Requests

I got the answers correct just by plugging all the numbers in the question into Desmos, but I would like to know the reasoning behind the answers.

$(x-18)^2+(x-14)^2-12=0$

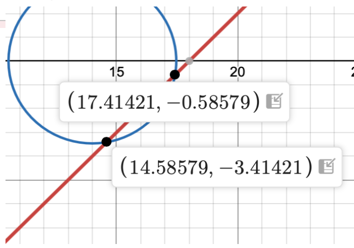
7. p. 101 Ch. 12 #37

37.
$$y = x - 18$$
$$y^2 + (x-14)^2 - 12 = 0$$

3

For the system of equations above, what is a possible value of $y$?

A) $-2+\sqrt{2}$
B) $\sqrt{2}$
C) $2+\sqrt{3}$
D) $-2-\sqrt{6}$




For #7, I didn't know which gray dot to look at, so I just plugged the answer choices in but I'm sure theres a much more logical way to go around it.

Solving the equation algebraically is likely slower than graphing to find the solutions and typing the choices to check for matching decimals. However, I've come up with an alternative that's probably a bit quicker and does not involve comparing long strings of digits visually.

8. p. 106 Ch. 13 #30

2 30. If $f(x) = x + \frac{1}{2x}$ and $g(x) = \frac{1}{x}$ what is the value of $f(g(\frac{1}{4}))$?

$$g\left(\tfrac{1}{4}\right) = \frac{1}{\frac{1}{4}} = 4$$

$$f(4) = 4 + \frac{1}{2\cdot 4} = 4\tfrac{1}{8}$$

$\frac{33}{8}$ $\quad 4.125$

For #8, I would like some clarification on how imbedded functions like the one in the question work.

The formal name for this sort of thing is **composition of functions**; $f(g(x))$ is called a **composite function**. (Interestingly, I looked up the imbed/ embed spelling and discovered they're both correct, but the second is more common.)

$f(g(\tfrac{1}{4})) \Rightarrow f$ of $(g(\tfrac{1}{4}))$

got this 1st

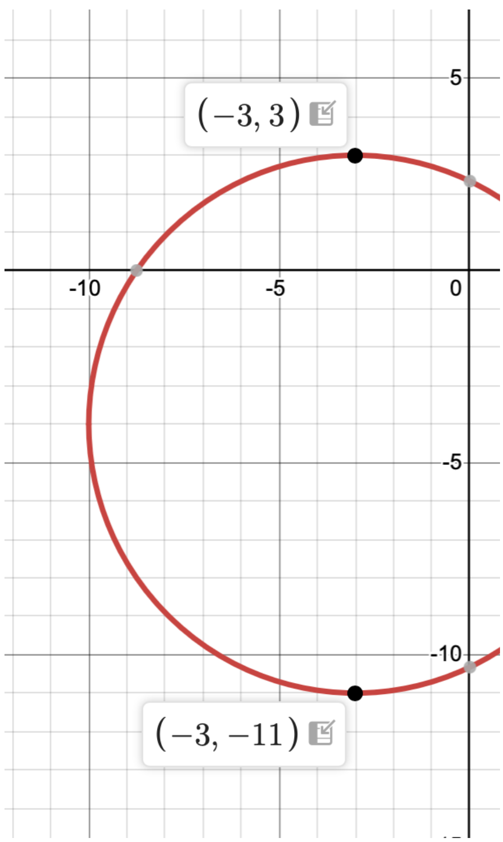
August 24, 2026

## 10. p. 262 Ch. 27 #24

4

24. The equation of a circle in the $xy$-plane is shown below. What is the radius of the circle?

$$2x^2 + 2y^2 + 12x + 16y - 48 = 0$$




14 = diameter

radius = 7

## 2. p. 13 Ch. 3 #14

14. Which expression is equivalent to $\frac{3+4x}{81-256x^4}$, where $x > 1$ ?

3

A) $\frac{1}{27-64x^3}$

B) $27 - 64x^3$

C) $\frac{1}{(9+16x^2)(3-4x)}$

D) $(9 + 16x^2)(3 - 4x)$

Nonlinear functions and equations

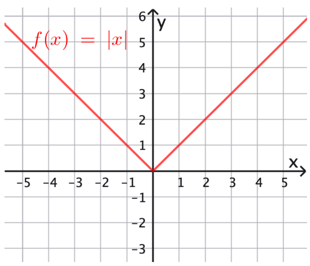
## 2. Advanced Math

Questions in this domain measure skills and knowledge central for progression to more advanced math courses, including demonstrating an understanding of absolute value, quadratic, exponential, polynomial, rational, radical, and other nonlinear equations. Questions include:

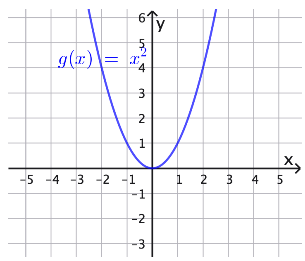
- Equivalent expressions
- Nonlinear equations in 1 variable and systems of equations in 2 variables
- Nonlinear functions

https://satsuite.collegeboard.org/in-school-assessments/whats-on-the-test/psat-nmsqt/math

