Using The TI-Nspire Calculator in AP Calculus

(Version 3.0)

You must be able to perform the following procedures on your calculator:

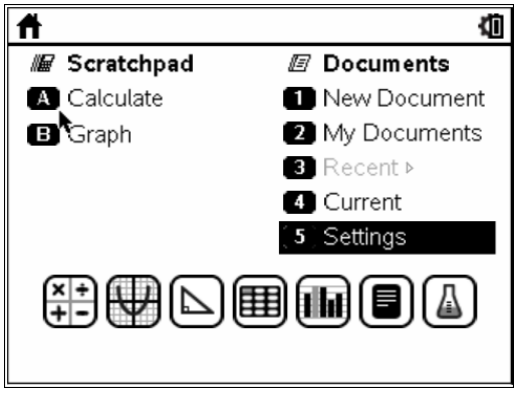
1. Plot the graph of a function within an arbitrary viewing window,
2. Find the zeros of functions (solve equations numerically),
3. Numerically calculate the derivative of a function, and
4. Numerically calculate the value of a definite integral.

On the free response questions,

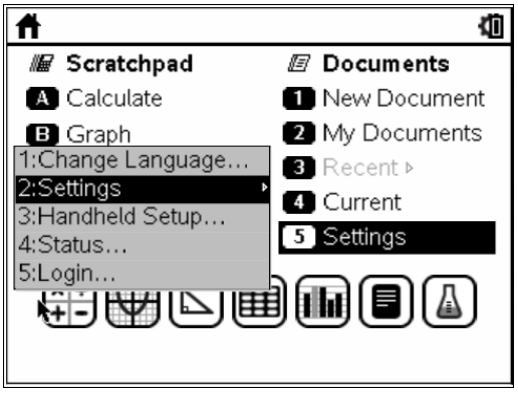
- You may use the calculator to perform any of the four listed procedures. When you do, you need only to write the "setup" (the equation, derivative, or definite integral that will produce the solution), then write the calculator result.
- For a solution for which you use the calculator for something other than the four procedures listed above, you must write down the mathematical steps that yield the answer.
- When asked to "justify", you must provide mathematical reasoning to support your answer. Calculator results alone will not be sufficient.

All answers on the AP exam must be accurate to 3 decimal places unless otherwise specified in the problem. Your calculator should be set to display enough decimal places to have that degree of accuracy.

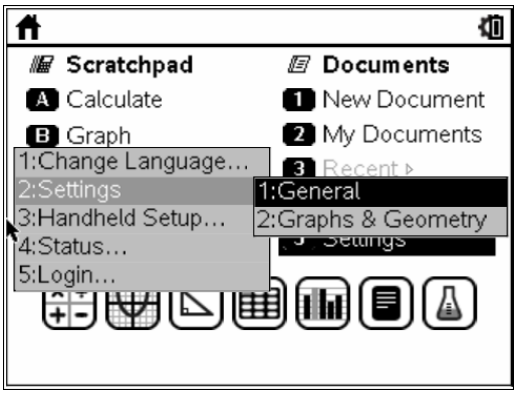
On **Home** screen, select **5. Settings**.

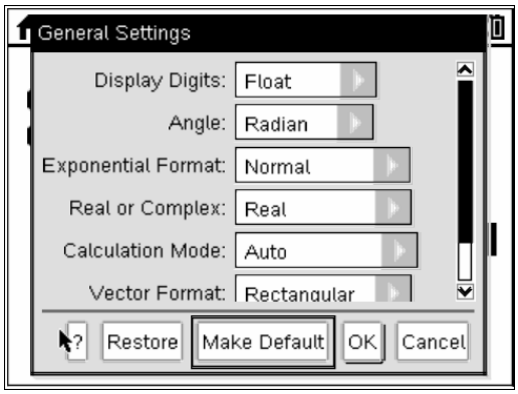


Select 2:Settings.

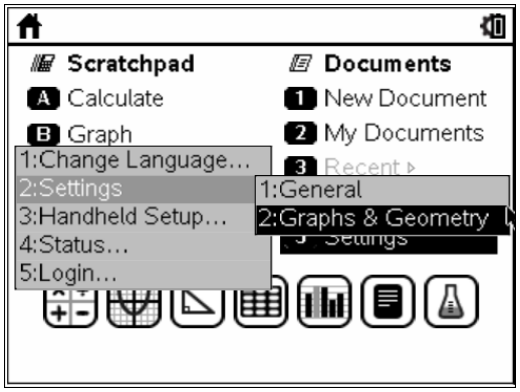


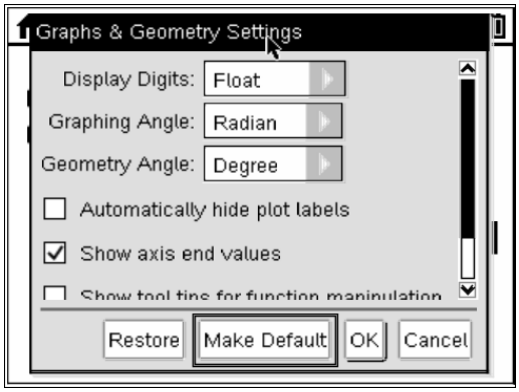
Change the **General** settings to **Float** and **Radian**. **Make Default**.





Change the **Graphs & Geometry** settings to **Float** and **Radian**. **Make Default**.

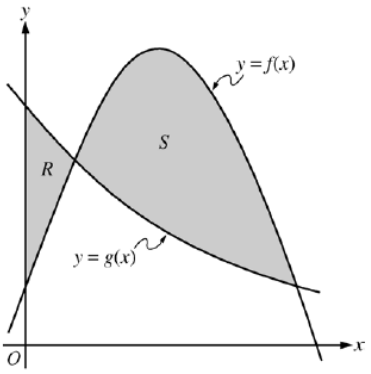




Plot the graph of a function within an arbitrary viewing window.

