# Question ID ba6b299f

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: ba6b299f**

The quadratic function $g$ models the depth, in meters, below the surface of the water of a seal $t$ minutes after the seal entered the water during a dive. The function estimates that the seal reached its maximum depth of $302.4$ meters $6$ minutes after it entered the water and then reached the surface of the water $12$ minutes after it entered the water. Based on the function, what was the estimated depth, to the nearest meter, of the seal $10$ minutes after it entered the water?

# Question ID e61cf654

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: e61cf654

The function $f$ is defined by $f(x) = |x - 4x|$. What value of $a$ satisfies $f(5) - f(a) = -15$?

A. $-20$

B. $5$

C. $10$

D. $45$

# Question ID fe023b12

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: fe023b12**

$$y = 576^{(2x+2)}$$

The graph of the given equation in the *xy*-plane has a *y*-intercept of $(r, s)$. Which of the following equivalent equations displays the value of $s$ as a constant, a coefficient, or the base?

A. $y =$ msup

B. $y =$ msup

C. $y = \frac{1}{24}$ msup

D. $y = \frac{1}{576}$ msup

# Question ID 89aff4d3

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 89aff4d3**

At the time that an article was first featured on the home page of a news website, there were $40$ comments on the article. An exponential model estimates that at the end of each hour after the article was first featured on the home page, the number of comments on the article had increased by $190\%$ of the number of comments on the article at the end of the previous hour. Which of the following equations best represents this model, where $C$ is the estimated number of comments on the article $t$ hours after the article was first featured on the home page and $t \leq 4$?

A. $C = 40$msup

B. $C = 40$msup

C. $C = 40$msup

D. $C = 40$msup

# Question ID f4ae2eb4

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: f4ae2eb4**

Which of the following functions has(have) a minimum value at $-3$?

I. $f(x) = -6(3)^x - 3$

II. $g(x) = -3(6)^x$

A. I only

B. II only

C. I and II

D. Neither I nor II

# Question ID a5ff934b

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: a5ff934b**

The area of a triangle is equal to $x^2$ square centimeters. The length of the base of the triangle is $2x + 22$ centimeters, and the height of the triangle is $x - 10$ centimeters. What is the value of $x$?

# Question ID dd31281d

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: dd31281d

$$P(t) = 260(1.04)^{(\frac{6}{4})t}$$

The function $P$ models the population, in thousands, of a certain city $t$ years after $2003$. According to the model, the population is predicted to increase by $4\%$ every $n$ months. What is the value of $n$?

A. $8$

B. $12$

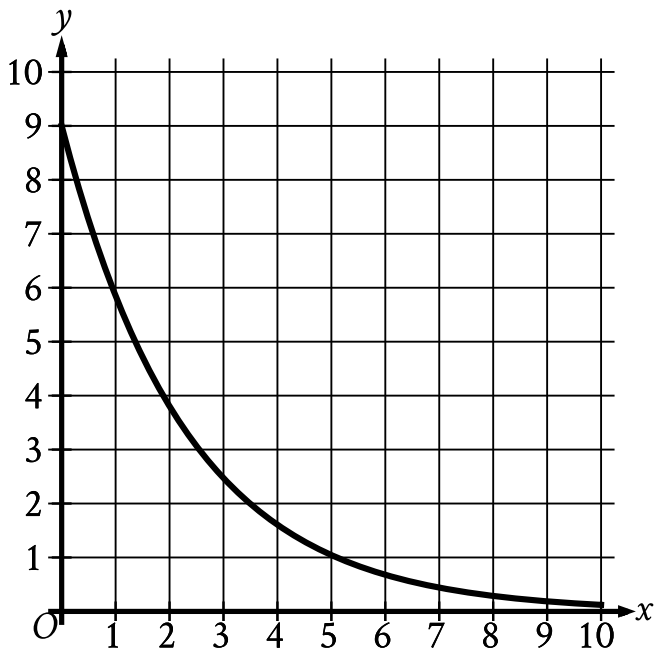
C. $18$

D. $72$

# Question ID 1f8d25fc

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 1f8d25fc




The graph gives the estimated number of catalogs $y$, in thousands, a company sent to its customers at the end of each year, where $x$ represents the number of years since the end of $1992$, where $0 \leq x \leq 10$. Which statement is the best interpretation of the *y*-intercept in this context?

A. The estimated total number of catalogs the company sent to its customers during the first $10$ years was $9{,}000$.

B. The estimated total number of catalogs the company sent to its customers from the end of $1992$ to the end of $2002$ was $90$.

C. The estimated number of catalogs the company sent to its customers at the end of $1992$ was $9$.

D. The estimated number of catalogs the company sent to its customers at the end of $1992$ was $9{,}000$.

# Question ID 97e5f390

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 97e5f390**

The product of two positive integers is $462$. If the first integer is $5$ greater than twice the second integer, what is the smaller of the two integers?

# Question ID bb19a769

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: bb19a769**

$$f(x) = (x - 2)(x + 15)$$

The function $f$ is defined by the given equation. For what value of $x$ does $f(x)$ reach its minimum?

# Question ID 59c7ac54

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 59c7ac54**

$$f(x) = 4{,}000(0.75)^x$$

An entomologist recommended a program to reduce a certain invasive beetle population in an area. The given function estimates this beetle species' population $x$ years after $2012$, where $x \leq 7$. Which of the following is the best interpretation of $4{,}000$ in this context?

A. The estimated initial beetle population for this species and area in $2012$

B. The estimated beetle population for this species and area $7$ years after $2012$

C. The estimated percent decrease in the beetle population for this species and area each year after $2012$

D. The estimated percent decrease in the beetle population for this species and area every $7$ years after $2012$

# Question ID 40dad627

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 40dad627**

$$f(x) = 9{,}000(0.66)^x$$

The given function $f$ models the number of advertisements a company sent to its clients each year, where $x$ represents the number of years since $1997$, and $0 \leq x \leq 5$. If $y = f(x)$ is graphed in the *xy*-plane, which of the following is the best interpretation of the *y*-intercept of the graph in this context?

