

Topics in Calculus: Applications of Derivatives

Finding Extreme Values

NCTM Principles and Standards

- **Content Standard:** Represent and analyze mathematical situations and structures using algebraic symbols
- **Process Standard:** Use representations to model and interpret physical, social, and mathematical phenomena

Use symbolic algebra to find the extreme values for $f(x)=x^4-3x^3-4x$.

- Find the derivative for $f(x)$. Press $\boxed{\text{F3}}\boxed{1}$ to select the differentiate command or press $\boxed{2\text{nd}}\boxed{8}\boxed{(\text{Y})}\boxed{1}\boxed{(\text{X})}\boxed{,}\boxed{(\text{X})}$

Calculator screen showing the differentiation of $f(x) = x^4 - 3x^3 - 4x$. The screen displays the derivative $\frac{d}{dx}(x^4 - 3x^3 - 4x) = 4x^3 - 9x^2 - 4$.

- Set the derivative equal to zero and solve for x . Press $\boxed{\text{F2}}\boxed{1}$ to paste the solve command in the entry line. Press \uparrow to arrow up to the derivative on the screen and press $\boxed{\text{ENTER}}$ to paste it into the entry line. Type $\boxed{=}\boxed{0}\boxed{,}\boxed{(\text{X})}\boxed{)}$ and press $\boxed{\text{ENTER}}$.

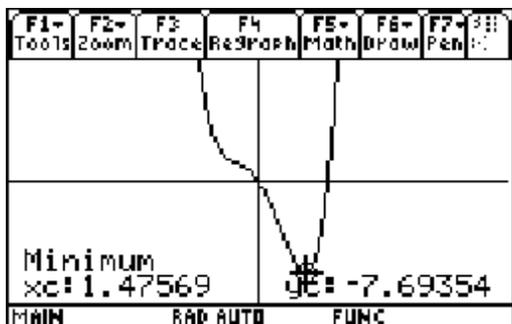
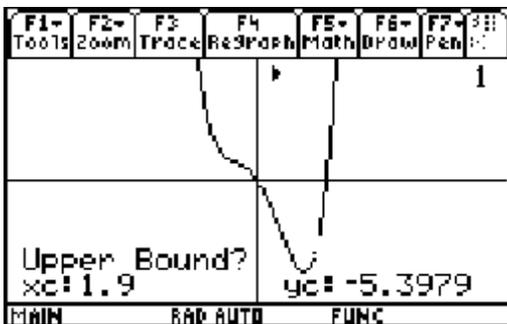
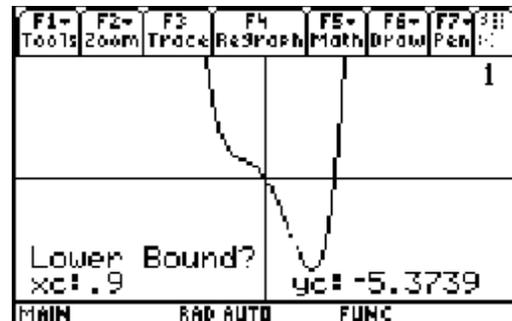
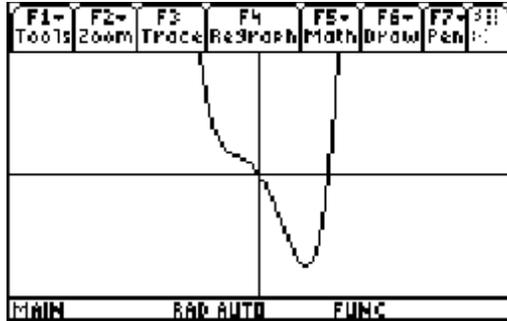
Calculator screen showing the solve command being used to solve the equation $4x^3 - 6x - 4 = 0$. The screen displays $\text{solve}(4x^3 - 6x - 4 = 0, x)$ and the solution $x = 1.47569$.

- To find the minimum, press $\boxed{\text{Y}}\boxed{1}\boxed{(\text{X})}\boxed{\leftarrow}$ $\boxed{\text{ENTER}}$ to paste the answer into the entry line. Press \leftarrow to arrow to the left and delete the $x=$. Press \rightarrow to arrow back to the end of the statement and press $\boxed{)}$ $\boxed{\text{ENTER}}$.

Calculator screen showing the function $y_1(1.475686517795)$ being evaluated. The screen displays $y_1(1.475686517795)$ and the result -7.69354 .

Use a graph to find the extreme:

- Press $\boxed{F5}\boxed{3}$. Use \leftarrow/\rightarrow to move to a point to the left of the minimum (lower bound) and press \boxed{ENTER} . Then press \rightarrow to move to the right of the minimum (upper bound) and press enter.



- Make the connection between the extreme values and the zeros of the derivative by graphing the function and the derivative on the same axes.