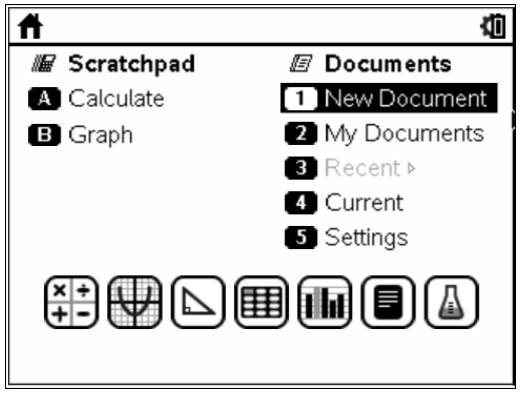
(Using TI-Nspire Version 3.0)

1. Let f and g be functions given by $f(x)=\frac{1}{4}+\sin(\pi x)$ and $g(x)=4^{-x}$.

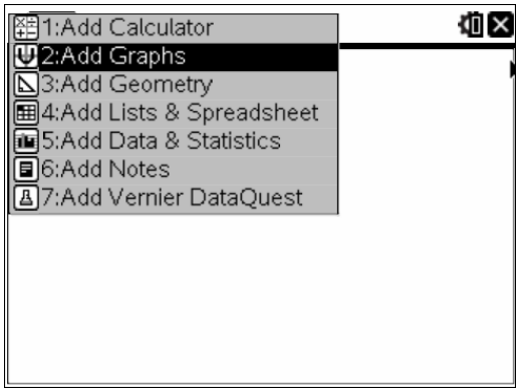


Let R be the shaded region in the first quadrant enclosed by the y-axis and the graphs of f and g, and let S be the shaded region in the first quadrant enclosed by the graphs of f and g, and shown in the figure above.

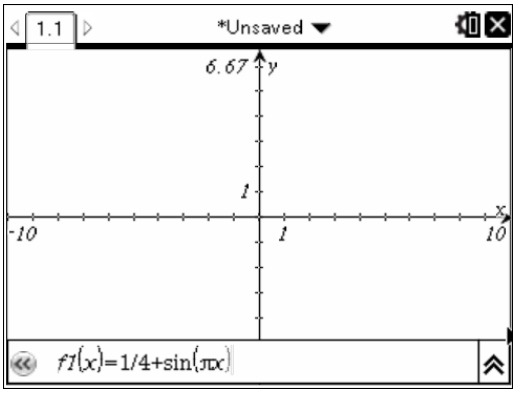
On **Home** screen, select **1. New Document**.



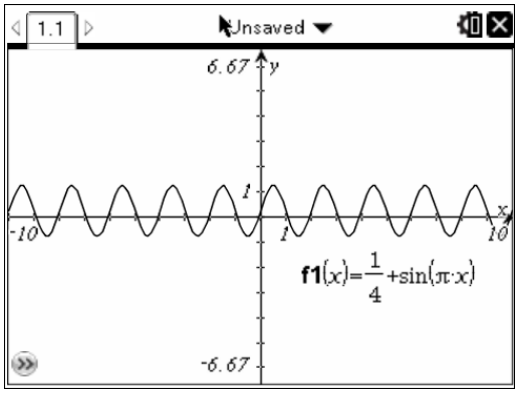
2:Add Graphs



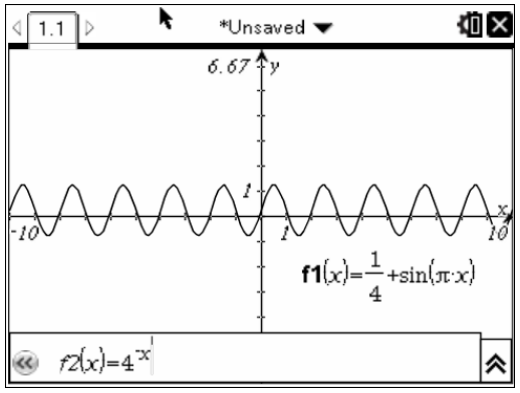
Enter the first function in f_1.



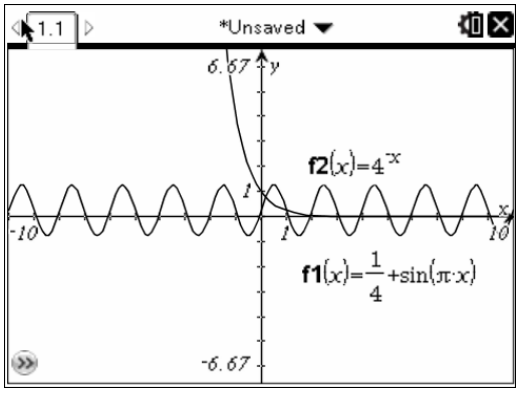
Press ·, then e .



Press e, then enter the second function in f_2.



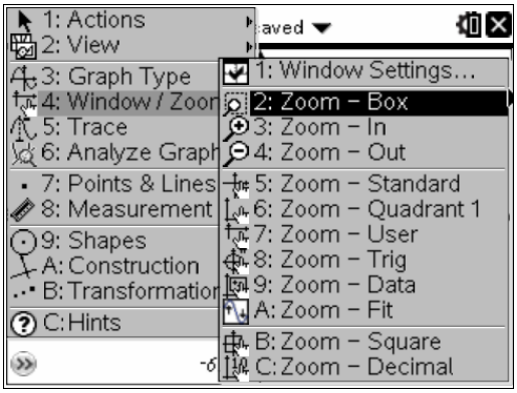
Press ·.