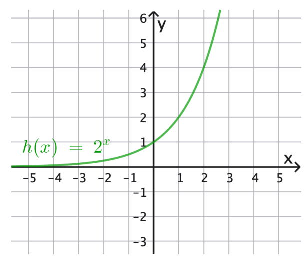
absolute value




quadratic

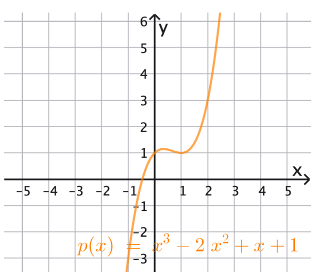



exponential

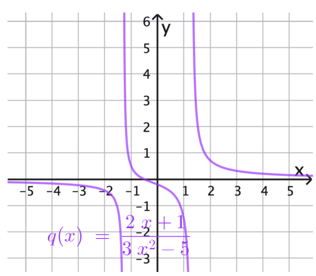



$g(x) = \dfrac{2x+1}{3x^2-5}$

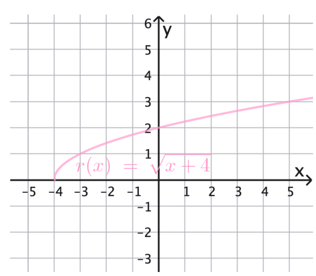
polynomial




rational




radical

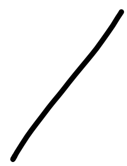



1 : 3    1 to 3    $\frac{1}{3}$

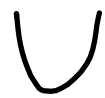
other nonlinear equations

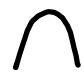
I'm not sure exactly what they mean here; I have not seen any questions that use trigonometric or inverse trigonometric functions (only the most basic ratios and values you can type into Desmos). I wonder if this refers to equations that involve more than one type of function.

linear 1st $y = mx + b$

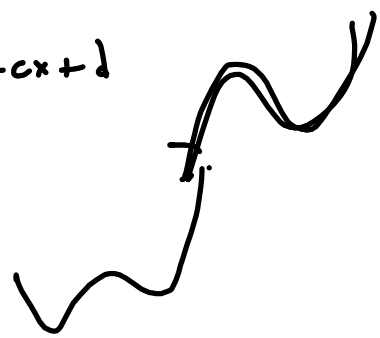


quadratic 2nd $y = ax^2 + bx + c$

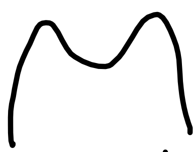




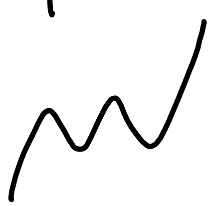
cubic 3rd $y = ax^3 + bx^2 + cx + d$



quartic



quintic



# Equivalent expressions

Equivalent expressions2/12/2026SATActive excluded

## 0:19 Question 2ba76e5

Hide Advanced Math - Equivalent expressions

$$0.36x^2 + 0.63x + 1.17$$

The given expression can be rewritten as $a\left(4x^2 + 7x + 13\right)$, where $a$ is a constant. What is the value of $a$?

The correct answer is $.09$. It's given that the expression $0.36x^2 + 0.63x + 1.17$ can be rewritten as $a\left(4x^2 + 7x + 13\right)$. Applying the distributive property to the expression $a\left(4x^2 + 7x + 13\right)$ yields $4ax^2 + 7ax + 13a$. Therefore, $0.36x^2 + 0.63x + 1.17$ can be rewritten as $4ax^2 + 7ax + 13a$. It follows that in the expressions $0.36x^2 + 0.63x + 1.17$ and $4ax^2 + 7ax + 13a$, the coefficients of $x^2$ are equivalent, the coefficients of $x$ are equivalent, and the constant terms are equivalent. Therefore, $0.36 = 4a$, $0.63 = 7a$, and $1.17 = 13a$. Solving any of these equations for $a$ yields the value of $a$. Dividing both sides of the equation $0.36 = 4a$ by $4$ yields $0.09 = a$. Therefore, the value of $a$ is $0.09$. Note that .09 and 9/100 are examples of ways to enter a correct answer.

## 0:08 Question 6d9852c

Hide Advanced Math - Equivalent expressions

$(x-11y)(2x-3y)-12y(-2x+3y)$

Which of the following is equivalent to the expression above?

- $x-23y$ ×
- $2x^2-xy-3y^2$
- $2x^2+24xy+36y^2$
- $2x^2-49xy+69y^2$ ×

Choice B is correct. Expanding all terms yields (x – 11y)(2x – 3y) – 12y(–2x + 3y), which is equivalent to $2x^2 - 22xy - 3xy + 33y^2 + 24xy - 36y^2$. Combining like terms gives $2x^2 - xy - 3y^2$.

Choice A is incorrect and may be the result of using the sums of the coefficients of the existing x and y terms as the coefficients of the x and y terms in the new expressions. Choice C is incorrect and may be the result of incorrectly combining like terms. Choice D is incorrect and may be the result of using the incorrect sign in front of the 12y term.

