n$
- B. $h(n) = 22(0.85)^n$
- C. $h(n) = 85(0.22)^n$
- D. $h(n) = 85(0.85)^n$

ID: db9e8c54 Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that for the function h , hn is the estimated maximum height, in feet, of the ball after it has hit the ground n times. It's also given that the function h estimates that the maximum height reached after each time the ball hits the ground is 85% of the maximum height reached after the previous time the ball hit the ground. It follows that h is a decreasing exponential function that can be written in the form $hn = a\frac{p}{100}^n$, where a is the initial height, in feet, the ball was dropped from and the function estimates that the maximum height reached after each time the ball hits the ground is $p\%$ of the maximum height reached after the previous time the ball hit the ground. It's given that the ball is dropped from an initial height of 22 feet. Therefore, $a = 22$. Since the function h estimates that the maximum height reached after each time the ball hits the ground is 85% of the maximum height reached after the previous time the ball hit the ground, $p = 85$. Substituting 22 for a and 85 for p in the equation $hn = a\frac{p}{100}^n$ yields $hn = 22\frac{85}{100}^n$, or $hn = 22(0.85)^n$.

Choice A is incorrect. This function estimates that the maximum height reached after each time the ball hits the ground is 22%, not 85%, of the maximum height reached after the previous time the ball hit the ground.

Choice C is incorrect. This function estimates that the ball is dropped from an initial height of 85 feet, not 22 feet, and that the maximum height reached after each time the ball hits the ground is 22%, not 85%, of the maximum height reached after the previous time the ball hit the ground.

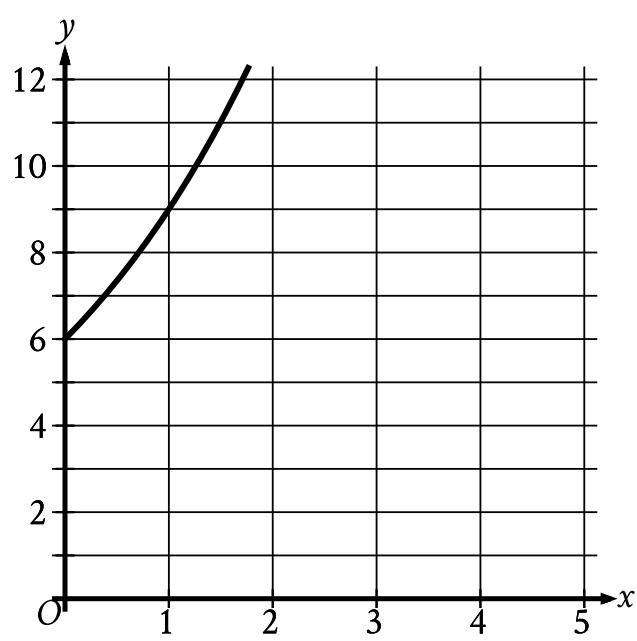
Choice D is incorrect. This function estimates that the ball is dropped from an initial height of 85 feet, not 22 feet.

Question Difficulty: Medium

Question ID 2bd489b5

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 2bd489b5



The graph gives the estimated population y , in thousands, of a town x years since 2003, where $0 \leq x \leq 5$. Which of the following best describes the increase in the estimated population from $x = 0$ to $x = 1$?

- A. The estimated population at $x = 1$ is 0.5 times the estimated population at $x = 0$.
- B. The estimated population at $x = 1$ is 1.5 times the estimated population at $x = 0$.
- C. The estimated population at $x = 1$ is 2.5 times the estimated population at $x = 0$.
- D. The estimated population at $x = 1$ is 3.5 times the estimated population at $x = 0$.

ID: 2bd489b5 Answer

Correct Answer: B

Rationale

Choice B is correct. On the graph shown, the y -axis represents estimated population, in thousands. The graph shows that when $x = 0$, the y -coordinate is 6. Therefore, the estimated population at $x = 0$ is 6 thousand. The graph also shows that when $x = 1$, the y -coordinate is 9. Therefore, the estimated population at $x = 1$ is 9 thousand. Dividing 9 thousand by 6 thousand yields 1.5; therefore, 9 thousand is 1.5 times 6 thousand. It follows that the estimated population at $x = 1$ is 1.5 times the estimated population at $x = 0$.

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: Medium

Question ID 44c23cf1

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 44c23cf1

The function $f(w) = 6w^2$ gives the area of a rectangle, **in square feet (ft^2)**, if its width is w **ft** and its length is **6** times its width. Which of the following is the best interpretation of $f(14) = 1,176$?