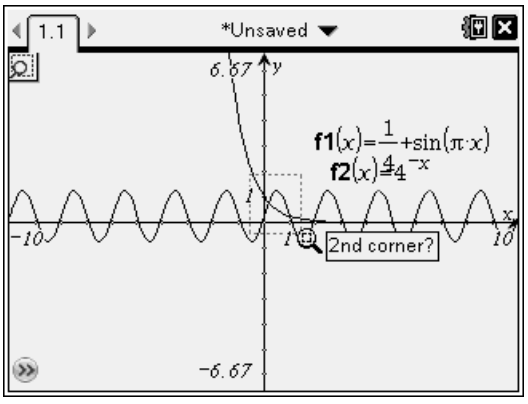
To adjust the window to match the given graph,

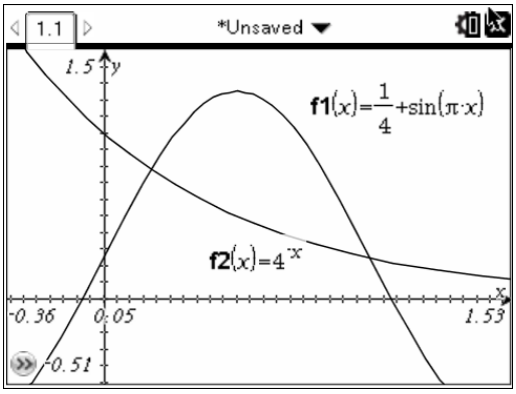
go to **b** ,

select **4: Window/Zoom**, then **2:Zoom-Box.**



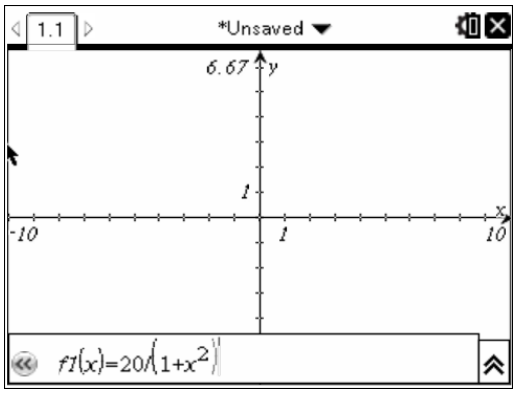
Put a box around the part of the graph you want to include in your window.
Move curser to the first corner of the box, ·,
then move to the opposite corner, ·.



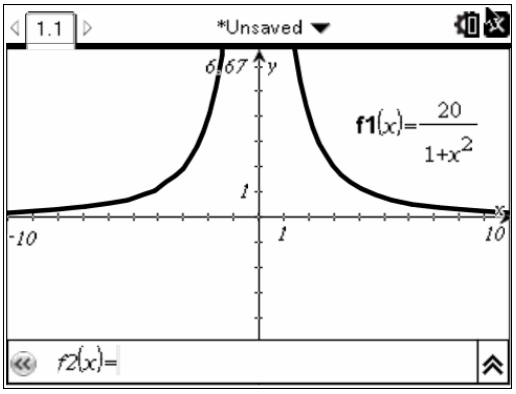


2. Let R be the region in the first and second quadrants bounded above by the graph of $y = \dfrac{20}{1+x^2}$ and below by the horizontal line $y = 2$.

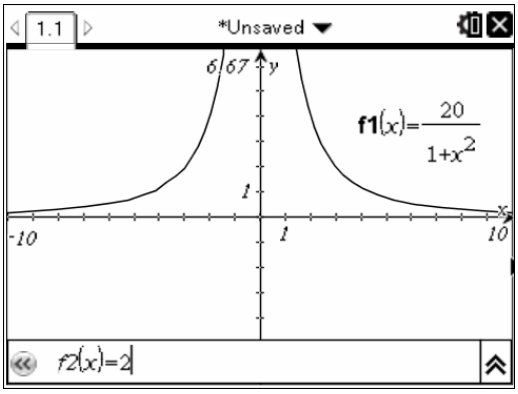
Enter the first function in f_1.



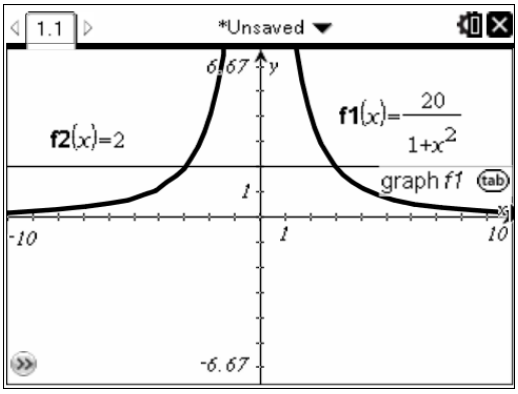
Press ·, then e.



Enter the second function in f_2.



Press ·.



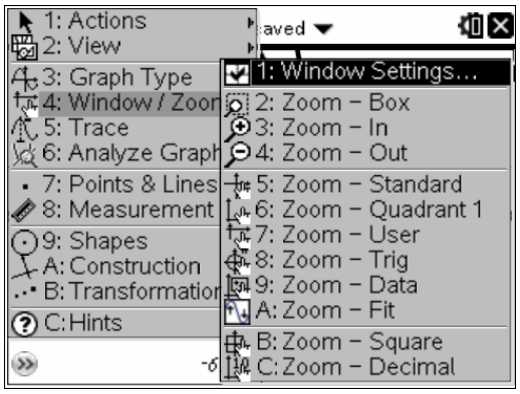
The graph displayed in the standard window is misleading. When this question appeared on the 2007 AP exam, several students were unable to answer correctly the questions that went along with the graph. Many students thought the graph had a vertical asymptote at $x = 0$.

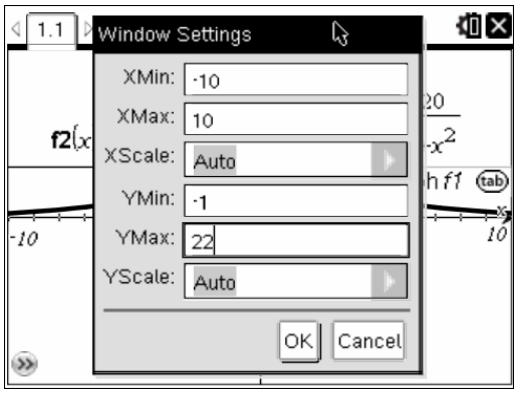
Think analytically about the function and adjust the window to show the y-intercept.

