DESMOS CALCULATOR GUIDE

While you are allowed to bring your own calculator for the digital exam just as you would for the paper exam, the digital exam will now contain a built-in graphing calculator for you to use through the Desmos interface. This calculator is similar to the regular TI-84 calculator that you are used to in class, but there are some important differences.

Algebraic Math

Maximizing Your Performance

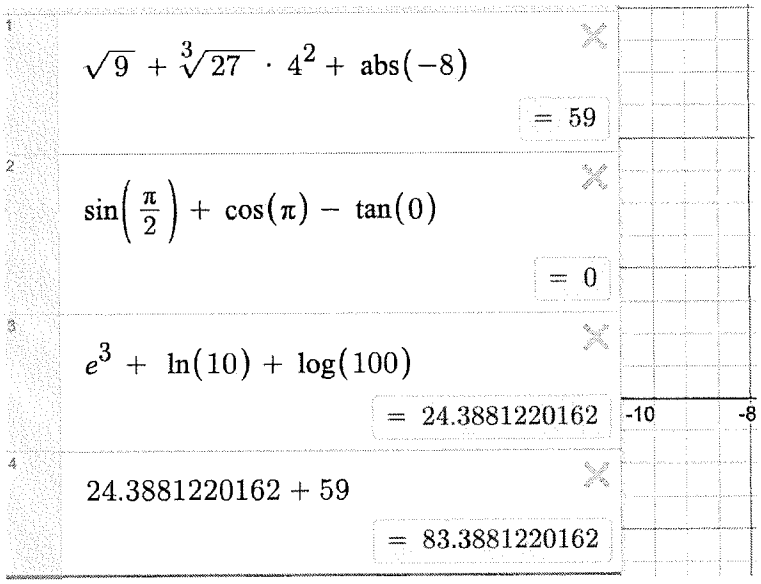
When tackling the algebraic challenges of the SAT, the Desmos calculator emerges as a powerful ally, mirroring the familiar functionalities of the classic TI-84 calculator. As you navigate through the exam, you'll find that inputting calculations into Desmos is a straightforward process: simply type your expression on the left side of the screen, keeping the order of operations firmly in mind. The answer will conveniently appear directly below your input.

Efficiency at Your Fingertips

One of the standout features of the Desmos calculator is its ability to enhance your workflow through the copy-paste function, allowing you to reuse previous calculations. Additionally, the expansive screen real estate means that you can view a comprehensive history of your past calculations without the need to scroll, allowing you to reference previous work.

Navigating Desmos: A Quick Guide

See below for how to execute common calculator functions, tailored specifically for the SAT algebra section, covering basic arithmetic operations to more advanced functions such as square roots, exponents, and trigonometric calculations.



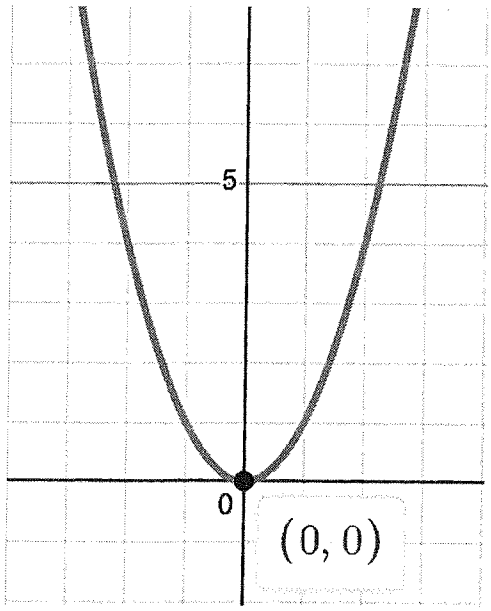
Graphing

Graphing Mastery

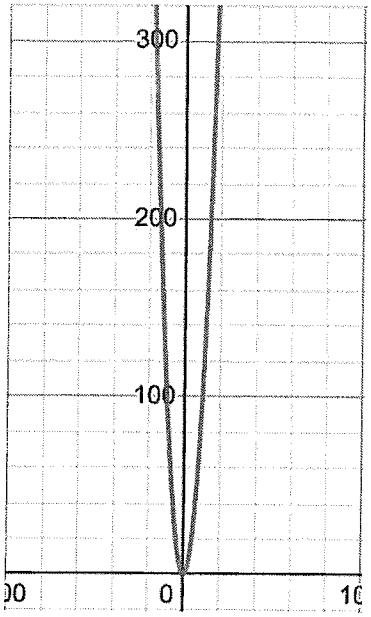
Embarking on the graphing section of the SAT, you'll find that the Desmos calculator offers an innovative approach, distinct from traditional graphing calculators. Desmos provides an expansive, infinite graphing canvas, ensuring that you are never confined by screen limitations. This feature is particularly advantageous for visualizing the behavior of functions across a wide range of values. Zooming in and out is achieved with a simple scroll of your mouse or touchpad, allowing for precise examination or a broader overview as needed.

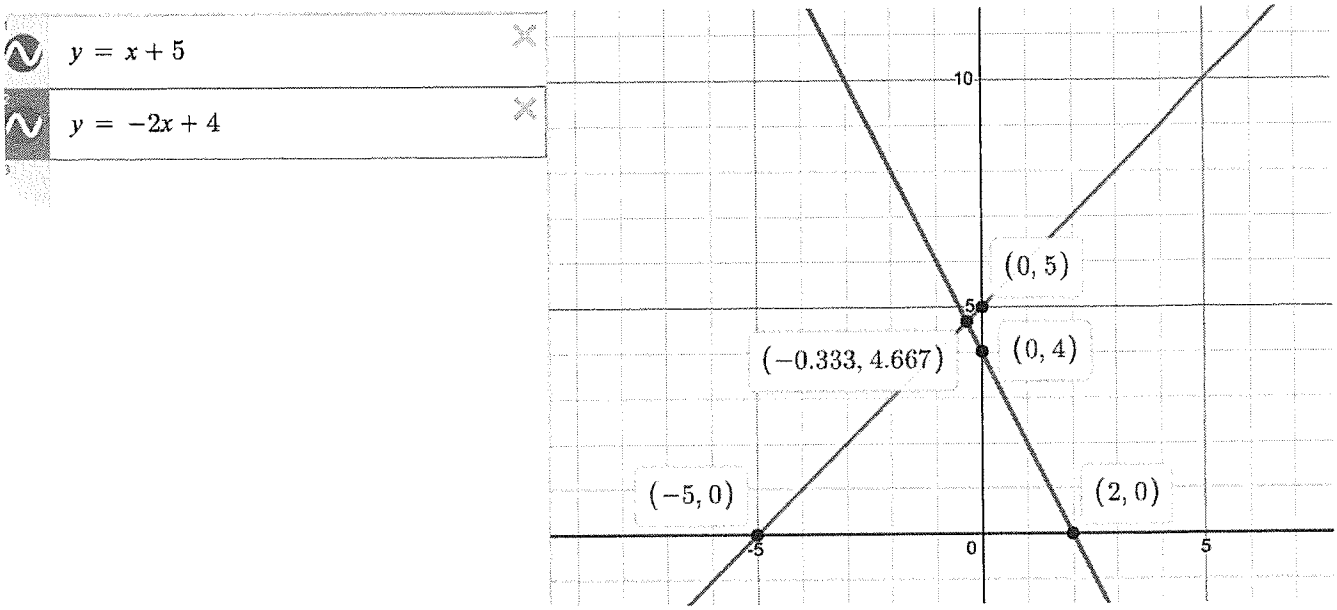
Inputting graphing equations is seamlessly integrated into the Desmos interface. You can enter equations for graphing in the same area where you perform algebraic calculations, starting with \(y = \) or another dependent variable. The Desmos calculator immediately generates a vivid, color-coded graph on the right side of the screen, providing a clear visual representation within the infinite 2-D graphing space. This color-coding is especially helpful when dealing with multiple functions, as it allows for quick and easy differentiation between graphs.