- A. If the width of the rectangle is **14 ft**, then the area of the rectangle is **1,176 ft^2** .
- B. If the width of the rectangle is **14 ft**, then the length of the rectangle is **1,176 ft**.
- C. If the width of the rectangle is **1,176 ft**, then the length of the rectangle is **14 ft**.
- D. If the width of the rectangle is **1,176 ft**, then the area of the rectangle is **14 ft^2** .

ID: 44c23cf1 Answer

Correct Answer: A

Rationale

Choice A is correct. The function f gives the area of the rectangle, in ft^2 , if its width is w ft. Since the value of $f(14)$ is the value of $f(w)$ if $w = 14$, it follows that $f(14) = 1,176$ means that $f(w)$ is 1,176 if $w = 14$. In the given context, this means that if the width of the rectangle is 14 ft, then the area of the rectangle is 1,176 ft^2 .

Choice B 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 interpreting $f(w)$ as the width, in ft, of the rectangle if its area is w ft^2 , rather than as the area, in ft^2 , of the rectangle if its width is w ft.

Question Difficulty: Medium

Question ID 7e7255de

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 7e7255de

The function p is defined by $p(n) = 7n^3$. What is the value of n when $p(n)$ is equal to 56?

- A. 2
- B. $\frac{8}{3}$
- C. 7
- D. 8

ID: 7e7255de Answer

Correct Answer: A

Rationale

Choice A is correct. It's given that $pn = 7n^3$. Substituting 56 for pn in this equation yields $56 = 7n^3$. Dividing each side of this equation by 7 yields $8 = n^3$. Taking the cube root of each side of this equation yields $2 = n$. Therefore, when pn is equal to 56, the value of n is 2.

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: Medium

Question ID 9514e764

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 9514e764

$$g(x) = x^2 + 55$$

What is the minimum value of the given function?

- A. 0
- B. 55
- C. 110
- D. 3,025

ID: 9514e764 Answer

Correct Answer: B

Rationale

Choice B is correct. For a quadratic function defined by an equation of the form $gx = ax - h^2 + k$, where a , h , and k are constants and $a > 0$, the minimum value of the function is k . In the given function, $a = 1$, $h = 0$, and $k = 55$. Therefore, the minimum value of the given function is 55.

Choice A is incorrect. This is the value of x for which the given function reaches its minimum value, not the minimum value of the function.

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: Medium

Question ID 194aa933

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 194aa933

$$P(t) = 24.8(1.036)^t$$

The function P gives the predicted population, in millions, of a certain country for the period from 1984 to 2018, where t is the number of years after 1984. According to the model, what is the best interpretation of the statement “ $P(8)$ is approximately equal to 32.91”?

- A. In 1984, the predicted population of this country was approximately 8 million.
- B. In 1984, the predicted population of this country was approximately 32.91 million.
- C. 8 years after 1984, the predicted population of this country was approximately 32.91 million.
- D. 32.91 years after 1984, the predicted population of this country was approximately 8 million.

ID: 194aa933 Answer

Correct Answer: C

Rationale

Choice C is correct. The function P gives the predicted population, in millions, of a certain country for the period from 1984 to 2018, where t is the number of years after 1984. Since the value of $P8$ is the value of Pt when $t = 8$, it follows that “ $P8$ is approximately equal to 32.91” means that the value of Pt is approximately equal to 32.91 when $t = 8$. Therefore, the best interpretation of the statement “ $P8$ is approximately equal to 32.91” is that 8 years after 1984, the predicted population of this country was approximately 32.91 million.

Choice A is incorrect. In 1984, the predicted population of this country was 24.8 million, not approximately 8 million.

Choice B is incorrect. In 1984, the predicted population of this country was 24.8 million, not approximately 32.91 million.