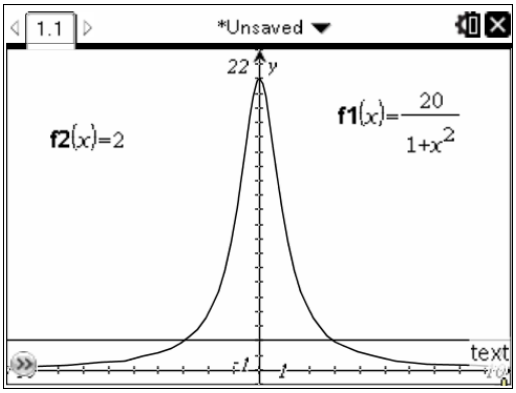
$$f(x) = \frac{20}{1+x^2} \quad \rightarrow \quad f(0) = \frac{20}{1+0^2} \quad \rightarrow \quad (0, 20)$$

From b , select **4:Window/Zoom**, then **1: Window Settings.**

Change the **YMax** to be greater than $y = 20$. Tab to OK , then ·.





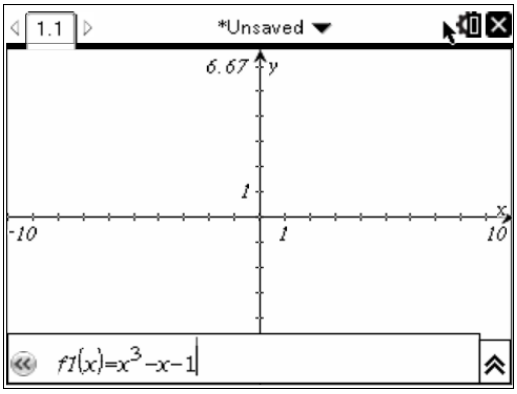


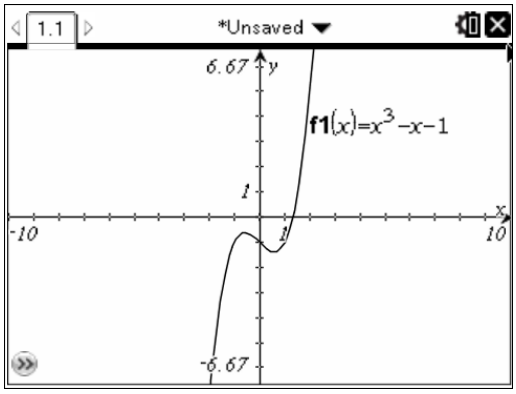
Find the zeros of functions (solve equations numerically)

(Using the TI-Nspire Version 3.0)

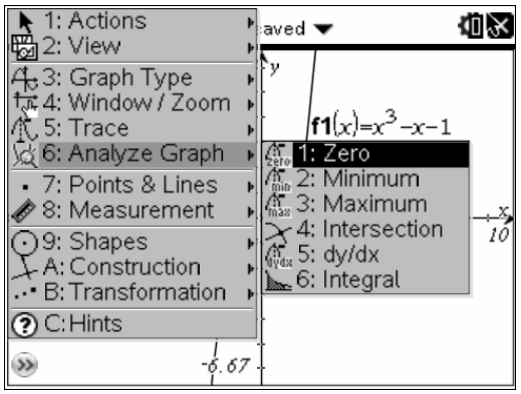
Example 1: Solve $x^3 - x - 1 = 0$.

Enter the function $f1(x) = x^3 - x - 1$.

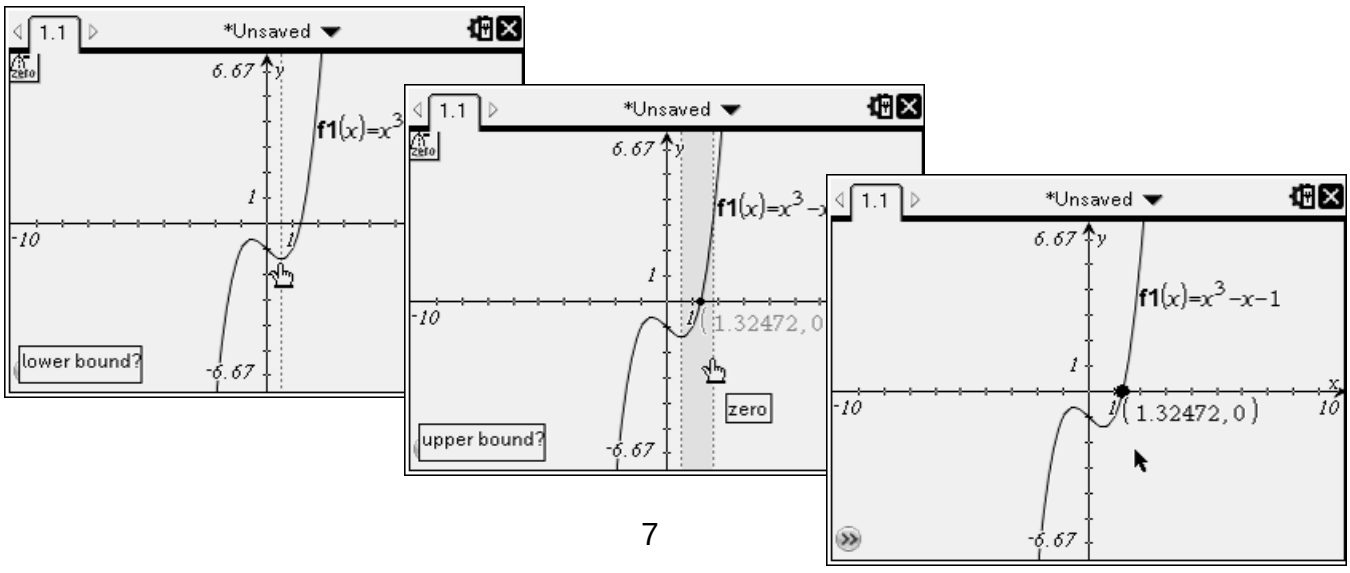




From b, select **6: Analyze Graph** then **1: Zero**.