A. The minimum estimated number of advertisements the company sent to its clients during the $5$ years was $1{,}708$.

B. The minimum estimated number of advertisements the company sent to its clients during the $5$ years was $9{,}000$.

C. The estimated number of advertisements the company sent to its clients in $1997$ was $1{,}708$.

D. The estimated number of advertisements the company sent to its clients in $1997$ was $9{,}000$.

# Question ID d809f2e5

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: d809f2e5**

A right rectangular prism has a height of $9$ inches. The length of the prism's base is $x$ inches, which is $7$ inches more than the width of the prism's base. Which function $V$ gives the volume of the prism, in cubic inches, in terms of the length of the prism's base?

A. $V(x) = x(x + 9)(x + 7)$

B. $V(x) = x(x + 9)(x - 7)$

C. $V(x) = 9x(x + 7)$

D. $V(x) = 9x(x - 7)$

# Question ID 55cc3589

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 55cc3589**

$$f(t) = 55t - 2t^2$$

The function $f$ is defined by the given equation. The function $g$ is defined by $g(t) = f(t) + 3$. Which expression represents the maximum value of $g(t)$?

A. $3 +$ msup

B. $3 + 2$msup

C. $3 - 2$msup

D. $3 -$ msup

# Question ID 42141e28

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 42141e28**

$$f(x) = (x - 44)(x - 46)$$

The function $f$ is defined by the given equation. For what value of $x$ does $f(x)$ reach its minimum?

A. $46$

B. $45$

C. $44$

D. $-1$

# Question ID 92f8fab6

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 92f8fab6**

The functions $f$ and $g$ are defined by the given equations, where $x \geq 0$. Which of the following equations displays, as a constant or coefficient, the maximum value of the function it defines, where $x \geq 0$?

I. $f(x) = 18(1.25)^x + 41$

II. $g(x) = 9(0.73)^x$

A. I only

B. II only

C. I and II

D. Neither I nor II

# Question ID 032ab67d

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 032ab67d

$$f(t) = 8{,}000(0.65)^t$$

The given function $f$ models the number of coupons a company sent to their customers at the end of each year, where $t$ represents the number of years since the end of $1998$, and $0 \leq t \leq 5$. If $y = f(t)$ is graphed in the *ty*-plane, which of the following is the best interpretation of the *y*-intercept of the graph in this context?

A. The minimum estimated number of coupons the company sent to their customers during the $5$ years was $1{,}428$.

B. The minimum estimated number of coupons the company sent to their customers during the $5$ years was $8{,}000$.

C. The estimated number of coupons the company sent to their customers at the end of $1998$ was $1{,}428$.

D. The estimated number of coupons the company sent to their customers at the end of $1998$ was $8{,}000$.

# Question ID 7b9287d0

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 7b9287d0**

The function $f(w) = 6w^2$ gives the area of a rectangle, $\textbf{in square feet } (\text{ft}^2)$, 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$^2$.

# Question ID 90f01cb4

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 90f01cb4**

The function $f$ is defined by $f(x) = 5\left(\frac{1}{4} - x\right)^2 + \frac{11}{4}$. What is the value of $f\left(\frac{1}{4}\right)$?

# Question ID bbeab5b6

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: bbeab5b6**

The function $f$ is defined by $f(x) = a^x + b$, where $a$ and $b$ are constants and $a > 0$. In the *xy*-plane, the graph of $y = f(x)$ has a *y*-intercept at $(0, -25)$ and passes through the point $(2, 23)$. What is the value of $a + b$?

# Question ID 720dc199

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 720dc199**

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. $270$

# Question ID bb0a06b2

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: bb0a06b2**

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. $\frac{21}{4}$

# Question ID 3d3e5400

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 3d3e5400**

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

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.

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

# Question ID 8df14879

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 8df14879

$$f(x) = (1.84)^{\frac{x}{4}}$$

The function $f$ is defined by the given equation. The equation can be rewritten as $f(x) = \left(1 + \frac{p}{100}\right)^x$, where $p$ is a constant. Which of the following is closest to the value of $p$?

A. $16$

B. $21$

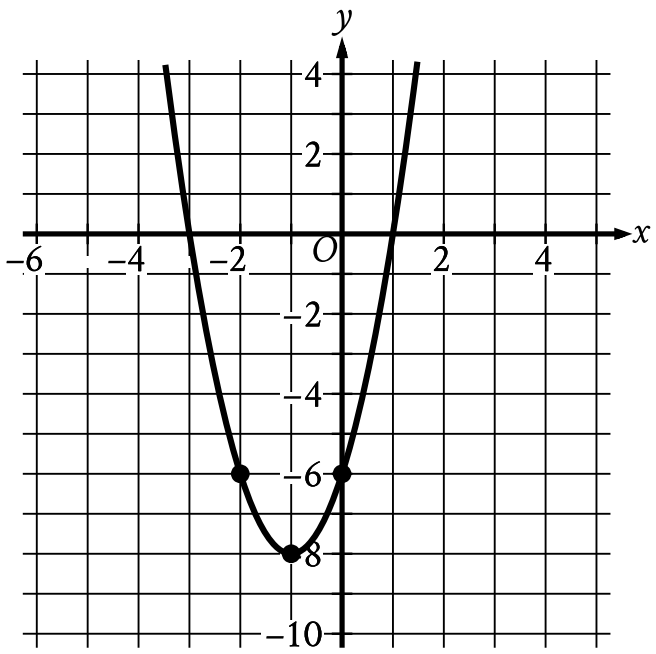
C. $46$

D. $96$

# Question ID 0a8ef03b

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 0a8ef03b**




The graph of $y = 2x^2 + bx + c$ is shown, where $b$ and $c$ are constants. What is the value of $bc$?

# Question ID 39250844

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 39250844**

$$y = 2(x - d)(x + d)(x + g)(x - d)$$

In the given equation, $d$ and $g$ are unique positive constants. When the equation is graphed in the *xy*-plane, how many distinct *x*-intercepts does the graph have?