The Desmos calculator revolutionizes the way you find key features of graphs. Unlike traditional calculators, which may require a series of button presses and menu navigations, Desmos enables you to interact directly with the graph using your mouse or touchscreen. Simply click on or hover over key points on the graph to reveal their coordinates, intersection points and roots, and other important information. Additionally, Desmos assists in locating and understanding the maximum or minimum points of a graph, crucial for analyzing the behavior of various functions.



⇐ Same Graph ⇒





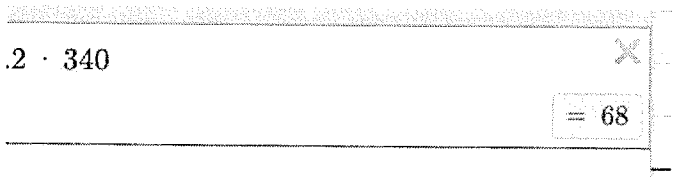
* Here I can see all important points on the graphs like intersections and intercepts

Function	How to Get
Square Root	Type **sqrt** then whatever you want inside it then the right arrow key to get out from under the radical
Cube Root	Type **cbrt** then whatever you want inside it then the right arrow key to get out from under the radical
Exponent	Use **Shift + 6** to get into the exponent and use the right arrow key to get out of the exponent
Sine	Type **Sin** then input what you want the sine of making sure to use parenthesis
Cosine	Type **Cos** then input what you want the cosine of making sure to use parenthesis
Tangent	Type **Tan** then input what you want the tangent of making sure to use parenthesis
e	Just type out **e** regularly and using proper order of operations, Desmos will recognize it as the constant number 2.718
Log / Ln	Just like the trig functions type **Log or Ln** followed by what you are looking for in parentheses
Pi	Just type out **pi** and it will turn into π
Absolute Value	Type **abs** and put what you want in parentheses to get the absolute value function

Some Example Question Uses

1. What is 20% of 340 ?

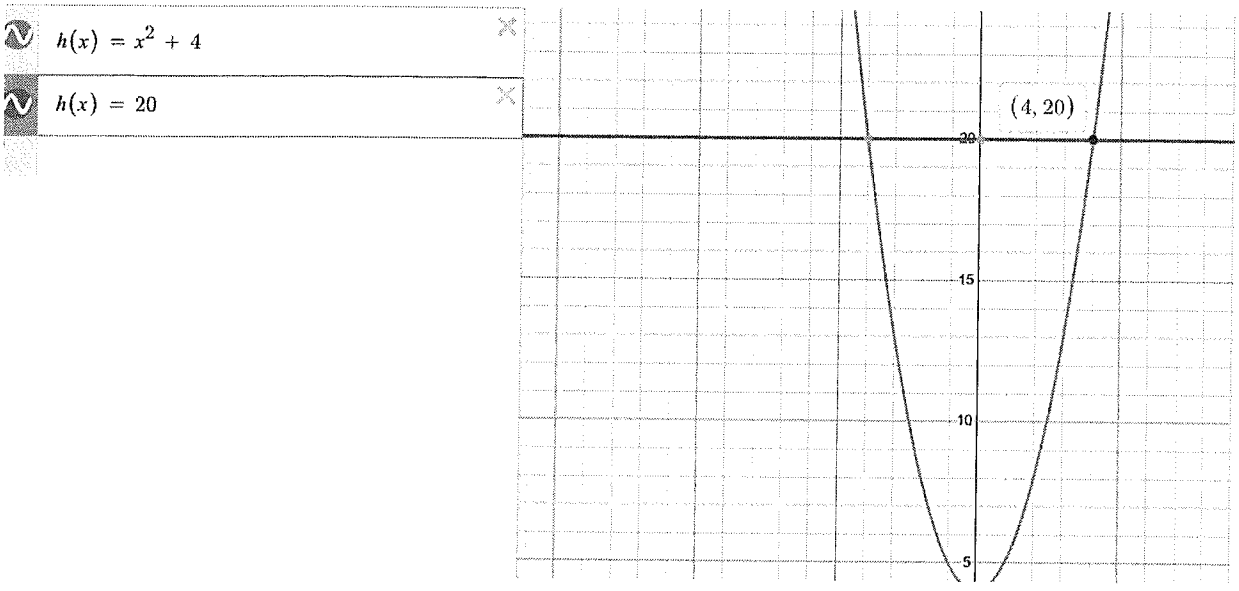
A) 30
B) 20
C) 34
D) 68



2. The function h is defined by $h(x) = x^2 + 4$. For which **Solution**
Type 20% as a number which means moving the decimal over 2 places to get .2. Then multiply this number by 340 and you will get answer D) 68.

h value of x is $h(x) = 20$?

A) 2
B) 3
C) 4
D) 5

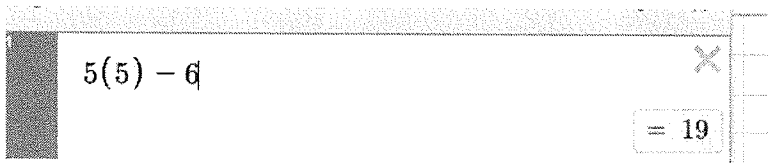


Solution

First plot the graph $h(x)$ in DESMOS then plot the line we want the function to equal. Then hover over the intersection to see where the two lines intersect and see what the x value is which in this case is C) 4.

3. The function f is defined by the equation $f(x) = 5x - 6$. What is the value of $f(x)$ when $x = 5$?

A) 19
B) 21
C) 25
D) 30



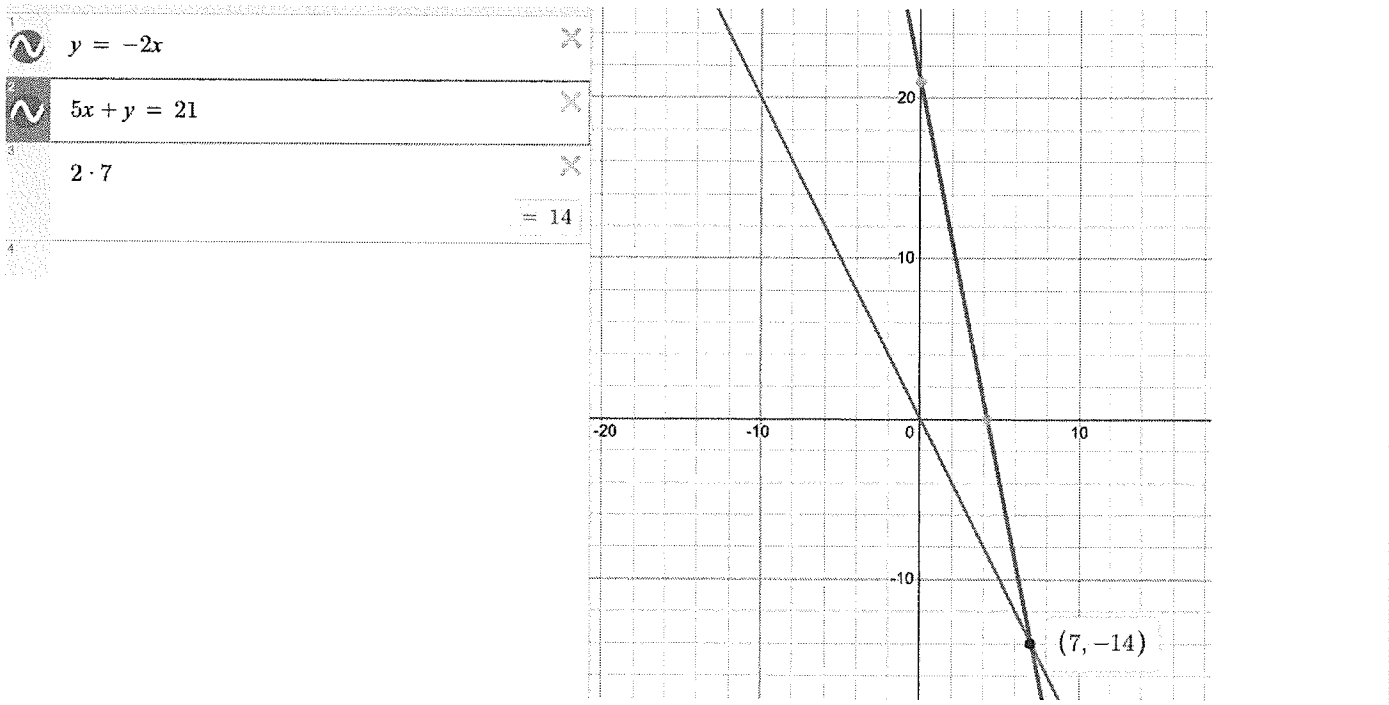
Solution

Since we know what we want x to equal and we have the function, we can just plug 5 into our function for x and figure out what the corresponding $f(x)$ value should be, which is A) 19.

