You have 50 minutes to complete this test. You must *show all work* to receive full credit. Work any 7 of the following 8 problems. Clearly **CROSS OUT** the problem you do not wish me to grade. Each problem is worth 14 points, and you get 2 points for free, for a total of 100 points. The answers will be posted on the electronic reserves later today.

1. Suppose $f(x) = \dfrac{x^2}{x-2}$. Find all critical numbers, list the intervals of increase and decrease, and tell whether each critical number will result in a maximum, a minimum, or neither. You do not need to find the y-values for the extrema.

2. For the following functions, find all horizontal and vertical asymptotes (remember that an asymptote is a LINE, not a number). If there are no asymptotes, say so.

    (a) $f(x) = \dfrac{2x^2 + 3x + 1}{3x^2 - 5x + 2}$

    (b) $f(x) = \dfrac{x+2}{x^2 - 4}$

    (c) $f(x) = x - \dfrac{1}{x}$

3. Suppose that $q(p) = 200 - 2p^2$ units of a product are demanded when the price is set at p dollars per unit, assuming $0 \le p \le 250$.

a) Calculate the elasticity of demand when $p = 6$.

b) Is the demand for the product elastic or inelastic at $p = 6$?

c) Give an example of a product in the correct price range whose demand function would, in general, behave as in (a).

4. Sketch a nice BIG graph of a function with all the properties listed below. Make sure your graph is clearly labeled.

a) $f'(x) < 0$ for $2 < x < 4$, but $f'(x) \ge 0$ otherwise

b) $f''(x) < 0$ for $x < 0$ and also for $x > 6$, but $f''(x) \ge 0$ otherwise

c) $f(x)$ is undefined when $x = 2$

d) $\lim_{x \to \infty} f(x) = 3$.

5. Find $f'(x)$ for the following functions. DO NOT simplify!

(a) $f(x) = x^2(3-2x)^3$

(b) $f(x) = \sqrt{\dfrac{1-2x}{3x-2}}$

6. Find the equation of the line tangent to the curve $(3xy^2 + 1)^4 = 2x - 3y$ at the point $\left(\dfrac{1}{2}, 0\right)$.

7.   Find the absolute minimum and absolute maximum *points* of $f(x) = \frac{1}{3}x^3 - 9x + 2$ on the interval $0 \le x \le 2$.

8.   Mrs. Jones runs a small insurance company that sells policies for a large firm. Mrs. Jones does not sell policies herself, but she is paid a commission of $50 for each policy sold by her employees. When she employs m salespeople, her company will sell q policies each week, where $q = m^3 - 12m^2 + 60m$. She pays her employees $750 per week, and her weekly fixed costs are $2500. Her office can accommodate at most 7 employees. How many employees should she have in order to maximize her weekly profit?