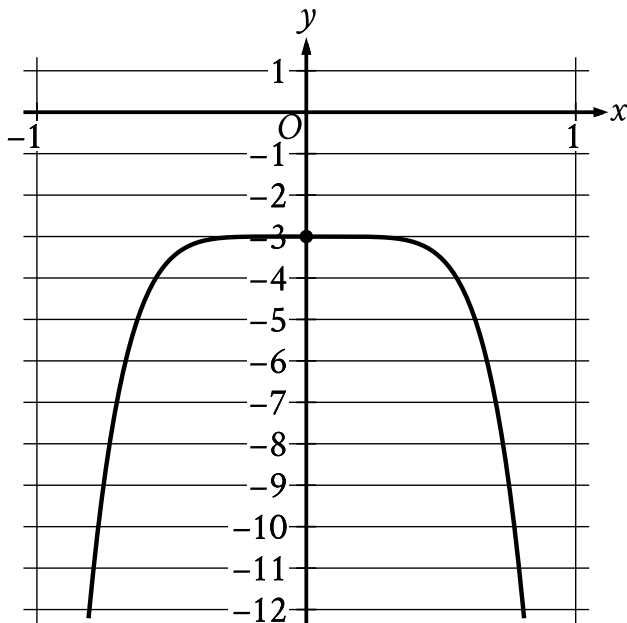
Choice D is incorrect. 32.91 years after 1984, the predicted population of this country was $24.8(1.036)^{32.91}$ million, or approximately 79.42 million, not approximately 8 million.

Question Difficulty: Medium

Question ID baf439a1

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: baf439a1



The graph of the polynomial function f , where $y = f(x)$, is shown. The y -intercept of the graph is $(0, y)$. What is the value of y ?

ID: baf439a1 Answer

Correct Answer: -3

Rationale

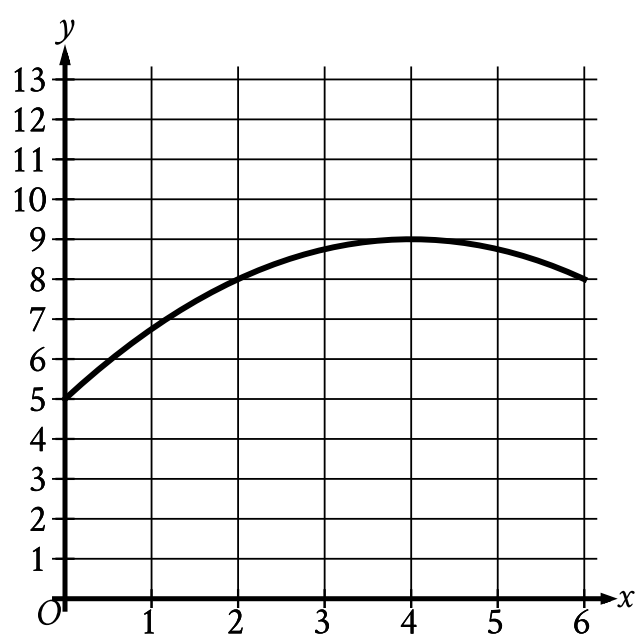
The correct answer is -3. The y -intercept of the graph of a function in the xy -plane is the point where the graph crosses the y -axis. The graph of the polynomial function shown crosses the y -axis at the point $0, -3$. It's given that the y -intercept of the graph is $0, y$. Thus, the value of y is -3.

Question Difficulty: Medium

Question ID fb72f2ed

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: fb72f2ed



The graph models the number of active projects a company was working on x months after the end of November **2012**, where $0 \leq x \leq 6$. According to the model, what is the predicted number of active projects the company was working on at the end of November **2012**?

- A. 0
- B. 5
- C. 8
- D. 9

ID: fb72f2ed Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that the graph models the number of active projects a company was working on x months after the end of November 2012. Therefore, the value of x that corresponds to the end of November 2012 is 0. The point at which $x = 0$ is the y -intercept of the graph. It follows that the y -intercept of the graph shown is the point 0, 5. Therefore, according to the model, the predicted number of active projects the company was working on at the end of November 2012 is 5.

Choice A is incorrect. This is the value of x that corresponds to the end of November 2012, not the predicted number of active projects the company was working on at the end of November 2012.

Choice C is incorrect. This is the predicted number of active projects the company was working on 2 months after the end of November 2012.