A. $4$

B. $3$

C. $2$

D. $1$

# Question ID 447489e5

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 447489e5**

| 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. $n =$ msup

B. $n =$ msup

C. $n = 604$msup

D. $n = 0.004$msup

# Question ID 8aabeb91

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 8aabeb91**

The function $f(t) = 40{,}000(2)^{\frac{t}{790}}$ gives the number of bacteria in a population $t$ minutes after an initial observation. How much time, in minutes, does it take for the number of bacteria in the population to double?

A. $2$

B. $790$

C. $1{,}580$

D. $40{,}000$

# Question ID 2179e29c

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 2179e29c**

$$f(x) = 3{,}000(0.75)^x$$

A conservation scientist implemented a program to reduce the population of a certain species in an area. The given function estimates this species' population $x$ years after $2008$, where $x \leq 8$. Which of the following is the best interpretation of $3{,}000$ in this context?

A. The estimated percent decrease in the population for this species and area every $8$ years after $2008$

B. The estimated percent decrease in the population for this species and area each year after $2008$

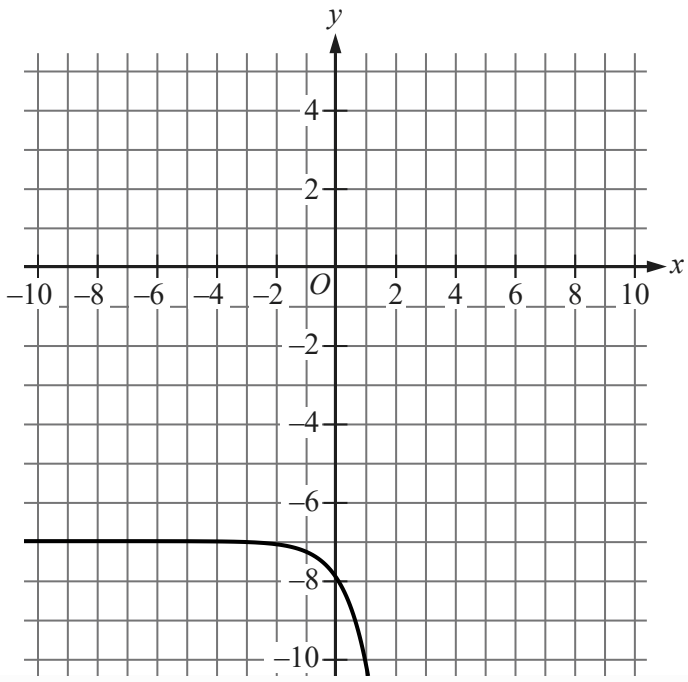
C. The estimated population for this species and area $8$ years after $2008$

D. The estimated initial population for this species and area in $2008$

# Question ID d41063f7

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: d41063f7




The graph of $y = f(x)$ is shown, where $f(x) = ab^x + c$, and $a$, $b$, and $c$ are constants. For how many values of $x$ does $f(x) = 0$?

A. Three

B. Two

C. One

D. Zero

# Question ID cb504804

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: cb504804**

A rectangle has an area of $155$ square inches. The length of the rectangle is $4$ inches less than $7$ times the width of the rectangle. What is the width of the rectangle, in inches?

# Question ID e0703e6c

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: e0703e6c**

The function $f$ is defined by $f(x) = 8x^3 + 4$. What is the value of $f(2)$?

# Question ID c6c505f3

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: c6c505f3**

The function $f$ is defined by $f(x) = ax^2 + bx + c$, where $a$, $b$, and $c$ are constants. The graph of $y = f(x)$ in the $xy$-plane passes through the points $(7, 0)$ and $(-3, 0)$. If $a$ is an integer greater than $1$, which of the following could be the value of $a + b$?

A. $-6$

B. $-3$

C. $4$

D. $5$

# Question ID 06c49455

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 06c49455

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

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 $\$1$.

# Question ID 21e50bbb

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 21e50bbb**

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

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. $2$

# Question ID 217e44de

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 217e44de**

$$m(t) = -0.0274\left(\frac{t}{7}\right)^2 + 7.3873\left(\frac{t}{7}\right) + 75.032$$

The function $m$ gives the predicted body mass $m(t)$, in $\text{kilograms } (\text{kg})$, of a certain animal $t$ days after it was born in a wildlife reserve, where $t \leq 390$. Which of the following is the best interpretation of the statement "$m(330)$ is approximately equal to $362$" in this context?

A. The predicted body mass of the animal was approximately $330 \text{ kg } 362$ days after it was born.

B. The predicted body mass of the animal was approximately $362 \text{ kg } 330$ days after it was born.

C. The predicted body mass of the animal was approximately $362 \text{ kg } \frac{330}{7}$ days after it was born.

D. The predicted body mass of the animal was approximately $\frac{330}{7} \text{ kg } 362$ days after it was born.

# Question ID 1ade75f8

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 1ade75f8**

On April $1$, there were $233$ views of an advertisement posted on a website. Every $2$ days after April $1$, the number of views of the advertisement had increased by $70\%$ of the number of views $2$ days earlier. The function $f$ gives the predicted number of views $x$ days after April $1$. Which equation defines $f$?

A. $f(x) = 233(0.70)^{\frac{x}{2}}$

B. $f(x) = 233(0.70)^{2x}$

C. $f(x) = 233(1.70)^{\frac{x}{2}}$

D. $f(x) = 233(1.70)^{2x}$

# Question ID aba35b4f

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: aba35b4f**

The function $f$ gives the product of a number, $x$, and a number that is $91$ more than $x$. Which equation defines $f$?

A. $f(x) = x^2 + x + 91$

B. $f(x) = x^2 + 91$

C. $f(x) = x^2 + 91x$

D. $f(x) = x^2 + 91x + 91$

# Question ID 8664387e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 8664387e**

| $x$ | $g(x)$ |
|---|---|
| $-1$ | $25$ |
| $0$ | $1$ |
| $1$ | $\frac{1}{25}$ |
| $2$ | $\frac{1}{625}$ |

For the exponential function $g$, the table shows four values of $x$ and their corresponding values of $g(x)$. Which equation defines $g$?