$$\begin{aligned} y &= -2x \\ 5x + y &= 21 \end{aligned}$$

4. The solution to the given system for equations is (x,y). What is the value of $2x$?

A) 7
B) -14
C) 14
D) 21



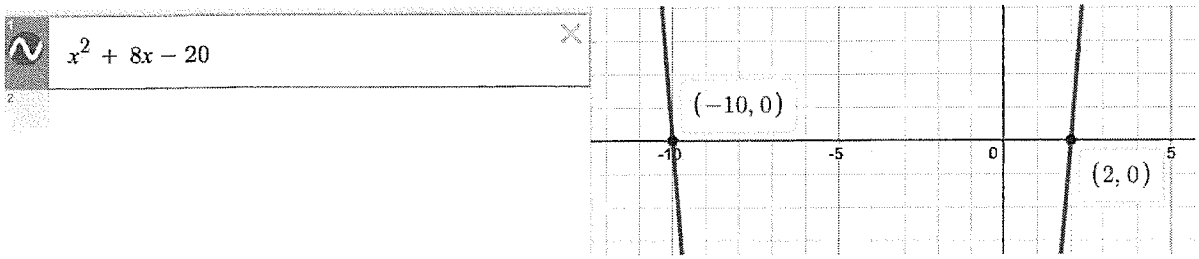
Solution

First plot the graphs in DESMOS then hover over the intersection to see where the two lines intersect and see what the x value of the intersection is which in this case is 7. Then since they ask for $2x$, we can multiply this value of 7 times 2 to get a final answer of C) 14.

$c^2 + 8c - 20$

5. What is one solution to the given equation

A) 2
B) 4
C) 8
D) 20

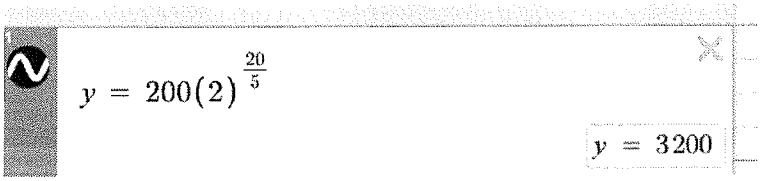


Solution

First plot the graph in DESMOS and look at the x-axis because that is where the roots/zeros/solutions will be. The variable itself does not matter so even though the question uses c, we will use x when we plug into DESMOS. Hover over these points to reveal both solutions and then look at the answer choices to see if there are any that match these points with the correct x values. The answer is A) 2.

6. Bacteria are growing in a liquid growth medium. There were 200 cells per milliliter during an initial observation. The number of cells per milliliter doubles every 5 hours. How many cells per milliliter will there be 20 hours after the initial observation?

A) 200
B) 800
C) 1000
D) 3200

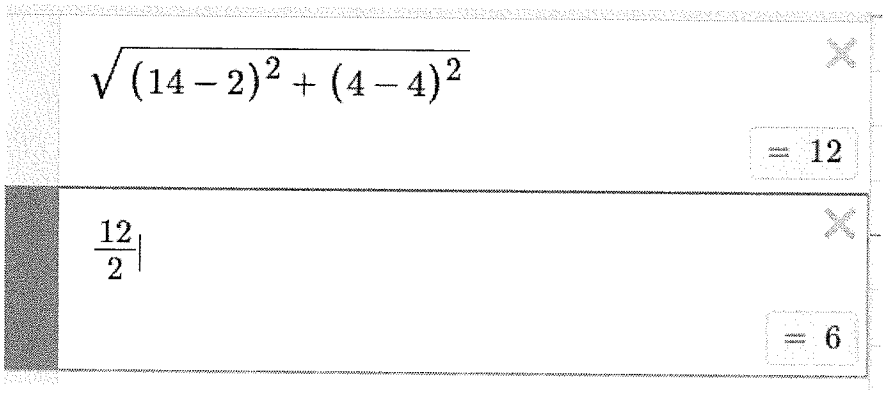


Solution

Since this is an exponential function, we can plot this in DESMOS using our traditional equation for an exponential. We know 200 is the initial value, since it doubles the rate inside the parenthesis is 2 and we know that $t = 20$ which should go into our exponent. We then see that the answer is D) 3200.

7. A circle in the xy-plane has a diameter with endpoints (4, 2) and (4, 14). An equation of this circle is $(x-4)^2+(y-8)^2=r^2$, where r is a positive constant. What is the value of r?

A) 4
B) 5
C) 6
D) 7

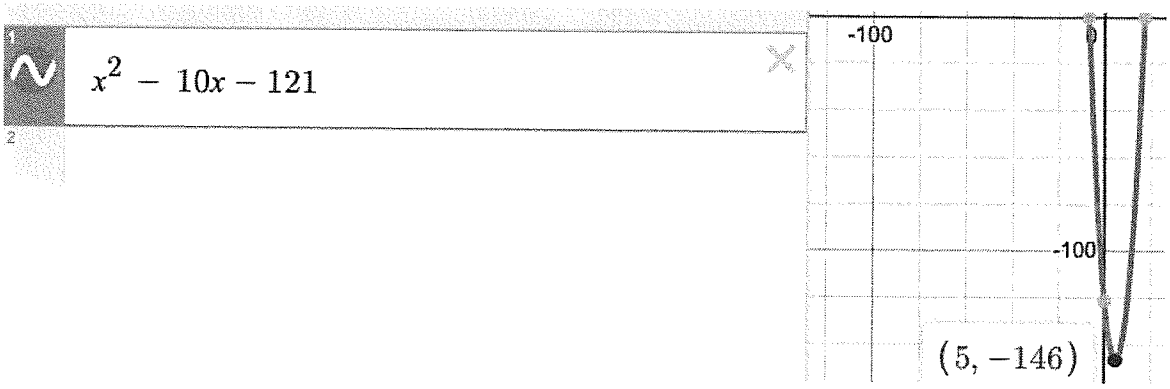


Solution

The first thing that we do is use the distance equation to find the length between the endpoints of the circle which we know will be the diameter. Once we find this, we know that the diameter is just twice the radius, so we need to divide this value (12) by 2 to get the radius C) 6.

8. In the xy-plane, the graph of the equation $y=x^2-10x-121$ intersects the line $y=c$ at exactly one point. What is the value of c?