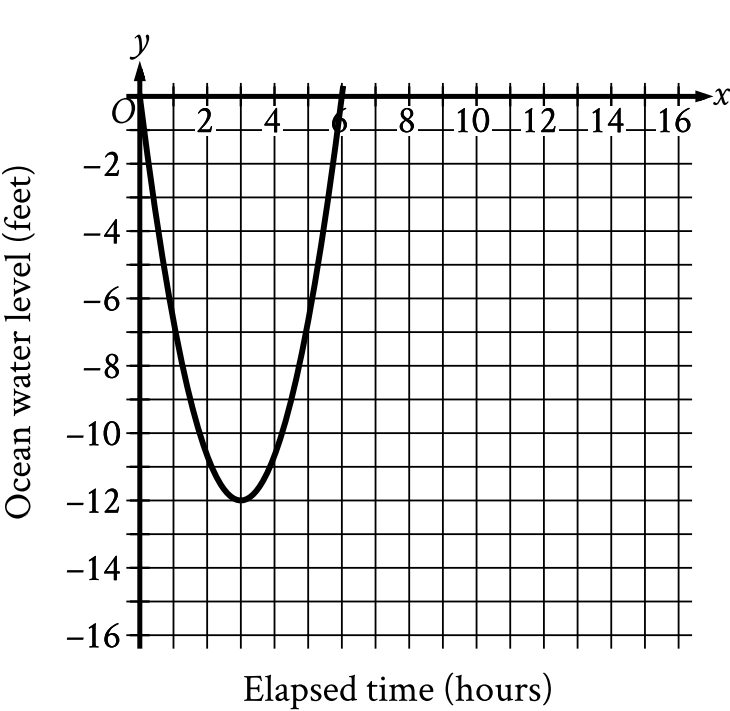
Choice D is incorrect. This is the predicted number of active projects the company was working on 4 months after the end of November 2012.

Question Difficulty: Medium

Question ID d84cbe50

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: d84cbe50



Scientists recorded data about the ocean water levels at a certain location over a period of **6** hours. The graph shown models the data, where **$y = 0$** represents sea level. Which table gives values of **x** and their corresponding values of **y** based on the model?

A.

x	y
0	-12
0	3
3	6

B.

x	y
0	0
3	12
0	-6

C.

x	y
0	0

3	-12
6	0

D.

x	y
0	0
12	3
-6	0

ID: d84cbe50 Answer

Correct Answer: C

Rationale

Choice C is correct. Each point x, y on the graph represents an elapsed time x , in hours, and the corresponding ocean water level y , in feet, at a certain location based on the model. The graph shown passes through the points 0, 0, 3, - 12, and 6, 0. Thus, the table in choice C gives the values of x and their corresponding values of y based on the model.

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: Medium

Question ID 27711b27

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 27711b27

A company has a newsletter. In January 2018, there were 1,300 customers subscribed to the newsletter. For the next 24 months after January 2018, the total number of customers subscribed to the newsletter each month was 7% greater than the total number subscribed the previous month. Which equation gives the total number of customers, c , subscribed to the company's newsletter m months after January 2018, where $m \leq 24$?

- A. $c = 1,300(0.07)^m$
- B. $c = 1,300(1.07)^m$
- C. $c = 1,300(1.7)^m$
- D. $c = 1,300(7)^m$

ID: 27711b27 Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that in January 2018, there were 1,300 customers subscribed to a company's newsletter and for the next 24 months after January 2018, the total number of customers subscribed to the newsletter each month was 7% greater than the total number subscribed the previous month. It follows that this situation can be represented by the equation $c = a1 + \frac{r}{100}^m$, where c is the total number of customers subscribed to the company's newsletter m months after January 2018, a is the number of customers subscribed to the newsletter in January 2018, and the total number of customers subscribed to the newsletter each month was $r\%$ greater than the total number subscribed the previous month. Substituting 1,300 for a and 7 for r in this equation yields $c = 1,3001 + \frac{7}{100}^m$, or $c = 1,3001.07^m$.

Choice A is incorrect. This equation represents a situation where the total number of customers subscribed each month was 93% less, not 7% greater, than the total number subscribed the previous month.

Choice C is incorrect. This equation represents a situation where the total number of customers subscribed each month was 70%, not 7%, greater than the total number subscribed the previous month.

Choice D is incorrect. This equation represents a situation where the total number of customers subscribed each month was 600%, not 7%, greater than the total number subscribed the previous month.

Question Difficulty: Medium

Question ID 0fb16f2f

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 0fb16f2f

A model predicts that the population of Bergen was **15,000** in **2005**. The model also predicts that each year for the next **5** years, the population p increased by **4%** of the previous year's population. Which equation best represents this model, where x is the number of years after **2005**, for $x \leq 5$?