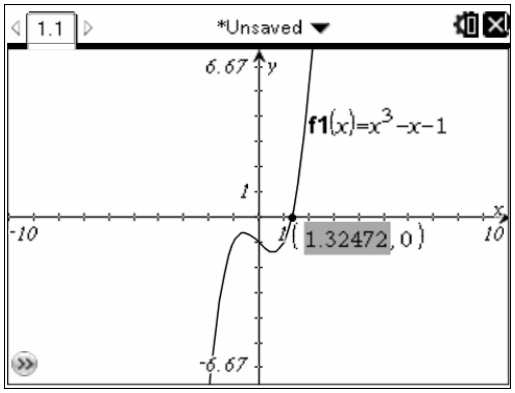


Move pointer to left side of the zero, ·, then the right side, · . ·

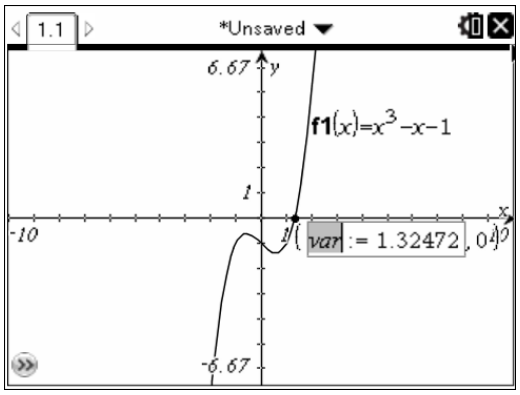


To save the x-coordinate of the zero to use later, store it as a variable.

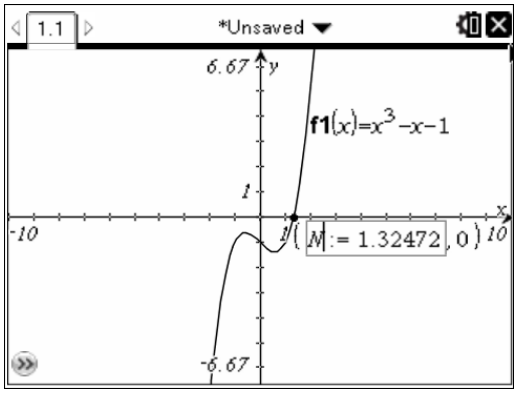
Highlight the x-coordinate.



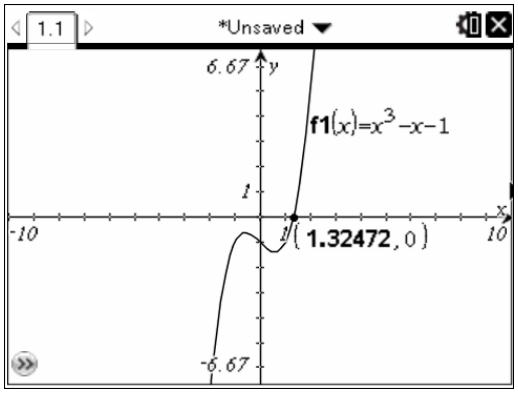
Press /h .



Type the variable name.



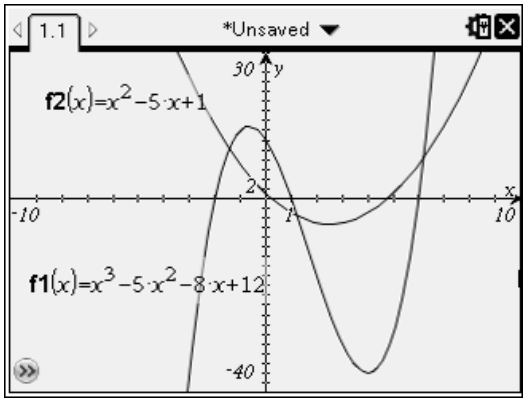
The bold x-coordinate indicates the value has been stored as a variable.



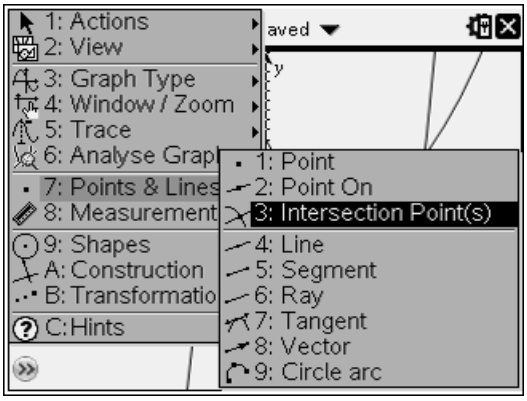
Example 2: Solve $x^3 - 5x^2 - 8x + 12 = x^2 - 5x + 1$.

On a graph page, enter $f_1(x) = x^3 - 5x^2 - 8x + 12$ and $f_2(x) = x^2 - 5x + 1$.

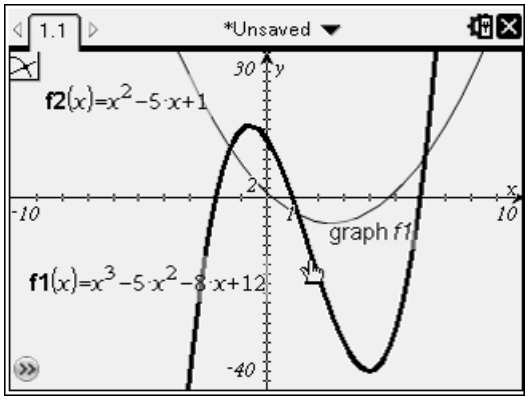
Set the window to see the intersections of the two functions.