$(a^m)^n = a^{mn}$

## 0:07 Question b3d25c5

Hide Advanced Math - Equivalent expressions

Which of the following is equivalent to $\sqrt[4]{x^2+8x+16}$, where $x>0$?

$\sqrt[4]{(x+4)^2}$

$= \left((x+4)^2\right)^{1/4}$

$= (x+4)^{2 \cdot \frac{1}{4}}$

$= (x+4)^{\frac{1}{2}}$

- $(x+4)^4$ ×
- $(x+4)^2$ ×
- $(x+4)$
- $(x+4)^{\frac{1}{2}}$

Choice D is correct. The given expression can also be written as $(x^2+8x+16)^{\frac{1}{4}}$. The trinomial $x^2+8x+16$ can be rewritten in factored form as $(x+4)^2$. Thus, the entire expression can be rewritten as $((x+4)^2)^{\frac{1}{4}}$. Simplifying the exponents yields $(x+4)^{\frac{1}{2}}$.

Choices A, B, and C are incorrect and may result from errors made when simplifying the exponents in the expression $((x+4)^2)^{\frac{1}{4}}$.

## 0:06 Question 12e7faf8

Hide Advanced Math - Equivalent expressions

$f(x) = \frac{\cancel{(x+7)}(x-1)}{\cancel{x+7}}$

$f(x)$ $\quad -1x+1 \quad a=1,\ d=-1$

The equation $\frac{x^2+6x-7}{x+7} = ax+d$ is true for all $x \neq -7$, where a and d are integers. What is the value of $a+d$ ?

$a+d=0$

- $-6$ ×
- $-1$
- $0$
- $1$

Choice C is correct. Since the expression $x^2+6x-7$ can be factored as $(x+7)(x-1)$, the given equation can be rewritten as $\frac{(x+7)(x-1)}{x+7} = ax+d$. Since $x \neq -7$, $x+7$ is also not equal to 0, so both the numerator and denominator of $\frac{(x+7)(x-1)}{x+7}$ can be divided by $x+7$. This gives $x-1 = ax+d$. Equating the coefficient of x on each side of the equation gives $a=1$. Equating the constant terms gives $d=-1$. The sum is $1+(-1)=0$.

Choice A is incorrect and may result from incorrectly simplifying the equation. Choices B and D are incorrect. They are the values of d and a, respectively, not $a+d$.

## Question 137cc6fd

Show Advanced Math - Equivalent expressions

$$\sqrt[5]{70n}\left(\sqrt[6]{70n}\right)^2$$

For what value of $x$ is the given expression equivalent to $(70n)^{30x}$, where $n > 1$?

**Answer**

$\sqrt[5]{70n} = (70n)^{\frac{1}{5}}$

$\left(\sqrt[6]{70n}\right)^2 = (70n)^{\frac{2}{6}}$

The correct answer is $\frac{4}{225}$. An expression of the form $\sqrt[k]{a}$, where $k$ is an integer greater than $1$ and $a \geq 0$, is equivalent to $a^{\frac{1}{k}}$. Therefore, the given expression, where $n > 1$, is equivalent to $(70n)^{\frac{1}{5}}\left((70n)^{\frac{1}{6}}\right)^2$. Applying properties of exponents, this expression can be rewritten as $(70n)^{\frac{1}{5}}(70n)^{\frac{1}{6}\cdot 2}$, or $(70n)^{\frac{1}{5}}(70n)^{\frac{1}{3}}$, which can be rewritten as $(70n)^{\frac{1}{5}+\frac{1}{3}}$, or $(70n)^{\frac{8}{15}}$. It's given that the expression $\sqrt[5]{70n}\left(\sqrt[6]{70n}\right)^2$ is equivalent to $(70n)^{30x}$, where $n > 1$. It follows that $(70n)^{\frac{8}{15}}$ is equivalent to $(70n)^{30x}$. Therefore, $\frac{8}{15} = 30x$. Dividing both sides of this equation by $30$ yields $\frac{8}{450} = x$, or $\frac{4}{225} = x$. Thus, the value of $x$ for which the given expression is equivalent to $(70n)^{30x}$, where $n > 1$, is $\frac{4}{225}$. Note that 4/225, .0177, .0178, 0.017, and 0.018 are examples of ways to enter a correct answer.

## Question 34847f8a

Show Advanced Math - Equivalent expressions

$$\frac{2}{x-2} + \frac{3}{x+5} = \frac{rx+t}{(x-2)(x+5)}$$

The equation above is true for all $x > 2$, where r and t are positive constants. What is the value of rt ?