A) -100
B) -121
C) -140
D) -146

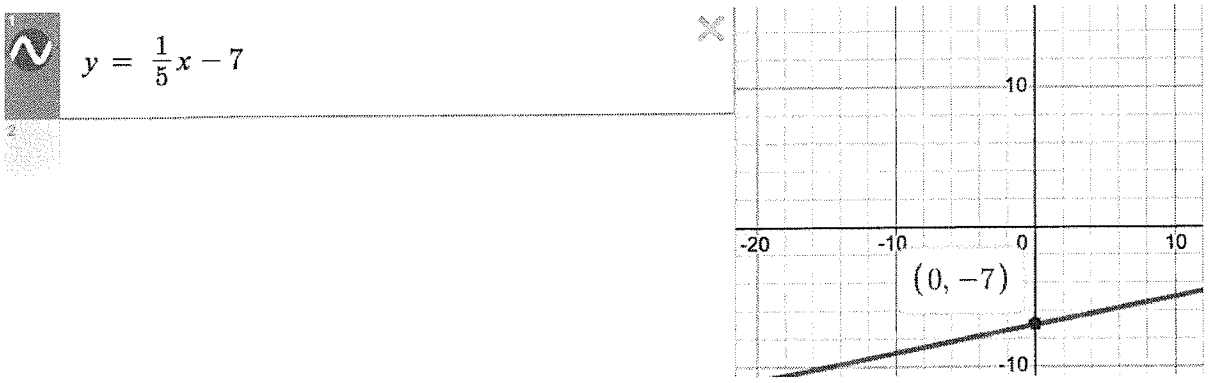


Solution

Plot this equation is DESMOS and then we know that the only time a parabola will hit a horizontal line once is at the vertex so we need to find that point. Hover over the vertex point and find the y-value associated with it and then we know that this value is the line that will only hit the parabola once, which is d) (-146).

9. The function g is defined by $g(x) = \frac{1}{5}x - 7$. What is the y-intercept of the graph $y = f(x)$ in the xy-plane?

A) -7
B) -3
C) $\frac{1}{5}$
D) 4



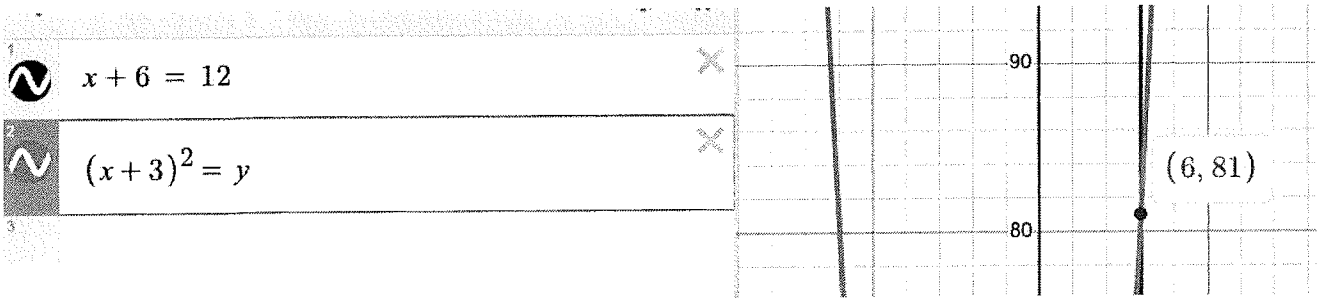
Solution

First plot the graph in DESMOS and since we are looking for the y-intercept we know that this is the value when $x = 0$. So we go down to the graph at this point to figure out what the corresponding y-value is. In this case it is answer C) -7.

$$x + 6 = 12$$
$$(x + 3)^2 = y$$

10. What ordered pair (x,y) is a solution to the given system of equations?

A) (3,36)
B) (4,49)
C) (0,0)
D) (6,81)

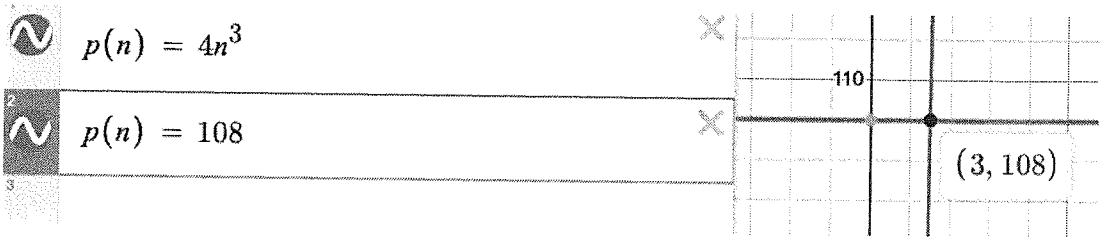


Solution

So we can plot both of these graphs just as they are in DESMOS and we are looking for the solution which is also known as the intersection point. We can highlight over this point and see the ordered pair that is the solution for this set of equations.

11. The function p is defined by $p(n) = 4n^3$. What is the value of n when $p(n) = 108$?

A) 2
B) 3
C) 4
D) 5



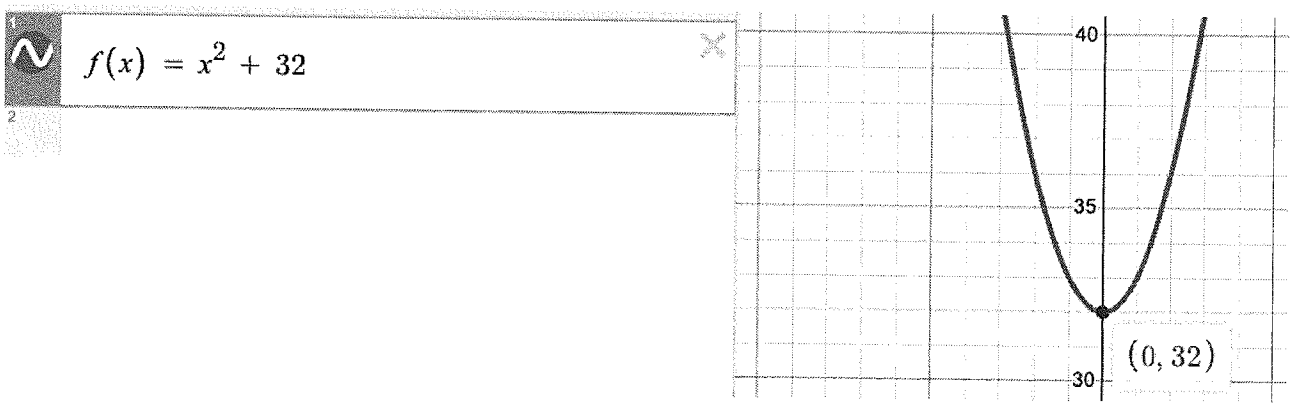
Solution

So first plot the graph $p(n)$ in DESMOS and then plot the value that we want to hit which is 108. Then we want to hover over the intersection point because this will give us the value of n where this happens, which is B) 3.

$f(x) - x^2 + 32$

12. What is the minimum value of the given function?

A) 0
B) 20
C) 28
D) 32



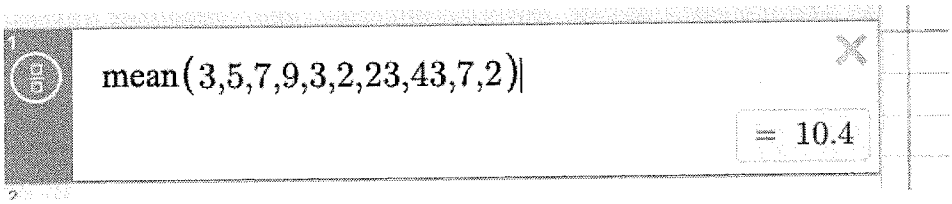
Solution

We know that the minimum value of a parabola occurs at the vertex so we are going to plot this graph to find the coordinates of the vertex. Plot this graph in DESMOS and then hover over the vertex to find the points of the vertex and see what the y-value is because that is what corresponds to the minimum value. The answer is D) 32.