A. $g(x) = -25^x$

B. $g(x) = -\left(\frac{1}{25}\right)^x$

C. $g(x) = 25^x$

D. $g(x) = \left(\frac{1}{25}\right)^x$

# Question ID e3fa3e11

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: e3fa3e11**

$$f(x) = x^5 + 9x + 17$$

For the given function $f$, the graph of $y = f(x)$ in the *xy*-plane passes through the point $(0, b)$, where $b$ is a constant. What is the value of $b$?

# Question ID 8112237d

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 8112237d**

A park ranger hung squirrel houses each in the shape of a right rectangular prism for fox squirrels. Each house has a height of $11$ inches. The length of each house's base is $x$ inches, which is $1$ inch more than the width of the house's base. Which function $V$ gives the volume of each house, in cubic inches, in terms of the length of the house's base?

A. $V(x) = 11x(x - 1)$

B. $V(x) = 11x(x + 1)$

C. $V(x) = x(x + 11)(x - 1)$

D. $V(x) = x(x + 11)(x + 1)$

# Question ID e6bfb764

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: e6bfb764**

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?

# Question ID 6a736803

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 6a736803**

Immanuel purchased a certain rare coin on January 1. The function $f(x) = 65(1.03)^x$, where $0 \leq x \leq 10$, gives the predicted value, in dollars, of the rare coin $x$ years after Immanuel purchased it. What is the best interpretation of the statement "$f(8)$ is approximately equal to $82$" in this context?

A. When the rare coin's predicted value is approximately $82$ dollars, it is $8\%$ greater than the predicted value, in dollars, on January 1 of the previous year.

B. When the rare coin's predicted value is approximately $82$ dollars, it is $8$ times the predicted value, in dollars, on January 1 of the previous year.

C. From the day Immanuel purchased the rare coin to $8$ years after Immanuel purchased the coin, its predicted value increased by a total of approximately $82$ dollars.

D. $8$ years after Immanuel purchased the rare coin, its predicted value is approximately $82$ dollars.

# Question ID 879a67f5

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 879a67f5

The function $f$ is defined by $f(x) = (-8)(2)^x + 22$. What is the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane?

A. $(0, 14)$

B. $(0, 2)$

C. $(0, 22)$

D. $(0, -8)$

# Question ID b57f93cd

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: b57f93cd**

The function $g$ is defined by $g(x) = \frac{|x|}{a} - 14$, where $a < 0$. What is the product of $g(15a)$ and $g(7a)$?

# Question ID 64a1e19a

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 64a1e19a**

$$f(x) = 272(2)^x$$

The function $f$ is defined by the given equation. If $h(x) = f(x - 4)$, which of the following equations defines function $h$?

A. $h(x) = 17(2)^x$

B. $h(x) = 68(2)^x$

C. $h(x) = 272(16)^x$

D. $h(x) = 272(8)^x$

# Question ID bbef0453

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: bbef0453**

$$f(x) = ax^2 + 4x + c$$

In the given quadratic function, $a$ and $c$ are constants. The graph of $y = f(x)$ in the *xy*-plane is a parabola that opens upward and has a vertex at the point $(h, k)$, where $h$ and $k$ are constants. If $k < 0$ and $f(-9) = f(3)$, which of the following must be true?

I. $c < 0$

II. $a \geq 1$

A. I only

B. II only

C. I and II

D. Neither I nor II

# Question ID 9537c92e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 9537c92e

$$f(x) = x^2 - 48x + 2{,}304$$

What is the minimum value of the given function?

# Question ID 778c50a3

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 778c50a3**

The function $f$ is defined by $f(x) = a\sqrt{x+b}$, where $a$ and $b$ are constants. In the *xy*-plane, the graph of $y = f(x)$ passes through the point $(-24, 0)$, and $f(24) < 0$. Which of the following must be true?

A. $f(0) = 24$

B. $f(0) = -24$

C. $a > b$

D. $a < b$

# Question ID 5342ef3e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 5342ef3e**

An auditorium has seats for $1{,}800$ people. Tickets to attend a show at the auditorium currently cost $\$4.00$. For each $\$1.00$ increase to the ticket price, $100$ fewer tickets will be sold. This situation can be modeled by the equation $y = -100x^2 + 1{,}400x + 7{,}200$, where $x$ represents the increase in ticket price, in dollars, and $y$ represents the revenue, in dollars, from ticket sales. If this equation is graphed in the *xy*-plane, at what value of $x$ is the maximum of the graph?

A. $4$

B. $7$

C. $14$

D. $18$

# Question ID c41ef15e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: c41ef15e**

The functions $g$ and $h$ are defined by the given equations, where $x \geq 0$. Which of the following equations displays, as a constant or coefficient, the minimum value of the function it defines, where $x \geq 0$?

I. $g(x) = 18(1.16)(1.4)^{x+2}$

II. $h(x) = 18(1.4)^{x+4}$

A. I only

B. II only

C. I and II

D. Neither I nor II

# Question ID bb682312

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: bb682312**

The function $f(x) = \frac{1}{9}(x - 7)^2 + 3$ gives a metal ball's height above the ground $f(x)$, in inches, $x$ seconds after it started moving on a track, where $0 \leq x \leq 10$. Which of the following is the best interpretation of the vertex of the graph of $y = f(x)$ in the *xy*-plane?

A. The metal ball's minimum height was $3$ inches above the ground.

B. The metal ball's minimum height was $7$ inches above the ground.

C. The metal ball's height was $3$ inches above the ground when it started moving.

D. The metal ball's height was $7$ inches above the ground when it started moving.

# Question ID cbd9bf3f

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: cbd9bf3f**

The product of a positive number $x$ and the number that is $8$ more than $x$ is $180$. What is the value of $x$?

A. $5$

B. $10$

C. $18$

D. $36$

# Question ID 3d0755fb

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 3d0755fb**

When the quadratic function $f$ is graphed in the *xy*-plane, where $y = f(x)$, its vertex is $(-3, 6)$. One of the *x*-intercepts of this graph is $\left(-\frac{17}{4}, 0\right)$. What is the other *x*-intercept of the graph?