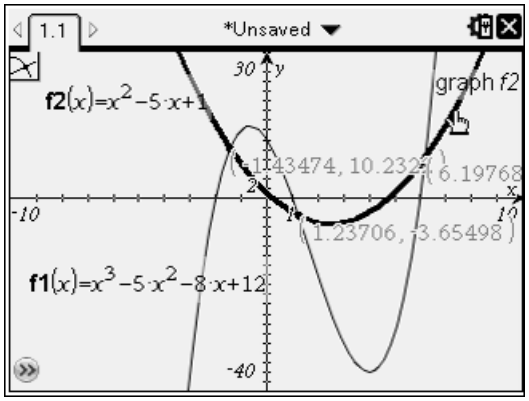


From b, select **7: Points & Lines,** then **3: Intersection Point(s).**

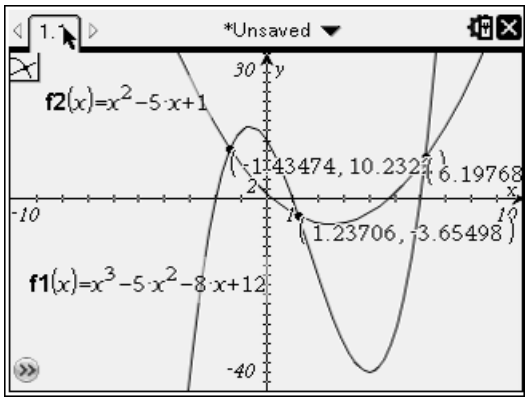


Use pointer to highlight the graph of each function. Press · to select each graph.

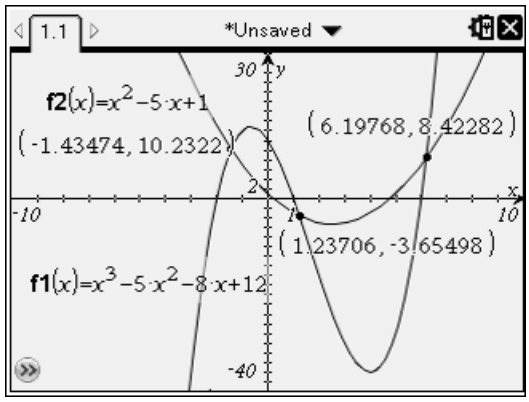




Press ·, then d.



Grab and move the coordinates of the intersection points.

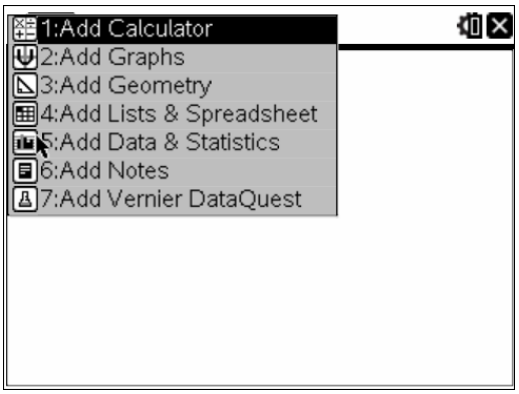


Numerically calculate the derivative of a function

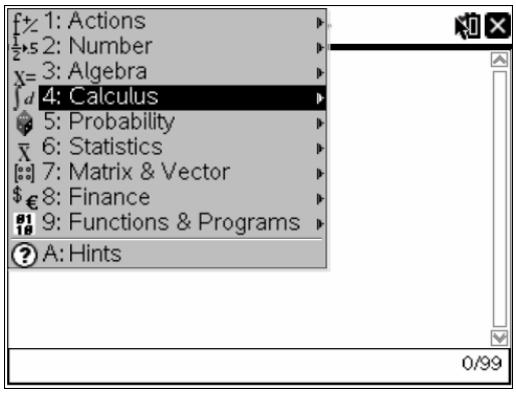
(Using the TI-Nspire, Version 3.0)

Example: Find $\frac{dy}{dx}$ at $x=3$ if $y=x^3-5x^2+8x-4$.

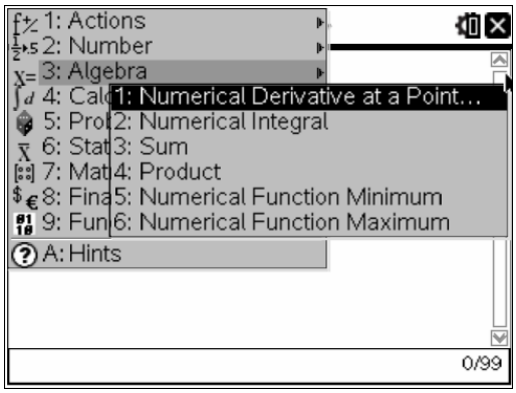
1: Add Calculator



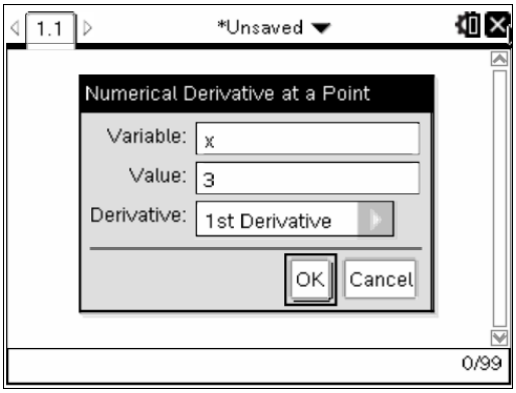
From **b** , select **4: Calculus.**



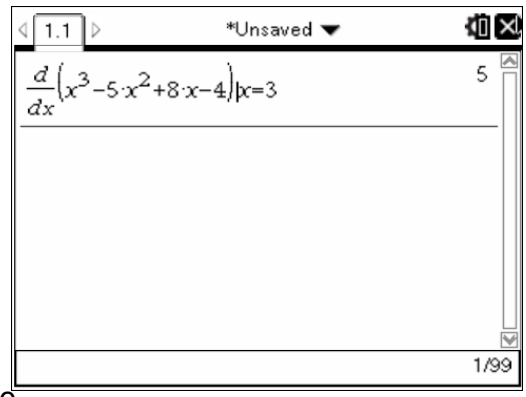
1: Numerical Derivative at a Point



Fill in the variable and value.