3, 5, 7, 9, 3, 2, 23, 43, 7, 2

13. What is the mean of the following data?

A) 7.5
B) 8.3
C) 10.4
D) 12.2

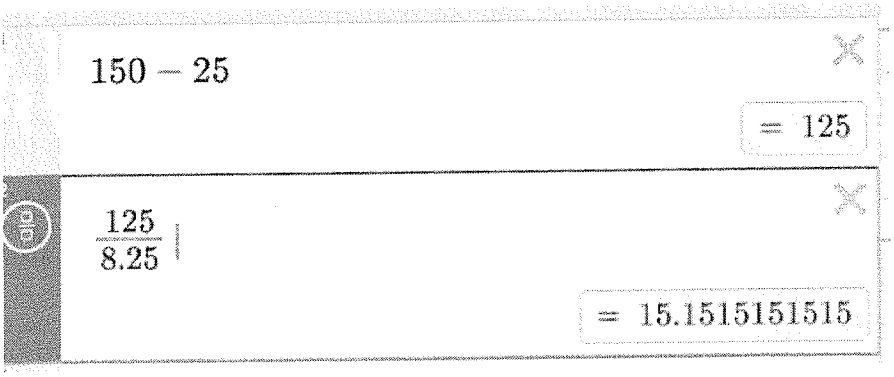


Solution

So here we can use the mean function that DESMOS has. First type mean then add a parentheses. Then add in all of the values each separated by a comma and then close the parenthesis. This function will then automatically give you the mean of the numbers. The answer is C) 10.4

14. Cory is planning a party. It costs Cory a one time fee of $25 to rent the venue and $8.25 per attendee. Cory has a budget of $150. What is the greatest number of attendees possible without exceeding the budget?

A) 12
B) 13
C) 14
D) 15

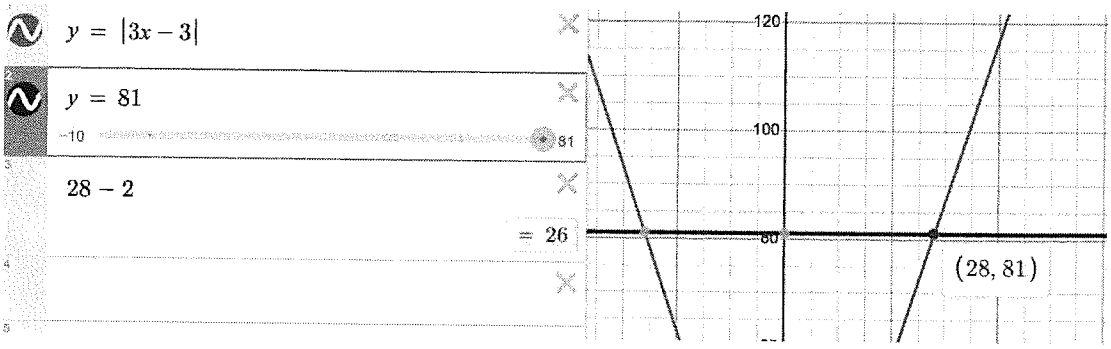


Solution

So first subtract the 25 dollars from the original 150. Then take the answer of that (125) and divide that by the amount it costs each person to attend. In this case since we cannot have a decimal amount of a person, we must round down to get an answer of 15, which is choice D.

15. If $|3x - 3| = 81$, what is the positive value of $x - 2$?

A) 20
B) 26
C) 28
D) 81

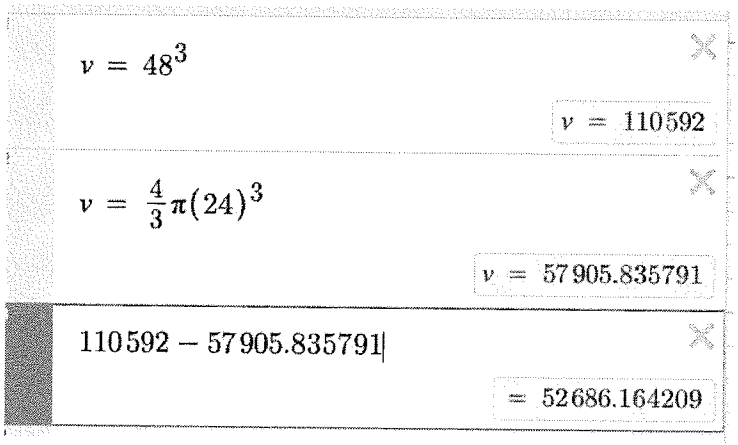


Solution

First graph the function and the value of 81 on DESMOS. Now look for the positive intersection point and hover over it to figure out the x value where this intersection happens on the positive side. Now since we want this value minus 2 we can plug that equation in below to solve for our answer, which is B) 26.

16. A cube has an edge length of 48 inches. A solid sphere with a radius of 24 inches is inside the cube, such that the sphere touches the center of each face of the cube. To the nearest cubic inch, what is the volume of the space in the cube not taken up by the sphere?

A) 516,087
B) 520,087
C) 525,243
D) 526,686



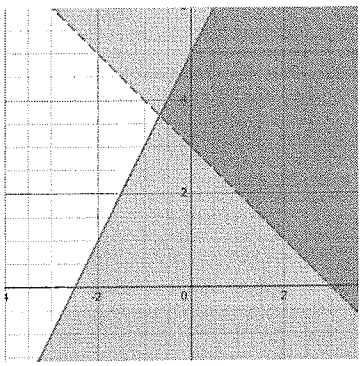
Solution

So first plug into the volume of a cube formula and then do the same thing for the volume of a sphere formula right below it. Use the numbers they give you for the components of the volumes and then subtract these two numbers to see what remaining volume is in the cube and not the sphere. The answer is choice D.

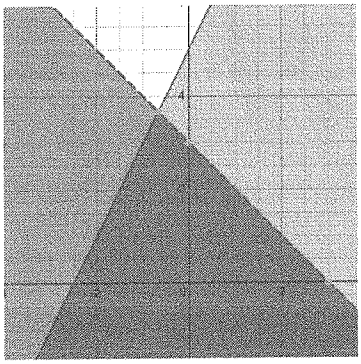
$y > -x + 3$
$y \leq 2x + 5$

17. Which graph represents the solution to the system of inequalities?

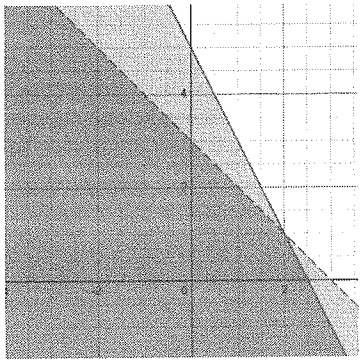
a)



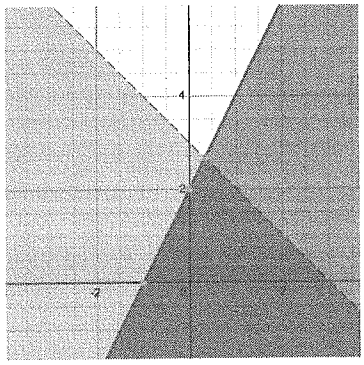
b)



c)

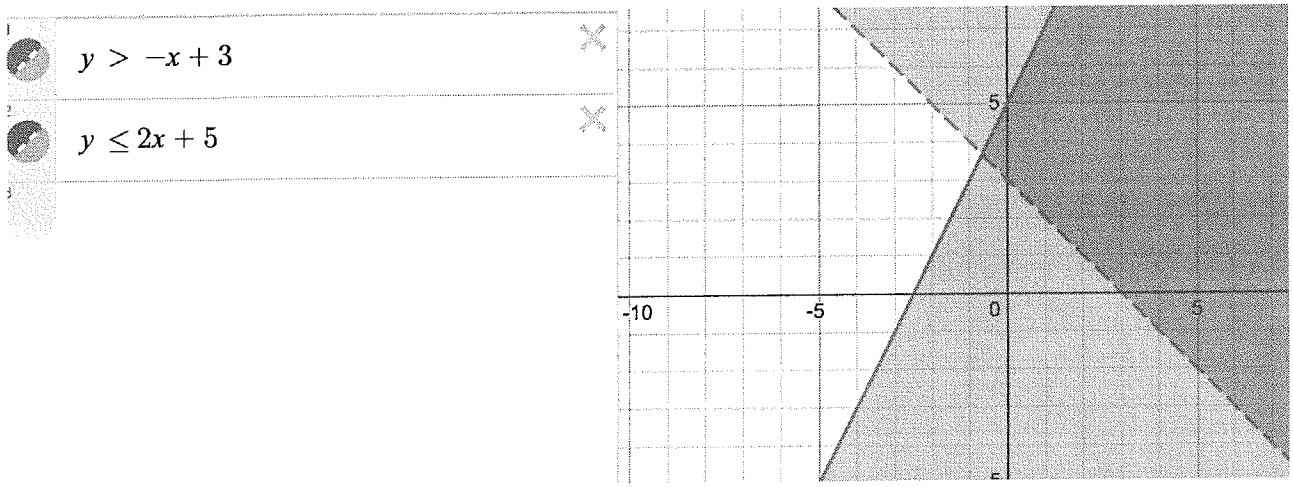


d)



Solution

When we plug the equations into DESMOS it is important to note that the signs are different and represent dotted and solid lines respectively. When we plot the system we look at the choices and see that our graph matches choice A.