A. $\left(-\frac{29}{4}, 0\right)$

B. $\left(-\frac{7}{4}, 0\right)$

C. $\left(\frac{5}{4}, 0\right)$

D. $\left(\frac{17}{4}, 0\right)$

# Question ID 5e2487bb

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 5e2487bb**

For the exponential function $f$, the value of $f(0)$ is $c$, where $c$ is a constant. Of the following equations that define the function $f$, which equation shows the value of $c$ as the coefficient or the base?

A. $f(x) = 22(1.5)^{x+1}$

B. $f(x) = 33(1.5)^{x}$

C. $f(x) = 49.5(1.5)^{x-1}$

D. $f(x) = 74.25(1.5)^{x-2}$

# Question ID 86b6d3b3

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 86b6d3b3**

The functions $f$ and $g$ are defined by the given equations.

$$f(x) = 3 + |-2x - x^2|$$

$$g(w) = \left|\frac{-w}{w-1}\right| - w + 5$$

If $f(-4) = c$, where $c$ is a constant, what is the value of $g(c)$?

# Question ID 55995d34

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 55995d34**

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. $c = 1{,}300$msup

B. $c = 1{,}300$msup

C. $c = 1{,}300$msup

D. $c = 1{,}300$msup

# Question ID 2e23b002

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 2e23b002**

The area of a rectangular banner is $2{,}661$ square inches. The banner's length $x$, in inches, is $24$ inches longer than its width, in inches. Which equation represents this situation?

A. $0 = x^2 - 24x - 2{,}661$

B. $0 = x^2 - 24x + 2{,}661$

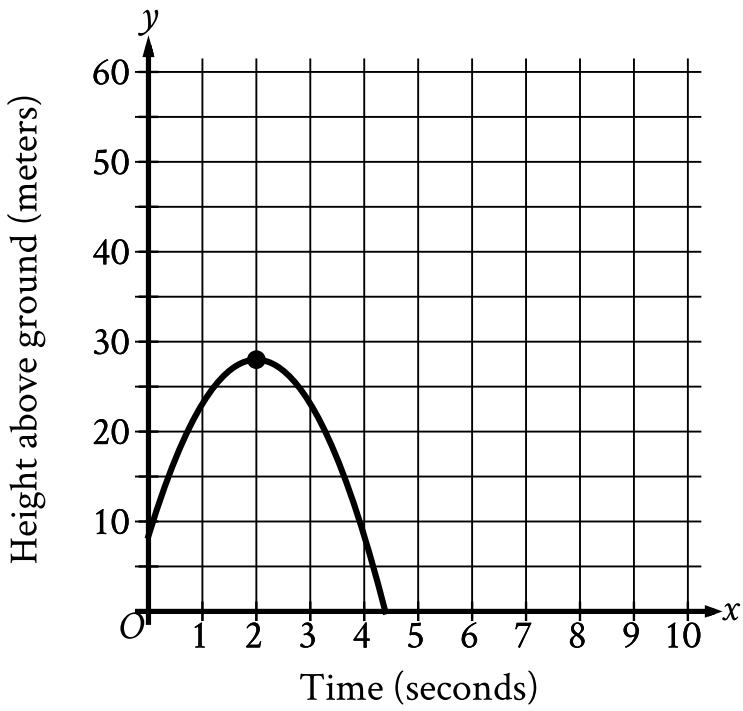
C. $0 = x^2 + 24x - 2{,}661$

D. $0 = x^2 + 24x + 2{,}661$

# Question ID 84997c9e

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 84997c9e




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 $x = 4$

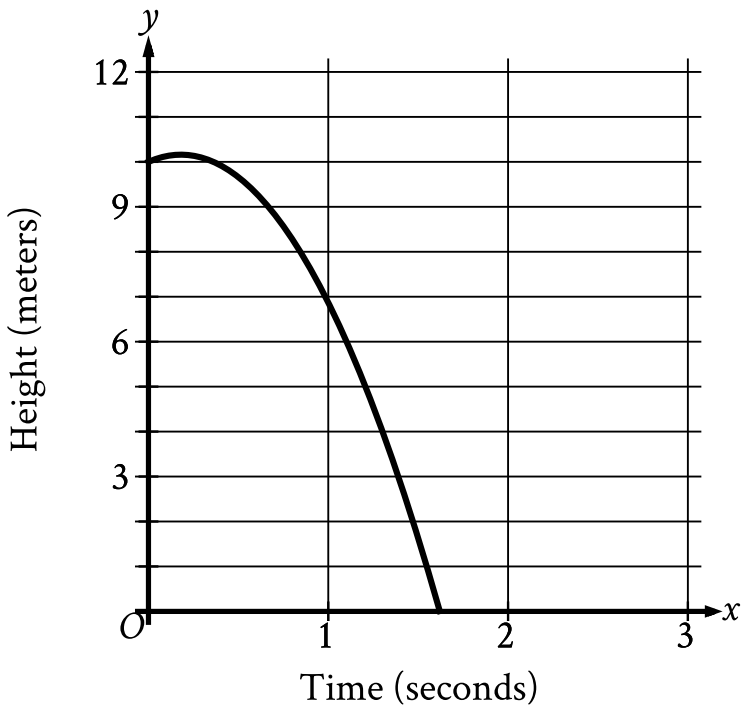
C. From $x = 2$ to $x = 3$

D. From $x = 3$ to $x = 4$

# Question ID bc13249f

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: bc13249f**




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.

# Question ID ac40b851

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: ac40b851**

$$p(x) + 57 = x^2$$

The given equation relates the value of $x$ and its corresponding value of $p(x)$ for the function $p$. What is the minimum value of the function $p$?