- −20
- 15
- 20
- 60

1

$$\frac{2}{x_1-2} + \frac{3}{x_1+5} \sim \frac{rx_1+t}{(x_1-2)(x_1+5)}$$

REGRESSION PARAMETERS

$r = 5$ $t = 4$

STATISTICS RESIDUALS

$RMSE = 0$ $e_1$

2

$x_1 = \text{random}(10)$

$= 0.479799082895$ $0.1758576$ 10 element list

Choice C is correct. To express the sum of the two rational expressions on the left-hand side of the equation as the single rational expression on the right-hand side of the equation, the expressions on the left-hand side must have the same denominator. Multiplying the first expression by $\frac{x+5}{x-5}$ results in $\frac{2(x+5)}{(x-2)(x+5)}$, and multiplying the second expression by $\frac{x-2}{x-2}$ results in $\frac{3(x-2)}{(x-2)(x+5)}$, so the given equation can be rewritten as $\frac{2(x+5)}{(x-2)(x+5)} + \frac{3(x-2)}{(x-2)(x+5)} = \frac{rx+t}{(x-2)(x+5)}$, or $\frac{2x+10}{(x-2)(x+5)} + \frac{3x-6}{(x-2)(x+5)} = \frac{rx+t}{(x-2)(x+5)}$. Since the two rational expressions on the left-hand side of the equation have the same denominator as the rational expression on the right-hand side of the equation, it follows that $(2x+10)+(3x-6) = rx+t$. Combining like terms on the left-hand side yields $5x+4 = rx+t$, so it follows that $r = 5$ and $t = 4$. Therefore, the value of $rt$ is $(5)(4) = 20$.

Choice A is incorrect and may result from an error when determining the sign of either r or t. Choice B is incorrect and may result from not distributing the 2 and 3 to their respective terms in $\frac{2(x+5)}{(x-2)(x+5)} + \frac{3(x-2)}{(x-2)(x+5)} = \frac{rx+t}{(x-2)(x+5)}$. Choice D is incorrect and may result from a calculation error.

# Solving equations in one variable

https://satquestionbank.org/start/1ad48ed3c62b

### Question 86bc4a4

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

Blood volume, $V_B$, in a human can be determined using the equation $V_B = \frac{V_P}{1-H}$, where $V_P$ is the plasma volume and H is the hematocrit (the fraction of blood volume that is red blood cells). Which of the following correctly expresses the hematocrit in terms of the blood volume and the plasma volume?

H in terms of $V_B$, $V_p$

- $H = 1 - \frac{V_P}{V_B}$ ×
- $H = \frac{V_B}{V_P}$ ×
- $H = 1 + \frac{V_B}{V_P}$ ×
- $H = V_B - V_P$ ×

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H in terms of ...

H = ... $V_p$, $V_B$ in there

Choice A is correct. The hematocrit can be expressed in terms of the blood volume and the plasma volume by solving the given equation $V_B = \frac{V_P}{1-H}$ for H. Multiplying both sides of this equation by $(1-H)$ yields $V_B(1-H) = V_p$. Dividing both sides by $V_B$ yields $1 - H = \frac{V_P}{V_B}$. Subtracting 1 from both sides yields $-H = -1 + \frac{V_p}{V_B}$. Dividing both sides by $-1$ yields $H = 1 - \frac{V_P}{V_B}$.

Choices B, C, and D are incorrect and may result from errors made when manipulating the equation.

### Question 1730960c

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$$\frac{2(x+1)}{x+5} = 1 - \frac{1}{x+5}$$

What is the solution to the equation above?

- 0 ×
- 2 ×
- 3 ×
- 5 ×

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Choice B is correct. Since $\frac{x+5}{x+5}$ is equivalent to 1, the right-hand side of the given equation can be rewritten as $\frac{x+5}{x+5} - \frac{1}{x+5}$, or $\frac{x+4}{x+5}$. Since the left- and right-hand sides of the equation $\frac{2(x+1)}{x+5} = \frac{x+4}{x+5}$ have the same denominator, it follows that $2(x+1) = x+4$. Applying the distributive property of multiplication to the expression $2(x+1)$ yields $2(x) + 2(1)$, or $2x+2$. Therefore, $2x+2 = x+4$. Subtracting x and 2 from both sides of this equation yields $x = 2$.

Choices A, C, and D are incorrect. If $x = 0$, then $\frac{2(0+1)}{0+5} = 1 - \frac{1}{0+5}$. This can be rewritten as $\frac{2}{5} = \frac{4}{5}$, which is a false statement. Therefore, 0 isn't a solution to the given equation. Substituting 3 and 5 into the given equation yields similarly false statements.

## Question 1a20a239

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$$x^2 - 5x - 24 = 0$$

What is the sum of the solutions to the given equation?

**Answer**

The correct answer is $5$. The given quadratic equation can be rewritten in factored form as $(x-8)(x+3)=0$. Based on the zero product property, it follows that $x-8=0$ or $x+3=0$. Adding $8$ to both sides of the equation $x-8=0$ yields $x=8$. Subtracting $3$ from both sides of the equation $x+3=0$ yields $x=-3$. Therefore, the solutions to the given equation are $8$ and $-3$. It follows that the sum of the solutions to the given equation is $8+(-3)$, or $5$.

## Question 23863e8c

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$\sqrt{x+4}=11$

What value of x satisfies the equation above?

**Answer**

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The correct answer is 117. Squaring both sides of the given equation gives $x+4=11^2$, or $x+4=121$. Subtracting 4 from both sides of this equation gives $x=117$.