CALCULATOR TIPS AND TRICKS

PERMITTED CALCULATORS ON THE SAT

Most students use some type of TI-83 or TI-84, which is allowed by the College Board on the SAT exam. Curvebreakers recommends the TI-84 Plus CE. For more information about using calculators on the SAT, read Curvebreakers' detailed blog posts online at curvebreakerstestprep.com/blog.

PROHIBITED DEVICES

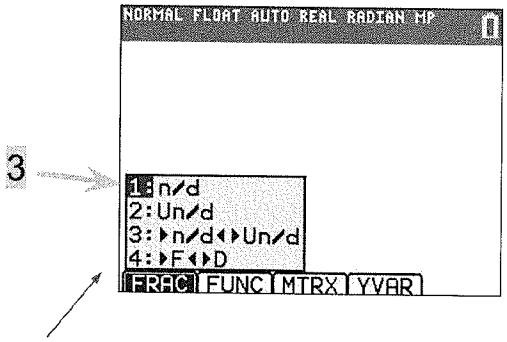
Unless students have an accommodation approved by the College Board, they can't access these items during the test or breaks:

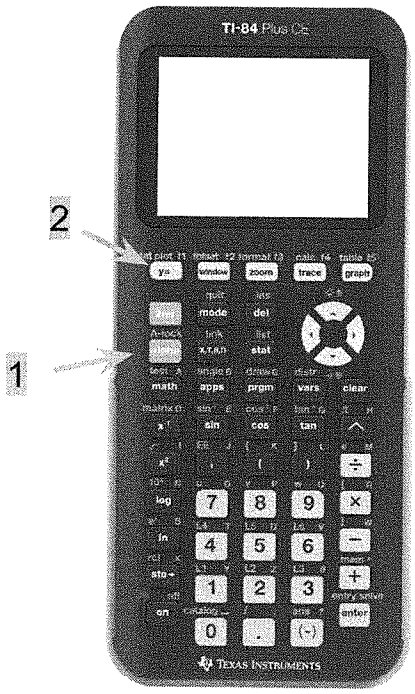
- Phones smartwatches, fitness trackers, or other wearable technology
- Audio players, Bluetooth devices (like wireless earbuds/headphones), or any other electronic devices (except your testing device)
- Detachable privacy screens
- External keyboards for use with laptops or Chromebooks (keyboards for iPads are allowed)
- Stylus for iPad
- Any cameras, recording device, or timer
- Notes, books, or any other reference materials
- Compasses, rulers, protractors, or cutting devices
- Headphones, earbuds, or earplugs
- Unacceptable calculators that have computer-style (QWERTY) keyboards, use paper tape, make noise, or use a power cord

HOW TO USE A GRAPHING CALCULATOR

Inputting A Fraction

1) Press "alpha"
2) Press "y="
3) Press "enter" to select "1: n/d"





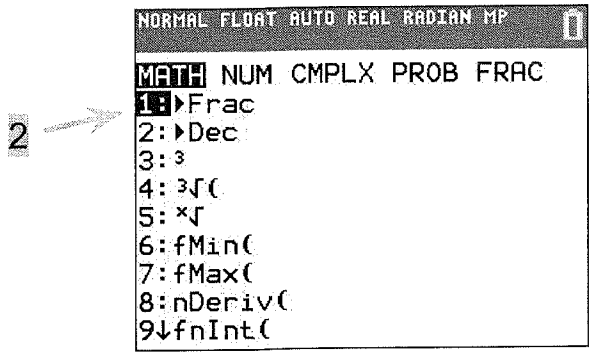
NOTE: There are several other functions you'll see in this list.

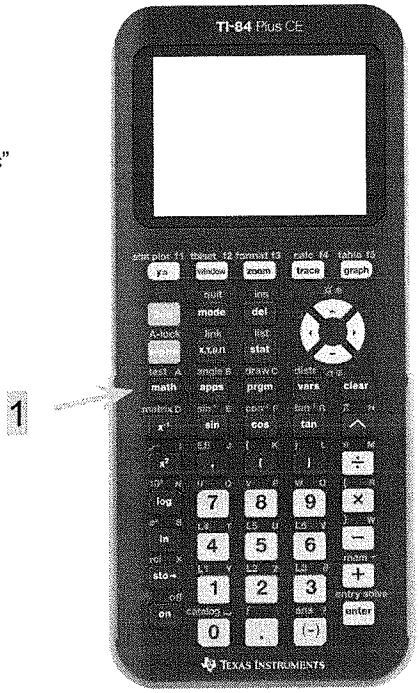
- "2: Un/d" will allow you to input a mixed number
- "3: ▶ n/d ◀ ▶Un/d" will change a fraction into a mixed number

To get a decimal in fraction form:

1) Press "math"
2) Press "enter" to select "1: ▶ Frac"
3) Press "enter"

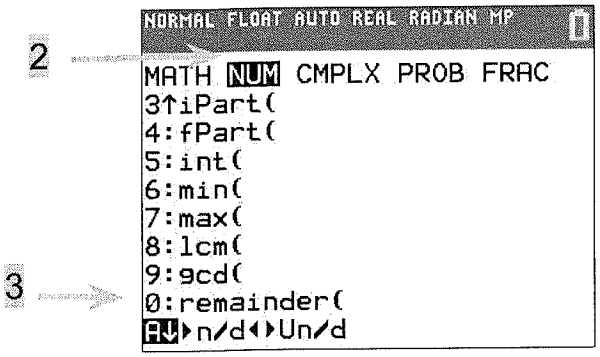
*To get from fraction form into decimal, repeat the procedure, but select "2: ▶ Dec"

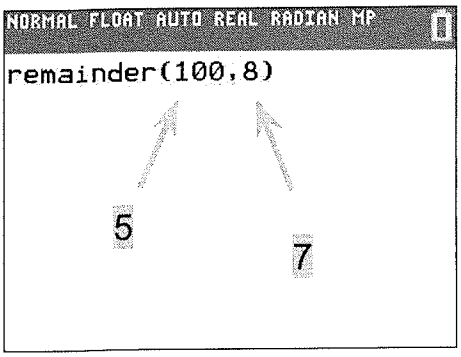


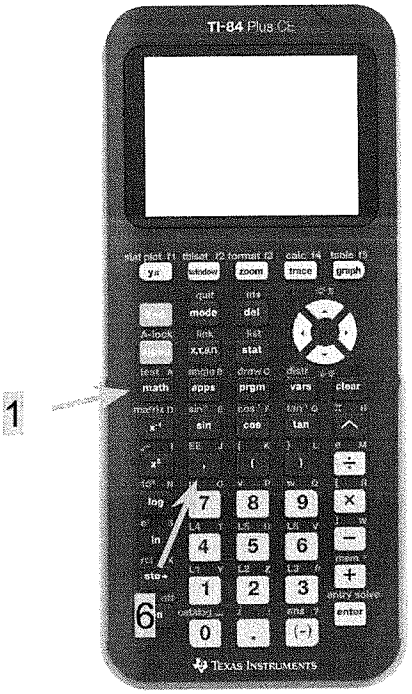


Calculating A Remainder:

1) Press "math"
2) Scroll right to "num"
3) Scroll down to "0: remainder("
4) Press "enter"
5) Input your dividend (what you're dividing)
6) Input a comma
7) Input your divisor (what you're dividing by)
8) Close parentheses and press "enter"







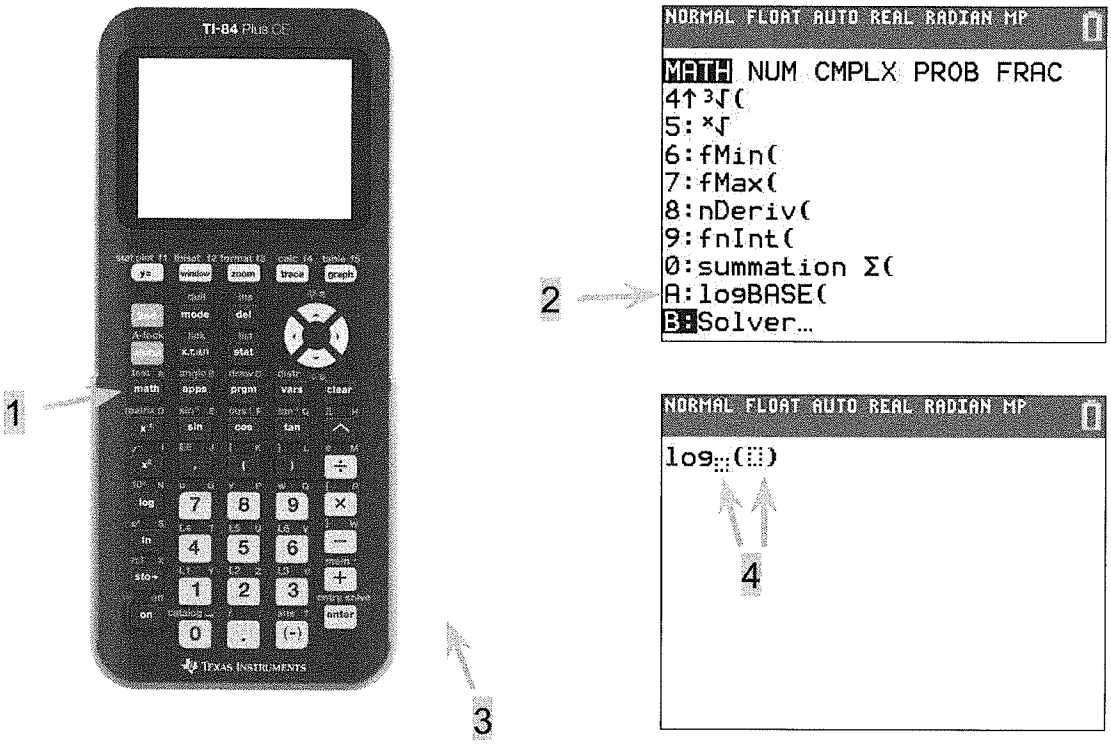
NOTE: There are several other functions you'll see in this list that can be calculated with the same steps.

- 8: lcm(" will calculate a least common multiple
- 9: gcd(" will calculate a greatest common divisor

*Place commas between your terms.

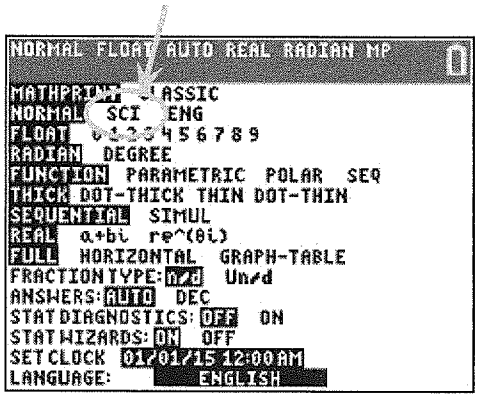
Logarithm with a Base not equal to 10:

1) Press "math"
2) Scroll down to "A: LogBASE("
3) Press "enter"
4) Input base and what you are calculating the logarithm of



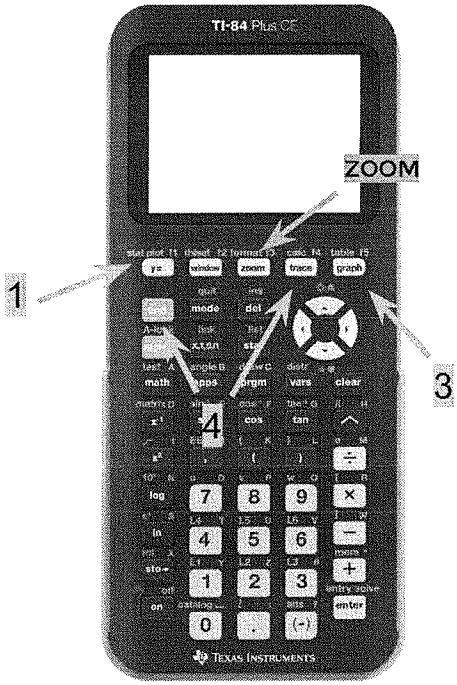
Scientific Notation

1) Press "mode"
2) Scroll down to second row and select "SCI"
3) Quit (Press 2nd and then "mode" to quit)



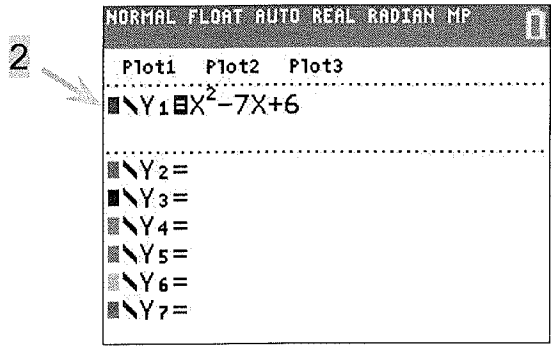
To find a zero (solution or root) by graphing:

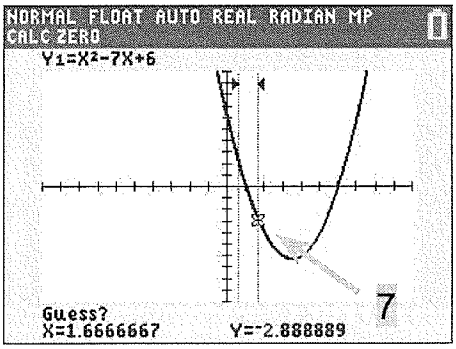
1) Press "y="
2) Input function into Y1=
3) Press "graph" (the graph will appear in your window; if it does not, try zooming out by pressing "zoom" and scrolling down to "3: zoom out")
4) Press "2ND" and then "trace"
5) Scroll down to "2: zero" and press "enter"
6) Move the cursor to a spot on the curve to the LEFT of the zero. Push "enter"
7) Move the cursor to a spot on the curve to the RIGHT of the zero. Push "enter"
8) Push "enter" a third time
9) The x and y coordinates will appear at the bottom of the screen

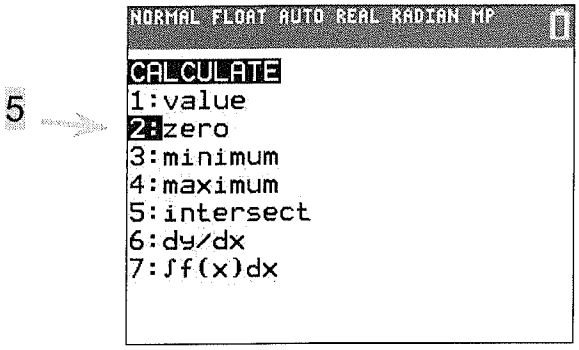


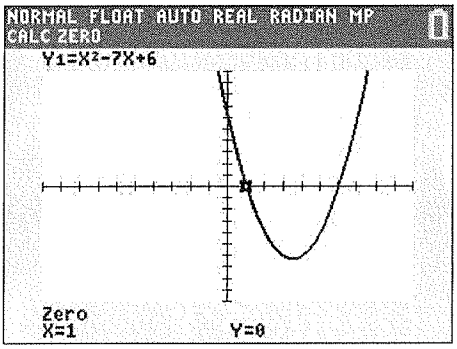
NOTE: You can find a maximum or minimum with the same procedure.
In step 5, select:

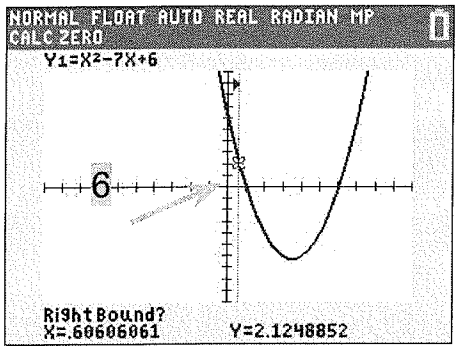
- "3: minimum" to trace a minimum
- "4: maximum" to trace a maximum





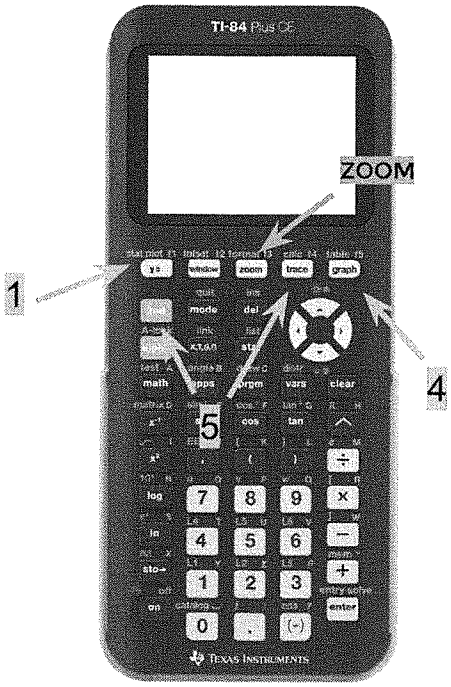






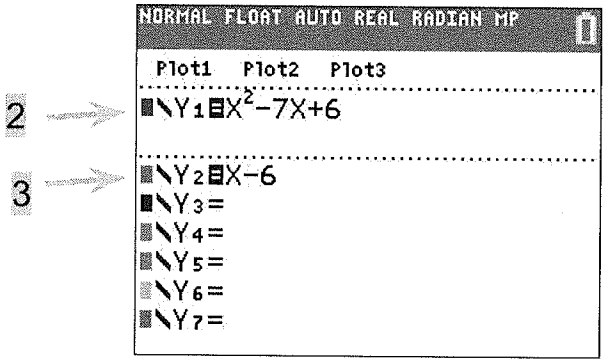
To find a point of intersection:

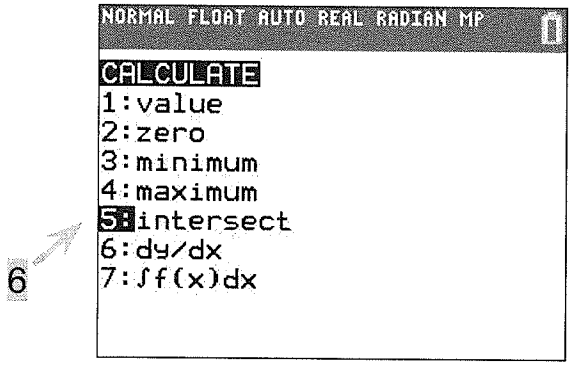
1) Press "y="
2) Input first function into Y1=
3) Input second function into Y2=
4) Press "graph" (both graphs will appear in your window; if they do not, try zooming out by pressing "zoom" and scrolling down to "3: zoom out")
5) Press "2ND" and then "trace"
6) Scroll down to "5: intersect" and press "enter"
7) Move the cursor to a spot near the intersection on the FIRST curve. Push "enter"
8) Move the cursor to a spot near the intersection on the SECOND curve. Push "enter"
9) Push "enter" a third time
10) The x and y coordinates will appear at the bottom of the screen

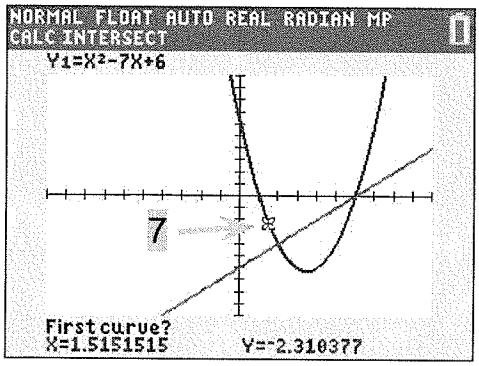


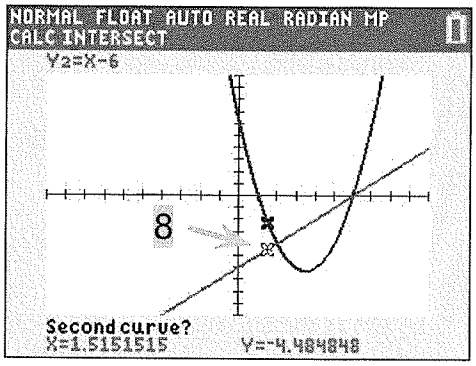
NOTE: This is a great way to solve equations that are difficult to solve by hand.

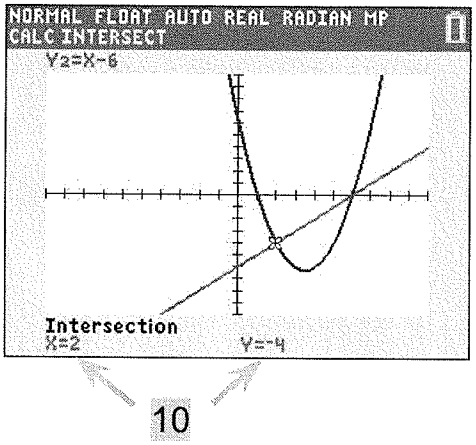
- Put one side of the equation into Y1=
- Put the other side of the equation into Y2=
- Trace the intersection







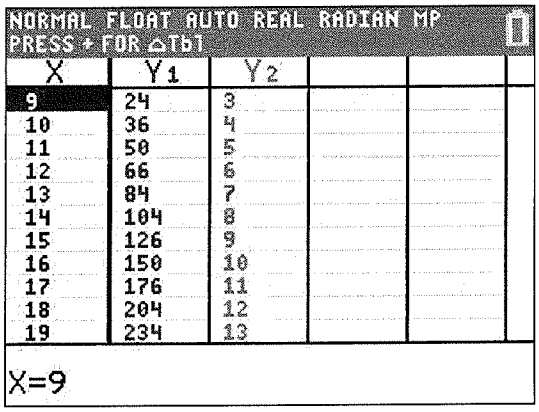




NOTE: A great way to test for **equivalency** (without needing to do the algebra) is to use the graphing component. Put one expression into Y1 and the other expression into Y2 and graph them both. If the functions are truly equivalent, they will have the same graphs.

They will also have the same table values. Viewing the table might be quicker than letting the calculator graph the entire functions. To locate a table:

1) Press "2nd"
2) Press "graph"



NOTE: The physical graphs, trace functions, and table values can help you determine several features about a function without needing to perform any operations by hand. You can simply *observe* them. These features include:

1) Y- Intercepts and X- Intercepts (zeros)
2) Maximums & Minimums
3) Points of Intersection
4) Points of Discontinuity
5) Asymptotes
6) Limits
7) Equivalencies to other functions

To determine the factors of a number:

1) Press "y="
2) Input that number divided by x into Y1
3) Press "2ND" and then "graph" to bring you to the table
4) Any x-y pairs that are whole numbers are factors of that initial value

2 →