A. $-3{,}249$

B. $-57$

C. $57$

D. $3{,}249$

# Question ID 4471075d

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

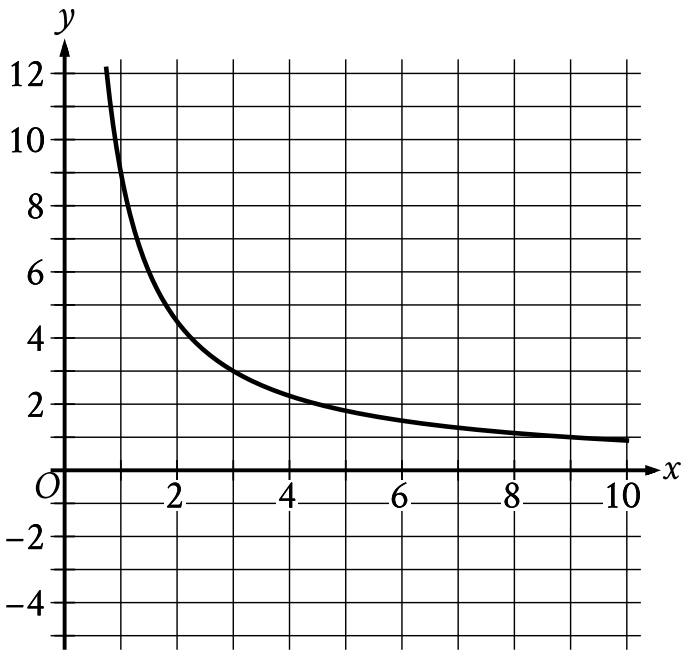
**ID: 4471075d**

Function $f$ is a quadratic function where $f(-20) = 0$ and $f(-4) = 0$. The graph of $y = f(x)$ in the *xy*-plane has a vertex at $(r, -64)$. What is the value of $r$?

# Question ID bc0f862d

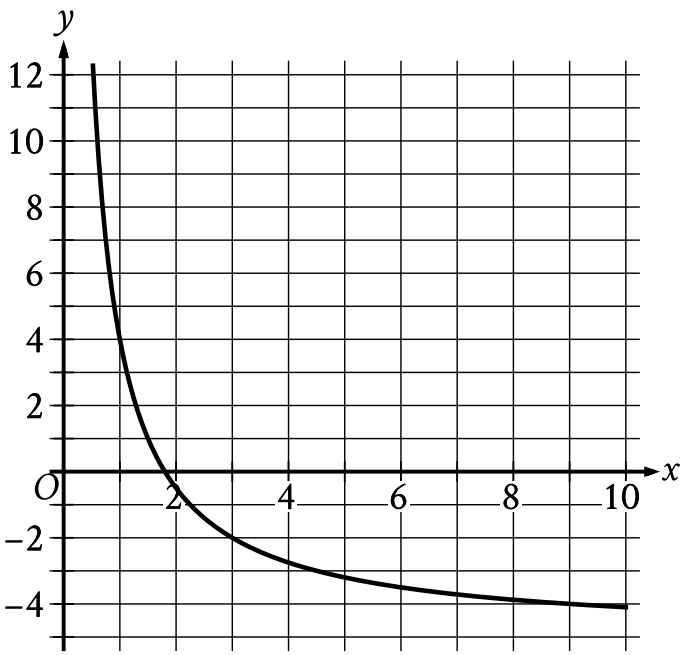
| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: bc0f862d

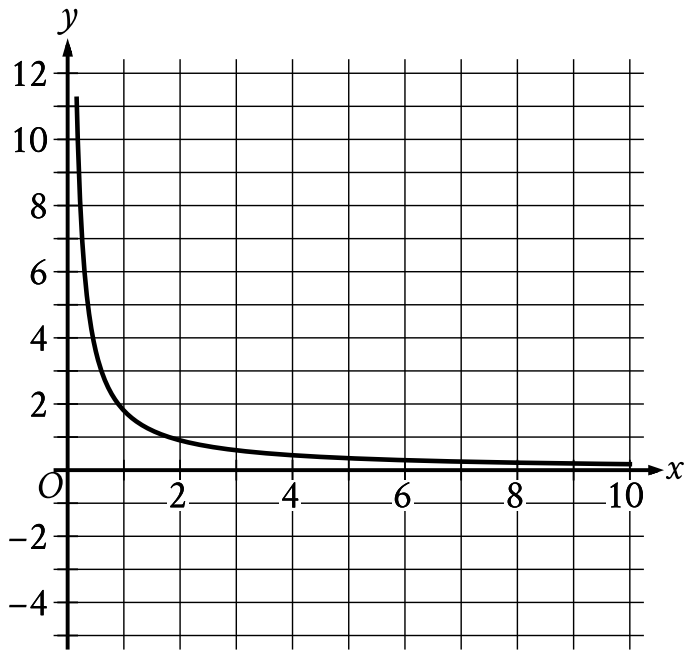



The graph of the rational function $f$ is shown, where $y = f(x)$ and $x \geq 0$. Which of the following is the graph of $y = f(x) + 5$, where $x \geq 0$?

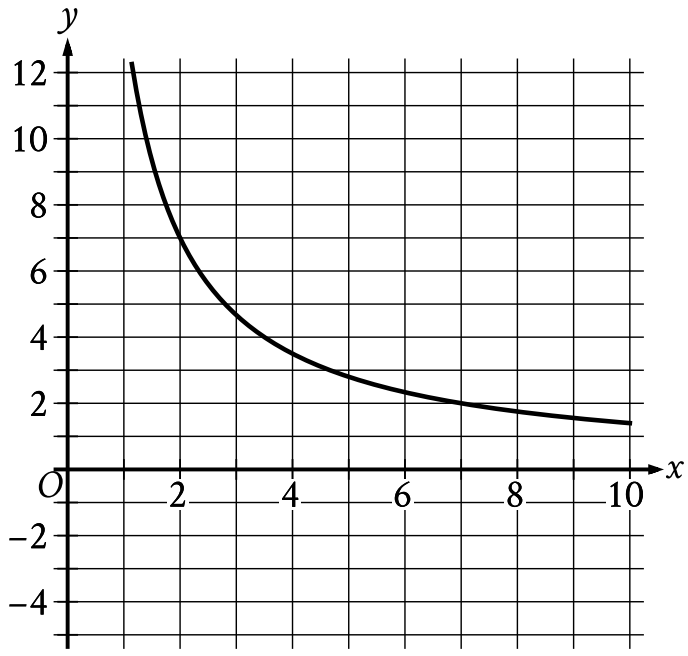
A.