## Question 220f67ab

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$6x^2+5x-7=0$

What are the solutions to the given equation?

- $\dfrac{-5\pm\sqrt{25+168}}{12}$
- $\dfrac{-6\pm\sqrt{25+168}}{12}$
- $\dfrac{-5\pm\sqrt{36-168}}{12}$
- $\dfrac{-6\pm\sqrt{36-168}}{12}$

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Choice A is correct. The quadratic formula, $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$, can be used to find the solutions to an equation in the form $ax^2+bx+c=0$. In the given equation, $a=6$, $b=5$, and $c=-7$. Substituting these values into the quadratic formula gives $\frac{-5\pm\sqrt{5^2-4(6)(-7)}}{2(6)}$, or $\frac{-5\pm\sqrt{25+168}}{12}$.

Choice B is incorrect and may result from using $\frac{-a\pm\sqrt{b^2-4ac}}{2a}$ as the quadratic formula. Choice C is incorrect and may result from using $\frac{-b\pm\sqrt{a^2+4ac}}{2a}$ as the quadratic formula. Choice D is incorrect and may result from using $\frac{-a\pm\sqrt{a^2+4ac}}{2a}$ as the quadratic formula.

# Solving systems of equations in two variables

### Question 262d47e

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$$x^2 + y + 7 = 7$$

$$20x + 100 - y = 0$$

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

**Answer**

The correct answer is $-10$. Adding $y$ to both sides of the second equation in the given system yields $20x + 100 = y$. Substituting $20x + 100$ for $y$ in the first equation in the given system yields $x^2 + 20x + 100 + 7 = 7$. Subtracting $7$ from both sides of this equation yields $x^2 + 20x + 100 = 0$. Factoring the left-hand side of this equation yields $(x + 10)(x + 10) = 0$, or $(x + 10)^2 = 0$. Taking the square root of both sides of this equation yields $x + 10 = 0$. Subtracting $10$ from both sides of this equation yields $x = -10$. Therefore, the value of $x$ is $-10$.

### Question 1d4f9e0d

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

In the *xy*-plane, a line with equation $2y = c$ for some constant $c$ intersects a parabola at exactly one point. If the parabola has equation $y = -2x^2 + 9x$, what is the value of $c$?

**Answer**

The correct answer is $\frac{81}{4}$. The given linear equation is $2y = c$. Dividing both sides of this equation by $2$ yields $y = \frac{c}{2}$. Substituting $\frac{c}{2}$ for $y$ in the equation of the parabola yields $\frac{c}{2} = -2x^2 + 9x$. Adding $2x^2$ and $-9x$ to both sides of this equation yields $2x^2 - 9x + \frac{c}{2} = 0$. Since it's given that the line and the parabola intersect at exactly one point, the equation $2x^2 - 9x + \frac{c}{2} = 0$ must have exactly one solution. An equation of the form $Ax^2 + Bx + C = 0$, where $A$, $B$, and $C$ are constants, has exactly one solution when the discriminant, $B^2 - 4AC$, is equal to $0$. In the equation $2x^2 - 9x + \frac{c}{2} = 0$, where $A = 2$, $B = -9$, and $C = \frac{c}{2}$, the discriminant is $(-9)^2 - 4(2)\left(\frac{c}{2}\right)$. Setting the discriminant equal to $0$ yields $(-9)^2 - 4(2)\left(\frac{c}{2}\right) = 0$, or $81 - 4c = 0$. Adding $4c$ to both sides of this equation yields $81 = 4c$. Dividing both sides of this equation by $4$ yields $c = \frac{81}{4}$. Note that 81/4 and 20.25 are examples of ways to enter a correct answer.

## Question 65e9d154

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$x - y = 1$
$x + y = x^2 - 3$

Which ordered pair is a solution to the system of equations above?

- $(1+\sqrt{3}, \sqrt{3})$
- $(\sqrt{3}, -\sqrt{3})$
- $(1+\sqrt{5}, \sqrt{5})$
- $(\sqrt{5}, -1+\sqrt{5})$

Choice A is correct. The solution to the given system of equations can be found by solving the first equation for x, which gives $x = y + 1$, and substituting that value of x into the second equation which gives $y + 1 + y = (y+1)^2 - 3$. Rewriting this equation by adding like terms and expanding $(y+1)^2$ gives $2y + 1 = y^2 + 2y - 2$. Subtracting $2y$ from both sides of this equation gives $1 = y^2 - 2$. Adding to 2 to both sides of this equation gives $3 = y^2$. Therefore, it follows that $y = \pm\sqrt{3}$. Substituting $\sqrt{3}$ for y in the first equation yields $x - \sqrt{3} = 1$. Adding $\sqrt{3}$ to both sides of this equation yields $x = 1 + \sqrt{3}$. Therefore, the ordered pair $(1+\sqrt{3}, \sqrt{3})$ is a solution to the given system of equations.