- A. $p = 0.96(15,000)^x$
- B. $p = 1.04(15,000)^x$
- C. $p = 15,000(0.96)^x$
- D. $p = 15,000(1.04)^x$

ID: 0fb16f2f Answer

Correct Answer: D

Rationale

Choice D is correct. It's given that a model predicts the population of Bergen in 2005 was 15,000. The model also predicts that each year for the next 5 years, the population increased by 4% of the previous year's population. The predicted population in one of these years can be found by multiplying the predicted population from the previous year by 1.04. Since the predicted population in 2005 was 15,000, the predicted population 1 year later is $15,000 (1.04)$. The predicted population 2 years later is this value times 1.04, which is $15,000 1.04 1.04$, or $15,000 1.04^2$. The predicted population 3 years later is this value times 1.04, or $15,000 1.04^3$. More generally, the predicted population, p , x years after 2005 is represented by the equation $p = 15,000 1.04^x$.

Choice A is incorrect. Substituting 0 for x in this equation indicates the predicted population in 2005 was 0.96 rather than 15,000.

Choice B is incorrect. Substituting 0 for x in this equation indicates the predicted population in 2005 was 1.04 rather than 15,000.

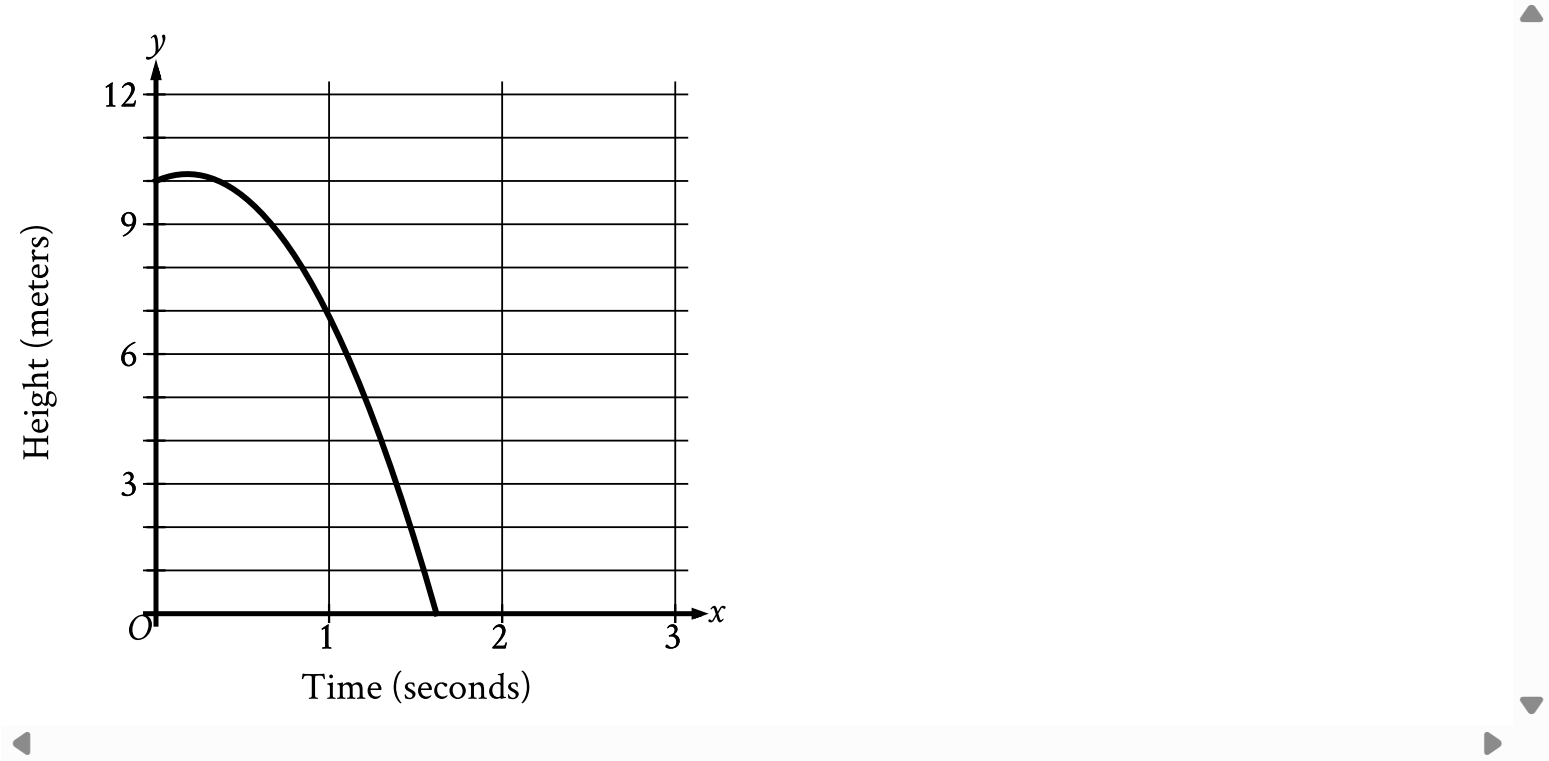
Choice C is incorrect. This equation indicates the predicted population is decreasing, rather than increasing, by 4% each year.

