Math 229
Practice Exam 3

1. Fine the first, second, and third derivative of the following functions:
   (a) $f(x) = 3x^4 - 4x^2 - 10x + 17$
   (b) $g(x) = \sqrt{3x - 4}$
   (c) $h(x) = (x^2 + 1)^1 0$
2. True or False:
   (a) If $f'(a) = 0$, then $(a, f(a))$ is either a relative maximum or a relative minumum of $f(x)$.
   (b) If $f'(a) = 0$, and $f''(a) > 0$, then $(a, f(a))$ is a relative minumum of $f(x)$.
   (c) The absolute maximum of a function $f(x)$ on an interval $[a, b]$ must occur when $x = a$, when $x = b$, or at a critical point of f inside the interval $[a, b]$.
3. Let $f(x) = \frac{1}{4}x^4 - x^3$
   (a) Find the x and y intercepts of $f(x)$.
   (b) Find the intervals where $f(x)$ is increasing and those where $f(x)$ is decreasing.
   (c) Find and classify the relative extrema of $f(x)$.
   (d) Find the intervals where $f(x)$ is concave up and those where $f(x)$ is concave down.
   (e) Find any inflection points of $f(x)$.
   (f) Graph $f(x)$. Be sure to label all relative extrema, intercepts, and inflection points.
4. Let $f(x) = \frac{3}{4}x^4 + x^3 - 9x^2 + 12$
   (a) Find the intervals where $f(x)$ is increasing and those where $f(x)$ is decreasing.
   (b) Find and classify the relative extrema of $f(x)$.
   (c) Find the equation for the tangent line to $f(x)$ when $x = 2$.
5. Sketch a function in the space provided that satisfies the following conditions:
   Domain: $(-\infty, \infty)$, x-intercepts: $(-4, 0), (2, 0), (8, 0)$, y-intercept: $(0, -3)$
   Increasing on: $(-2, 5)$, Decreasing on: $(-\infty, -2) \cup (5, \infty)$
   Concave up on: $(-\infty, 0) \cup (2, 4)$, Concave down on: $(0, 2) \cup (4, \infty)$
   Local Max: $(5, 5)$, Local Min: $(-2, -5)$, Inflection Points: $(0, -3), (2, 0), (4, 3)$
6. Suppose the daily cost and revenue for producing x widgets are given by the functions:
   $C(x) = 750 - 3x + .005x^2$ and $R(x) = 825 + 2x - .005x^2$ for $0 \leq x \leq 400$.
   (a) Find the production level which minimizes the daily production costs. Also find the cost at this production level.
   (b) Find the production level which maximizes daily **profits**. Also find the amount of profit at this production level.