Choice B is incorrect. Substituting $\sqrt{3}$ for x and $-\sqrt{3}$ for y in the first equation yields $\sqrt{3} - (-\sqrt{3}) = 1$, or $2\sqrt{3} = 1$, which isn't a true statement. Choice C is incorrect. Substituting $1 + \sqrt{5}$ for x and $\sqrt{5}$ for y in the second equation yields $(1+\sqrt{5}) + \sqrt{5} = (1+\sqrt{5})^2 - 3$, or $1 + 2\sqrt{5} = 2\sqrt{5} + 3$, which isn't a true statement. Choice D is incorrect. Substituting $\sqrt{5}$ for x and $(-1+\sqrt{5})$ for y in the second equation yields $\sqrt{5} + (-1+\sqrt{5}) = (\sqrt{5})^2 - 3$, or $2\sqrt{5} - 1 = 2$, which isn't a true statement.

## Question 67c08ea4

Show Advanced Math - Nonlinear equations in one variable and systems of equations in two variables

$x + y = 17$
$xy = 72$

If one solution to the system of equations above is $(x, y)$, what is one possible value of x ?

**Answer**

The correct answer is either 8 or 9. The first equation can be rewritten as $y = 17 - x$. Substituting $17 - x$ for y in the second equation gives $x(17 - x) = 72$. By applying the distributive property, this can be rewritten as $17x - x^2 = 72$. Subtracting 72 from both sides of the equation yields $x^2 - 17x + 72 = 0$. Factoring the left-hand side of this equation yields $(x-8)(x-9) = 0$. Applying the Zero Product Property, it follows that $x - 8 = 0$ and $x - 9 = 0$. Solving each equation for x yields $x = 8$ and $x = 9$ respectively. Note that 8 and 9 are examples of ways to enter a correct answer.

**Question 1cdfc27**

Show Advanced Math - Nonlinear functions

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

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?

- The estimated initial beetle population for this species and area in $2012$
- The estimated beetle population for this species and area $7$ years after $2012$
- The estimated percent decrease in the beetle population for this species and area each year after $2012$
- The estimated percent decrease in the beetle population for this species and area every $7$ years after $2012$

Choice A is correct. For an exponential function in the form $f(x) = a(b)^x$, where $a$ and $b$ are positive constants and $b < 1$, the initial value of $f(x)$, or the value of $f(x)$ when $x = 0$, is $a$ and the value of $f(x)$ decreases by $100(1-b)\%$ each time $x$ increases by $1$. Therefore, the initial value of the function $f(x) = 4{,}000(0.75)^x$, or the value of $f(x)$ when $x = 0$, is $4{,}000$. Therefore, the best interpretation of $4{,}000$ in this context is the estimated initial beetle population for this species and area in $2012$.

Choice B is incorrect. The estimated beetle population for this species and area $7$ years after $2012$ is $4{,}000(0.75)^7$, or approximately $534$, not $4{,}000$.

Choice C is incorrect. The estimated percent decrease in the beetle population for this species and area each year after $2012$ is $100(1-0.75)$, or $25$, not $4{,}000$.

Choice D is incorrect. The estimated percent decrease in the beetle population for this species and area every $7$ years after $2012$ is $100\left(1-0.75^7\right)$, or approximately $87$, not $4{,}000$.

**Question 664c858**

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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?

- $15$
- $18$
- $30$
- $36$

Choice B is correct. The area, $A$, of a triangle is given by the formula $A = \frac{1}{2}bh$, where $b$ represents the length of the base of the triangle and $h$ represents its height. It's given that the area of a triangle is $270$ square centimeters and that the length of the base of this triangle is $12$ centimeters greater than the height of the triangle. Let $x$ represent the height, in centimeters, of the triangle. It follows that the length of the base of the triangle can be expressed as $x + 12$. Substituting $270$ for $A$, $x$ for $h$, and $x + 12$ for $b$ in the formula $A = \frac{1}{2}bh$ yields $270 = \frac{1}{2}(x+12)(x)$, or $270 = \frac{1}{2}x(x+12)$. Multiplying both sides of this equation by $2$ yields $540 = x(x+12)$. Applying the distributive property on the right-hand side of this equation yields $540 = x^2 + 12x$. Subtracting $540$ from both sides of this equation yields $0 = x^2 + 12x - 540$. In factored form, this equation is equivalent to $(x+30)(x-18) = 0$. Applying the zero product property, it follows that $x + 30 = 0$ or $x - 18 = 0$. Subtracting $30$ from both sides of the equation $x + 30 = 0$ yields $x = -30$. Adding $18$ to both sides of the equation $x - 18 = 0$ yields $x = 18$. Since $x$ represents the height of the triangle, it must be positive. Therefore, the height, in centimeters, of the triangle is $18$.

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

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

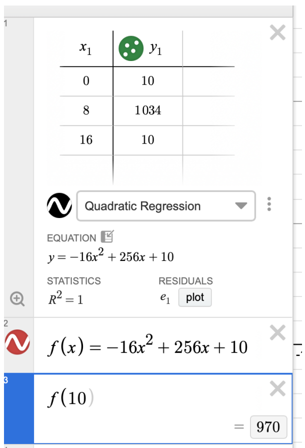
Choice D is incorrect and may result from conceptual or calculation errors.