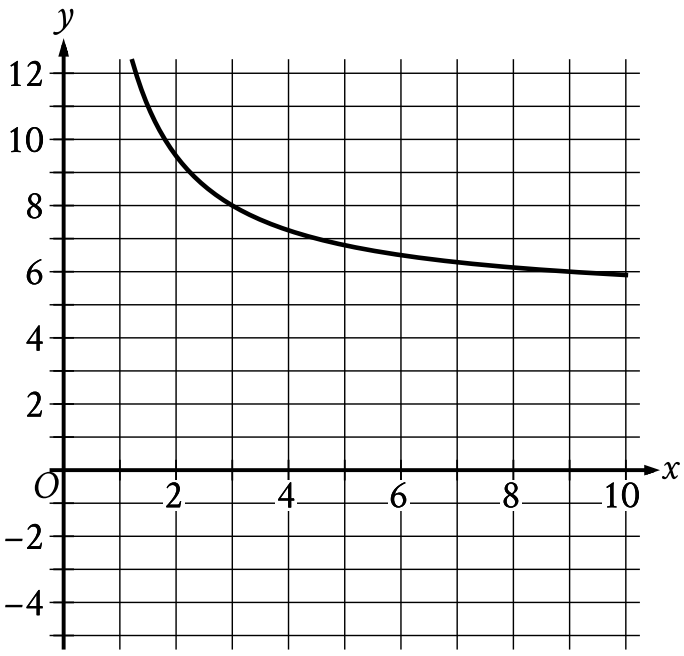
B.




C.



D.



# Question ID 44665c9b

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 44665c9b**

The function $f$ is defined by $f(x) = a(2.2^x + 2.2^b)$, where $a$ and $b$ are integer constants and $0 < a < b$. The functions $g$ and $h$ are equivalent to function $f$, where $k$ and $m$ are constants. Which of the following equations displays the *y*-coordinate of the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane as a constant or coefficient?

I. $g(x) = a(2.2^x + k)$

II. $h(x) = a(2.2)^x + m$

A. I only

B. II only

C. I and II

D. Neither I nor II

# Question ID 0d567847

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 0d567847

The area of a triangle is $270$ square centimeters. The length of the base of the triangle is $12$ centimeters greater than the height of the triangle. What is the height, in centimeters, of the triangle?

A. $15$

B. $18$

C. $30$

D. $36$

# Question ID f9bbe9d9

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: f9bbe9d9**

The function $f(x) = 206(1.034)^x$ models the value, in dollars, of a certain bank account by the end of each year from $1957$ through $1972$, where $x$ is the number of years after $1957$. Which of the following is the best interpretation of "$f(5)$ is approximately equal to $243$" in this context?

A. The value of the bank account is estimated to be approximately $5$ dollars greater in $1962$ than in $1957$.

B. The value of the bank account is estimated to be approximately $243$ dollars in $1962$.

C. The value, in dollars, of the bank account is estimated to be approximately $5$ times greater in $1962$ than in $1957$.

D. The value of the bank account is estimated to increase by approximately $243$ dollars every $5$ years between $1957$ and $1972$.

# Question ID 16749ce5

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 16749ce5**

| $x$ | $f(x)$ |
|---|---|
| $-1$ | $10$ |
| $0$ | $14$ |
| $1$ | $20$ |

For the quadratic function $f$, the table shows three values of $x$ and their corresponding values of $f(x)$. Which equation defines $f$?

A. $f(x) = 3x^2 + 3x + 14$

B. $f(x) = 5x^2 + x + 14$

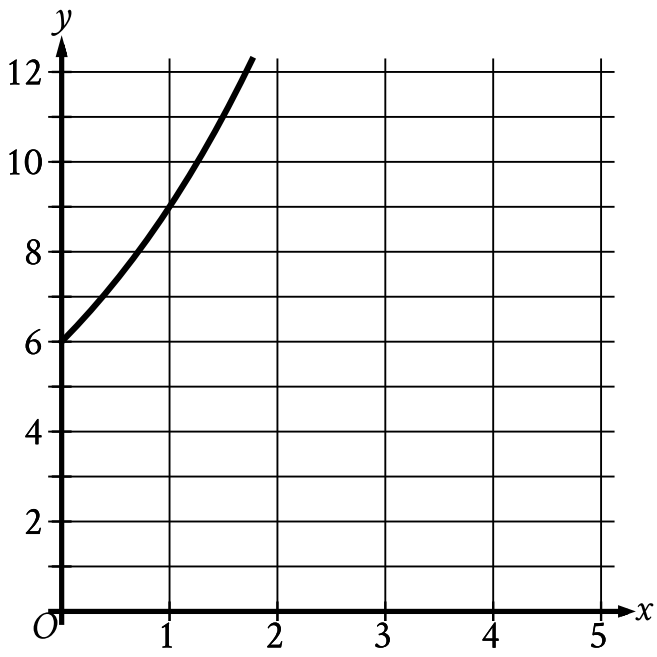
C. $f(x) = 9x^2 - x + 14$

D. $f(x) = x^2 + 5x + 14$

# Question ID 23cc8869

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 23cc8869




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 $x = 0$.

# Question ID 0ed88ab6

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 0ed88ab6**

The function $f$ is defined by $f(x) = a^x + b$, where $a$ and $b$ are constants. In the $xy$-plane, the graph of $y = f(x)$ has an $x$-intercept at $(2, 0)$ and a $y$-intercept at $(0, -323)$. What is the value of $b$?

# Question ID 5ce507ae

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 5ce507ae**

| $x$ | $y$ |
|---|---|
| 1 | 11 |
| 2 | 19 |
| 3 | $a$ |

The table shows three values of $x$ and their corresponding values of $y$ for the equation $y = 4(2)^x + 3$. In the table, $a$ is a constant. What is the value of $a$?

A. $67$

B. $35$

C. $32$

D. $27$

# Question ID d662c359

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: d662c359**

The function $g$ is defined by $g(x) = (x + 14)(t - x)$, where $t$ is a constant. In the *xy*-plane, the graph of $y = g(x)$ passes through the point $(24, 0)$. What is the value of $g(0)$?

