Math 1300-001, Quiz 3 Name: _____

This is a take-home quiz, due Monday, February 16th at the beginning of class. Please use this as a cover page for your work.

1. Using the definition of the derivative as limit of difference quotients, find the derivatives of the following. Clearly show all of your work.
   (a) $y = x^4$ (use binomial theorem, $(x+h)^4 = ?$)
   (b) $y = x^{1/3}$ (use difference of cubes, $((x+h)^{1/3})^3 - (x^{1/3})^3 = ?$)
2. Find the equations of the tangent lines to the graph of $y = x^2$ that also go through the point $(0, -4)$. (Draw a picture; there are two such lines.)
3. Let $f(x) = x^4 - 18x^2 + 77$. Find exact values in your answers to the folloing questions, i.e. don't use decimal approximations.
   (a) For what values of x is $f(x) = 0$? (If $y = x^2$ then $f(y) = y^2 - 18y + 77$. Use the quadratic formula to find y. You should get four values for x).
   (b) Find $f'(x)$ and the values of x for which $f'(x) = 0$
   (c) On what intervals is f increasing? Decreasing?
   (d) Find the points on the graph of f where f has a local maximum or local minimum.
   (e) Find $f''(x)$ and the values of x for which $f''(x) = 0$.
   (f) On what intervals is the graph of f concave up? Concave down?
   (g) Find the coordinates of any inflection points.
   (h) Use the above information to sketch a graph of f.