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 \( f(x) = \frac{x^2}{x - 2} \). 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) \( f(x) = \frac{2x^2 + 3x + 1}{3x^3 - 5x + 2} \)

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

   (c) \( f(x) = x - \frac{1}{x} \)
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 \( 0 \leq p \leq 250 \).

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 \( f'(x) \geq 0 \) otherwise
b) \( f''(x) < 0 \) for \( x < 0 \) and also for \( x > 6 \), but \( f''(x) \geq 0 \) otherwise
c) \( f(x) \) is undefined when \( x = 2 \)
d) \( \lim_{x \to a} f(x) = 3 \).
5. Find \( f'(x) \) for the following functions. DO NOT simplify!

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

(b) \( f(x) = \sqrt[3]{\frac{1 - 2x}{3x - 2}} \)

6. Find the equation of the line tangent to the curve \((3xy^2 + 1)^4 = 2x - 3y\) at the point \( \left( \frac{1}{2}, 0 \right) \).
7. Find the absolute minimum and absolute maximum points of \( f(x) = \frac{1}{3}x^3 - 9x + 2 \) on the interval \( 0 \leq x \leq 2 \).

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?