### Question 95e390e

Show Advanced Math - Nonlinear functions

A quadratic function models the height, in feet, of an object above the ground in terms of the time, in seconds, after the object is launched off an elevated surface. The model indicates the object has an initial height of $10$ feet above the ground and reaches its maximum height of $1{,}034$ feet above the ground $8$ seconds after being launched. Based on the model, what is the height, in feet, of the object above the ground $10$ seconds after being launched?

- 234 ×
- 778 ×
- 970 ×
- 1,014 ×




Choice C is correct. It's given that a quadratic function models the height, in feet, of an object above the ground in terms of the time, in seconds, after the object is launched off an elevated surface. This quadratic function can be defined by an equation of the form $f(x) = a(x-h)^2 + k$, where $f(x)$ is the height of the object $x$ seconds after it was launched, and $a$, $h$, and $k$ are constants such that the function reaches its maximum value, $k$, when $x = h$. Since the model indicates the object reaches its maximum height of $1{,}034$ feet above the ground $8$ seconds after being launched, $f(x)$ reaches its maximum value, $1{,}034$, when $x = 8$. Therefore, $k = 1{,}034$ and $h = 8$. Substituting $8$ for $h$ and $1{,}034$ for $k$ in the function $f(x) = a(x-h)^2 + k$ yields $f(x) = a(x-8)^2 + 1{,}034$. Since the model indicates the object has an initial height of $10$ feet above the ground, the value of $f(x)$ is $10$ when $x = 0$. Substituting $0$ for $x$ and $10$ for $f(x)$ in the equation $f(x) = a(x-8)^2 + 1{,}034$ yields $10 = a(0-8)^2 + 1{,}034$, or $10 = 64a + 1{,}034$. Subtracting $1{,}034$ from both sides of this equation yields $64a = -1{,}024$. Dividing both sides of this equation by $64$ yields $a = -16$. Therefore, the model can be represented by the equation $f(x) = -16(x-8)^2 + 1{,}034$. Substituting $10$ for $x$ in this equation yields $f(10) = -16(10-8)^2 + 1{,}034$, or $f(10) = 970$. Therefore, based on the model, $10$ seconds after being launched, the height of the object above the ground is $970$ feet.

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

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

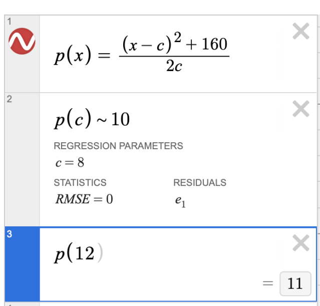
Choice D is incorrect and may result from conceptual or calculation errors.

### Question b76bb67

Show Advanced Math - Nonlinear functions

Let the function p be defined as $p(x) = \frac{(x-c)^2 + 160}{2c}$, where c is a constant. If $p(c) = 10$, what is the value of $p(12)$ ?

- 10.00 ×
- 10.25 ×
- 10.75 ×
- 11.00 ×




Choice D is correct. The value of p(12) depends on the value of the constant c, so the value of c must first be determined. It is given that p(c) = 10. Based on the definition of p, it follows that:

$$p(c) = \frac{(c-c)^2 + 160}{2c} = 10$$

$$\frac{160}{2c} = 10$$

$$2c = 16$$

$$c = 8$$

This means that $p(x) = \frac{(x-8)^2 + 160}{16}$ for all values of x.

Therefore:

$$p(12) = \frac{(12-8)^2 + 160}{16}$$

$$= \frac{16 + 160}{16}$$

$$= 11$$

Choice A is incorrect. It is the value of p(8), not p(12). Choices B and C are incorrect. If one of these values were correct, then x = 12 and the selected value of p(12) could be substituted into the equation to solve for c. However, the values of c that result from choices B and C each result in p(c) < 10.

## Question 30703968

Show Advanced Math - Nonlinear functions

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 $r$?

**Answer**

The correct answer is $-12$. It's given that function $f$ is a quadratic function where $f(-20) = 0$ and $f(-4) = 0$. It follows that the graph of $y = f(x)$ in the *xy*-plane passes through the points $(-20, 0)$ and $(-4, 0)$. When the graph of a quadratic function contains two points $(a, 0)$ and $(b, 0)$, the *x*-coordinate of the vertex of the graph is the average of $a$ and $b$. Therefore, the *x*-coordinate of the vertex of the graph of $y = f(x)$ is $\frac{-20+(-4)}{2}$, or $-12$. It's given that the graph of $y = f(x)$ in the *xy*-plane has a vertex at $(r, -64)$. It follows that the value of $r$ is $-12$.

## Question 66a6b2f9

Show Advanced Math - Nonlinear functions

There were no jackrabbits in Australia before 1788 when 24 jackrabbits were introduced. By 1920 the population of jackrabbits had reached 10 billion. If the population had grown exponentially, this would correspond to a 16.2% increase, on average, in the population each year. Which of the following functions best models the population $p(t)$ of jackrabbits t years after 1788?

