Goal: To collect information about the first and second derivatives of a function, then use this information to graph the function without using technology.

1. Consider the function $f(x)=3 x^{4}-8 x^{3}+6 x^{2}$.
(a) Determine the open intervals on which the function is increasing/decreasing.
(b) Find the local maxima and local minima of $f(x)$, if any. Be sure to find the critical points, classify them using either the first or second derivative test, then substitute the $x$-values into $f(x)$ to find the local mininum/maximum values.
(c) Find the inflection points of the function, if any. Be sure to find where the second derivative is zero, use a sign chart to determine whether or not the second derivative changes, then substitute the $x$-values into $f(x)$ to find the $y$-value at each inflection point.
(d) Plot the local extrema and the inflection points on the graph. Transfer the information from parts (a) and (b) to the number lines for $f^{\prime}(x)$ and $f^{\prime \prime}(x)$. Sketch the graph of the function $f(x)=3 x^{4}-8 x^{3}+6 x^{2}$, using all of the information.


(e) Now use your graphing calculator to get the graph of $y=f(x)$ on this domain, and compare it to the graph you just drew. How well did you do?
2. Using the same process as in the previous problem, graph $f(x)=x^{\frac{1}{3}}(x+4)$ on the next page.

