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 $f(x) = 3x^4 8x^3 + 6x^2$.
 - (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 minimum/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'(x) and f''(x). Sketch the graph of the function $f(x) = 3x^4 - 8x^3 + 6x^2$, 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.



Graph of $f(x) = x^{\frac{1}{3}}(x+4)$