- $p(t) = 1.162(24)^t$
- $p(t) = 24(2)^{1.162t}$
- $p(t) = 24(1.162)^t$
- $p(t) = (24 \cdot 1.162)^t$

Choice C is correct. This exponential growth model can be written in the form $p(t) = A(1 + r)^t$, where $p(t)$ is the population t years after 1788, A is the initial population, and r is the yearly growth rate, expressed as a decimal. Since there were 24 jackrabbits in Australia in 1788, $A = 24$. Since the number of jackrabbits increased by an average of 16.2% each year, $r = 0.162$. Therefore, the equation that best models this situation is $p(t) = 24(1.162)^t$.

Choices A, B, and D are incorrect and may result from misinterpreting the form of an exponential growth model.

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## Question 92ae7544

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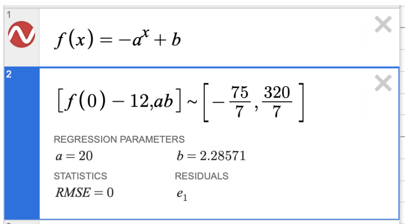
Function $f$ is defined by $f(x) = -a^x + b$, where $a$ and $b$ are constants. In the *xy*-plane, the graph of $y = f(x) - 12$ has a *y*-intercept at $\left(0, -\frac{75}{7}\right)$. The product of $a$ and $b$ is $\frac{320}{7}$. What is the value of $a$?

**Answer**




The correct answer is $20$. It's given that $f(x) = -a^x + b$. Substituting $-a^x + b$ for $f(x)$ in the equation $y = f(x) - 12$ yields $y = -a^x + b - 12$. It's given that the *y*-intercept of the graph of $y = f(x) - 12$ is $\left(0, -\frac{75}{7}\right)$. Substituting $0$ for $x$ and $-\frac{75}{7}$ for $y$ in the equation $y = -a^x + b - 12$ yields $-\frac{75}{7} = -a^0 + b - 12$, which is equivalent to $-\frac{75}{7} = -1 + b - 12$, or $-\frac{75}{7} = b - 13$. Adding $13$ to both sides of this equation yields $\frac{16}{7} = b$. It's given that the product of $a$ and $b$ is $\frac{320}{7}$, or $ab = \frac{320}{7}$. Substituting $\frac{16}{7}$ for $b$ in this equation yields $(a)\left(\frac{16}{7}\right) = \frac{320}{7}$. Dividing both sides of this equation by $\frac{16}{7}$ yields $a = 20$.

## Question 94b5bb4b

Show Advanced Math - Nonlinear functions

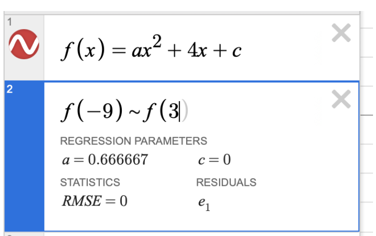
$$f(x) = ax^2 + 4x + c$$

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. $a \geq 1$

- I only
- II only
- I and II
- Neither I nor II




Choice D is correct. It's given that the graph of $y = f(x)$ in the *xy*-plane is a parabola with vertex $(h, k)$. If $f(-9) = f(3)$, then for the graph of $y = f(x)$, the point with an *x*-coordinate of $-9$ and the point with an *x*-coordinate of $3$ have the same *y*-coordinate. In the *xy*-plane, a parabola is a symmetric graph such that when two points have the same *y*-coordinate, these points are equidistant from the vertex, and the *x*-coordinate of the vertex is halfway between the *x*-coordinates of these two points. Therefore, for the graph of $y = f(x)$, the points with *x*-coordinates $-9$ and $3$ are equidistant from the vertex, $(h, k)$, and $h$ is halfway between $-9$ and $3$. The value that is halfway between $-9$ and $3$ is $\frac{-9+3}{2}$, or $-3$. Therefore, $h = -3$. The equation defining $f$ can also be written in vertex form, $f(x) = a(x-h)^2 + k$. Substituting $-3$ for $h$ in this equation yields $f(x) = a(x-(-3))^2 + k$, or $f(x) = a(x+3)^2 + k$. This equation is equivalent to $f(x) = a(x^2 + 6x + 9) + k$, or $f(x) = ax^2 + 6ax + 9a + k$. Since $f(x) = ax^2 + 4x + c$, it follows that $6a = 4$ and $9a + k = c$. Dividing both sides of the equation $6a = 4$ by $6$ yields $a = \frac{4}{6}$, or $a = \frac{2}{3}$. Since $\frac{2}{3} < 1$, it's not true that $a \geq 1$. Therefore, statement II isn't true. Substituting $\frac{2}{3}$ for $a$ in the equation $9a + k = c$ yields $9\left(\frac{2}{3}\right) + k = c$, or $6 + k = c$. Subtracting $6$ from both sides of this equation yields $k = c - 6$. If $k < 0$, then $c - 6 < 0$, or $c < 6$. Since $c$ could be any value less than $6$, it's not necessarily true that $c < 0$. Therefore, statement I isn't necessarily true. Thus, neither I nor II must be true.

Note that this is a little dangerous, because $c$ could be lots of things.