Fill in the template with the function.

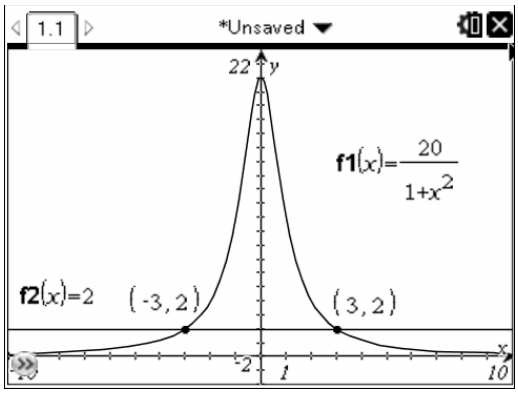


Numerically calculate the value of a definite integral

(Using the TI-Nspire, Version 3.0)

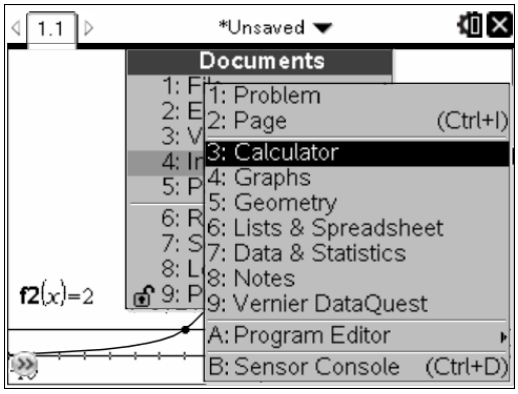
Example: Find the area of the region between $y = \dfrac{20}{1+x^2}$ and the horizontal line $y = 2$

(Evaluate $\displaystyle\int_{-3}^{3}\left(\frac{20}{1+x^2}-2\right)dx$)

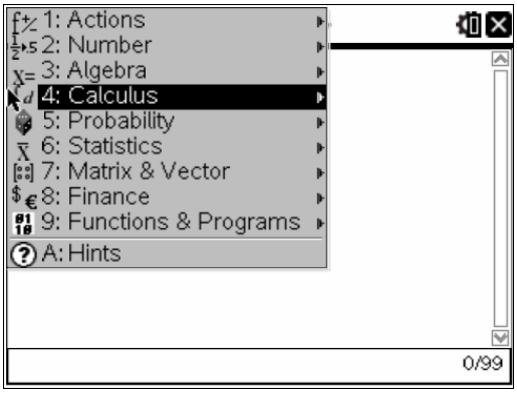


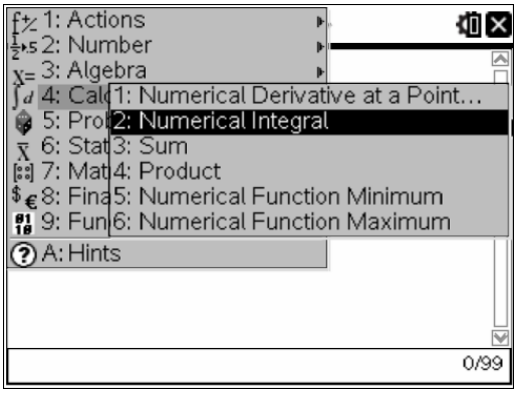
Press ~ ,

Select **4:Insert**, then **3:Calculator**.

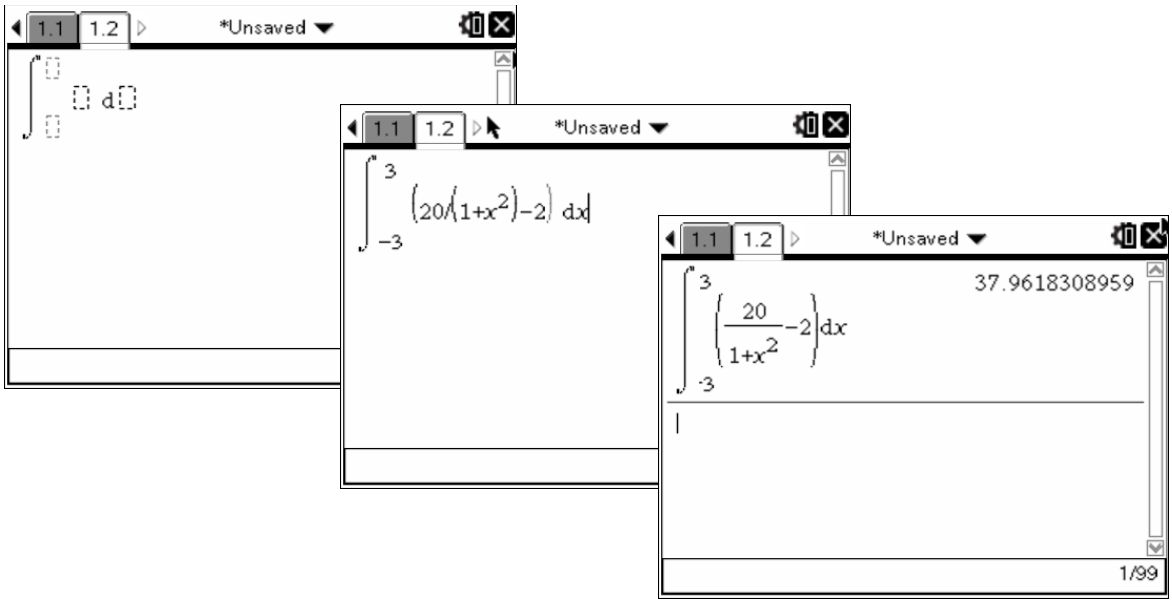


From **b** , select **4: Calculus**, then **2: Numerical Integral.**





Fill in the definite integral template to evaluate the integral.