Question Difficulty: Medium

Question ID 05e193b5

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 05e193b5



A competitive diver dives from a platform into the water. The graph shown gives the height above the water y , in meters, of the diver x seconds after diving from the platform. What is the best interpretation of the x -intercept of the graph?

- A. The diver reaches a maximum height above the water at **1.6** seconds.
- B. The diver hits the water at **1.6** seconds.
- C. The diver reaches a maximum height above the water at **0.2** seconds.
- D. The diver hits the water at **0.2** seconds.

ID: 05e193b5 Answer

Correct Answer: B

Rationale

Choice B is correct. It's given that the graph shows the height above the water y , in meters, of a diver x seconds after diving from a platform. The x -intercept of a graph is the point at which the graph intersects the x -axis, or when the value of y is 0. The graph shown intersects the x -axis between $x = 1$ and $x = 2$. In other words, the diver is 0 meters above the water, or hits the water, between 1 and 2 seconds after diving from the platform. Of the given choices, only choice B includes an interpretation where the diver hits the water between 1 and 2 seconds. Therefore, the best interpretation of the x -intercept of the graph is the diver hits the water at 1.6 seconds.

Choice A is incorrect and may result from conceptual errors.

Choice C is incorrect. This is the best interpretation of the maximum value, not the x-intercept, of the graph.

Choice D is incorrect and may result from conceptual errors.

Question Difficulty: Medium

Question ID 4cc2980e

Assessment	Test	Domain	Skill	Difficulty
PSAT/NMSQT & PSAT 10	Math	Advanced Math	Nonlinear functions	<div><div></div><div></div><div></div></div>

ID: 4cc2980e

A company opens an account with an initial balance of **\$36,100.00**. The account earns interest, and no additional deposits or withdrawals are made. The account balance is given by an exponential function ***A***, where ***A*(*t*)** is the account balance, in dollars, ***t*** years after the account is opened. The account balance after **13** years is **\$68,071.93**. Which equation could define ***A***?

- A. $A(t) = 36,100.00(1.05)^t$
- B. $A(t) = 31,971.93(1.05)^t$
- C. $A(t) = 31,971.93(0.05)^t$
- D. $A(t) = 36,100.00(0.05)^t$

ID: 4cc2980e Answer

Correct Answer: A

Rationale

Choice A is correct. Since it's given that the account balance, *At*, in dollars, after *t* years can be modeled by an exponential function, it follows that function *A* can be written in the form $At = Nr^t$, where *N* is the initial value of the function and *r* is a constant related to the growth of the function. It's given that the initial balance of the account is \$ 36,100.00, so it follows that the initial value of the function, or *N*, must be 36,100.00. Substituting 36,100.00 for *N* in the equation $At = Nr^t$ yields $At = 36,100.00r^t$. It's given that the account balance after 13 years, or when *t* = 13, is \$ 68,071.93. It follows that $A13 = 68,071.93$, or $36,100.00r^{13} = 68,071.93$. Dividing each side of the equation $36,100.00r^{13} = 68,071.93$ by 36,100.00 yields $r^{13} = \frac{68,071.93}{36,100.00}$. Taking the 13th root of both sides of this equation yields $r = \sqrt[13]{\frac{68,071.93}{36,100.00}}$, or *r* is approximately equal to 1.05. Substituting 1.05 for *r* in the equation $At = 36,100.00r^t$ yields $At = 36,100.001.05^t$, so the equation $At = 36,100.001.05^t$ could define *A*.

Choice B is incorrect. Substituting 0 for *t* in this function indicates an initial balance of \$ 31,971.93, rather than \$ 36,100.00.

Choice C is incorrect. Substituting 0 for *t* in this function indicates an initial balance of \$ 31,971.93, rather than \$ 36,100.00. Additionally, this function indicates the account balance is decreasing, rather than increasing, over time.

Choice D is incorrect. This function indicates the account balance is decreasing, rather than increasing, over time.

Question Difficulty: Medium