# Question ID 883e8024

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 883e8024

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. $p(x) = 2{,}000(0.97)^x$

# Question ID 4623a954

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 4623a954**

A submersible device is used for ocean research. The function $g(x) = -\frac{1}{55}(x + 19)(x - 35)$ gives the depth below the surface of the ocean, in meters, of the submersible device $x$ minutes after collecting a sample, where $x > 0$. How many minutes after collecting the sample did it take for the submersible device to reach the surface of the ocean?

# Question ID 14e8f4fa

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 14e8f4fa**

| $x$ | $h(x)$ |
|---|---|
| $0$ | $1.23$ |
| $2$ | $1.54$ |
| $4$ | $1.94$ |

The table shows the exponential relationship between the number of years, $x$, since Hana started training in pole vault, and the estimated height $h(x)$, in meters, of her best pole vault for that year. Which of the following functions best represents this relationship, where $x \leq 4$?

A. $h(x) = 1.12(0.23)^x$

B. $h(x) = 1.12(1.23)^x$

C. $h(x) = 1.23(0.12)^x$

D. $h(x) = 1.23(1.12)^x$

# Question ID adfb10a0

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: adfb10a0**

| 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. $d = 0.006$msup

B. $d = 670$msup

C. $d =$ msup

D. $d =$ msup

# Question ID 1d689159

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 1d689159

$$h(t) = -16t^2 + b$$

The function $h$ estimates an object's height, in feet, above the ground $t$ seconds after the object is dropped, where $b$ is a constant. The function estimates that the object is $3{,}364$ feet above the ground when it is dropped at $t = 0$. Approximately how many seconds after being dropped does the function estimate the object will hit the ground?

A. $7.25$

B. $14.50$

C. $105.13$

D. $210.25$

# Question ID 9e589c7d

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 9e589c7d

| $x$ | $g(x)$ |
|---|---|
| $-27$ | $3$ |
| $-9$ | $0$ |
| $21$ | $5$ |

The table shows three values of $x$ and their corresponding values of $g(x)$, where $g(x) = \frac{f(x)}{x+3}$ and $f$ is a linear function. What is the *y*-intercept of the graph of $y = f(x)$ in the *xy*-plane?

A. $(0, 36)$

B. $(0, 12)$

C. $(0, 4)$

D. $(0, -9)$

# Question ID d62dd40b

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: d62dd40b**

The function $g$ is defined by $g(x) = x(x-2)(x+6)^2$. The value of $g(7-w)$ is $0$, where $w$ is a constant. What is the sum of all possible values of $w$?

# Question ID e2d8deca

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: e2d8deca**

A sample of a certain isotope takes $29$ years to decay to half its original mass. The function $s(t) = 184(0.5)^{\frac{t}{29}}$ gives the approximate mass of this isotope, in grams, that remains $t$ years after a $184$-gram sample starts to decay. Which statement is the best interpretation of $s(87) = 23$ in this context?

A. Approximately $23$ grams of the sample remains $87$ years after the sample starts to decay.

B. The mass of the sample has decreased by approximately $23$ grams $87$ years after the sample starts to decay.

C. The mass of the sample has decreased by approximately $87$ grams $23$ years after the sample starts to decay.

D. Approximately $87$ grams of the sample remains $23$ years after the sample starts to decay.

# Question ID 560d6aef

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 560d6aef**

A physics class is planning an experiment about a toy rocket. The equation $y = -16(x - 5.6)^2 + 502$ gives the estimated height $y$, in feet, of the toy rocket $x$ seconds after it is launched into the air. Which of the following is the best interpretation of the vertex of the graph of the equation in the *xy*-plane?

A. This toy rocket reaches an estimated maximum height of $502$ feet $16$ seconds after it is launched into the air.

B. This toy rocket reaches an estimated maximum height of $502$ feet $5.6$ seconds after it is launched into the air.

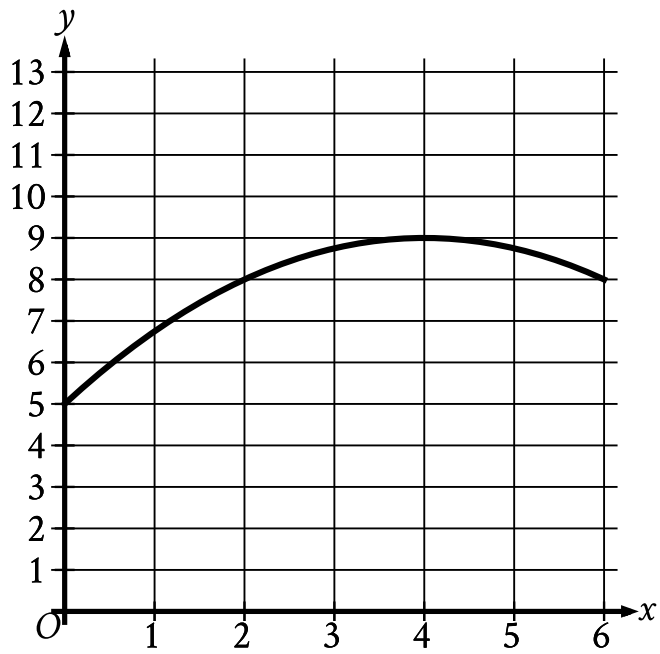
C. This toy rocket reaches an estimated maximum height of $16$ feet $502$ seconds after it is launched into the air.

D. This toy rocket reaches an estimated maximum height of $5.6$ feet $502$ seconds after it is launched into the air.

# Question ID 95614941

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

ID: 95614941




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. $9$

# Question ID b35da809

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: b35da809**

What is an *x*-coordinate of an *x*-intercept of the graph of $y = 3(x - 14)(x + 5)(x + 4)$ in the *xy*-plane?

# Question ID 1c9eaa21

| Assessment | Test | Domain | Skill | Difficulty |
|---|---|---|---|---|
| PSAT 8/9 | Math | Advanced Math | Nonlinear functions | Hard |

**ID: 1c9eaa21**

$$f(x) = (x - 1)(x + 3)(x - 2)$$

In the *xy*-plane, when the graph of the function $f$, where $y = f(x)$, is shifted up $6$ units, the resulting graph is defined by the function $g$. If the graph of $y = g(x)$ crosses through the point $(4, b)$, where $b$ is a constant, what is the value of $b$?