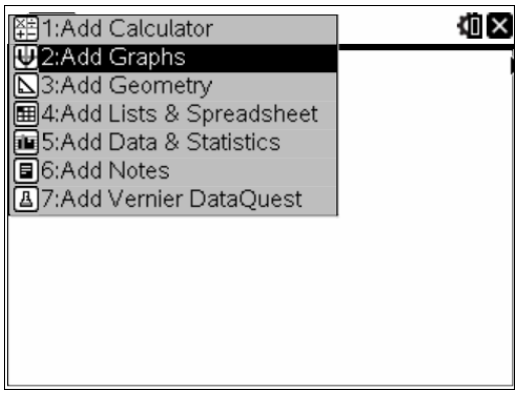
OR It is often easier to use the name of the function instead of the function itself.

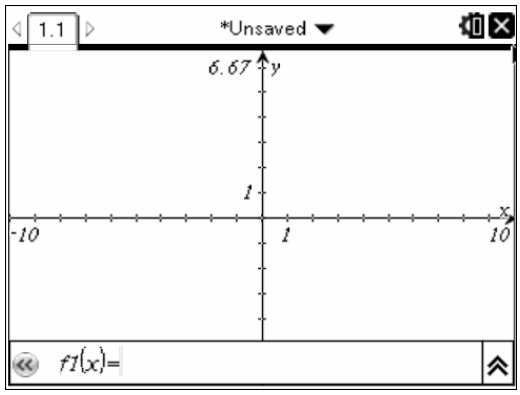
Graphing a Slope Field and Solution Curve for a Differential Equation

(This is not one of the four calculator procedures that do not require showing mathematical steps.)

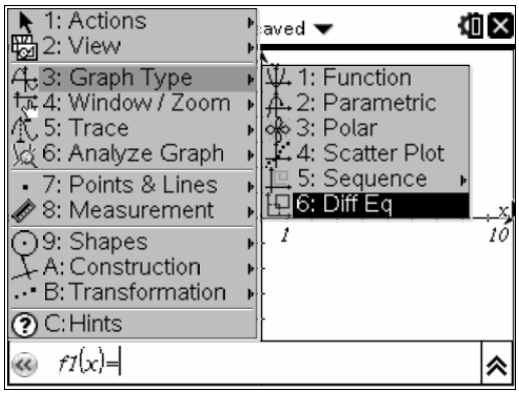
Example: Graph the slope field for $\frac{dy}{dx} = \frac{x}{y}$ and the solution curve for $x = -1,\ y = 2$.

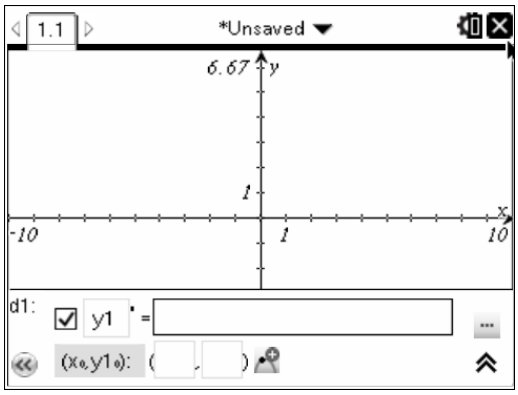
Open a graph page.



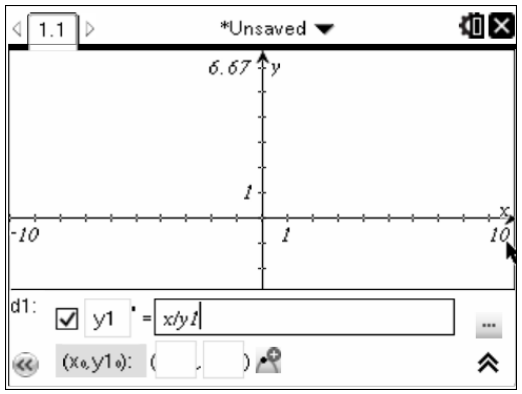


From **b** , select **3: Graph Type**, then **6: Diff Eq.**

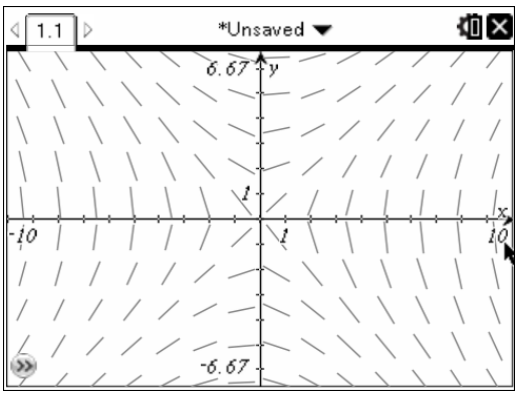




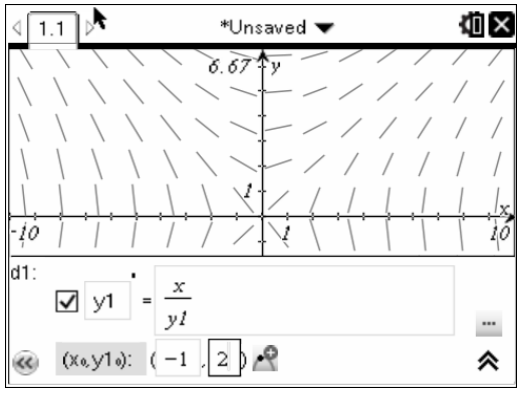
Type x / y_1 in the box for y_1'.



Press · to view the slope field graph.



To see a solution curve drawn through the given point $(-1,2)$, type $(-1,2)$ in the box next to (x_0, y_0).



Press · to view the solution curve through $(-1,2)$.