NAME_____   Math 12
                                    Test 2
                                    Fall 2011

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.   Find and identify all extrema and inflection points of the graph of $f(x) = x^3 - 12x + 20$. Do not sketch the graph.

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) $f(x) = 2 + \dfrac{1}{x^2}$

   b) $f(x) = \dfrac{\sqrt[3]{8x^6 - 5}}{3x^2 + 1}$

   c) $f(x) = \dfrac{x - 3}{x^2 - 5x + 6}$

3.   Suppose that at price p, demand for a certain product is given by $q(p) = \sqrt{2500 - p^2}$ when price is a positive value less than \$50.

   a) Find the price elasticity of demand when price is \$30. Is demand elastic or inelastic at this price?

   b) Find the price elasticity of demand when price is \$40. Is demand elastic or inelastic at this price?

   c) If price moves up from \$30 to \$40, what happens to the elasticity of demand, as shown in (a) and (b)? Explain why elasticity can change depending on price.

4.   Given the function $f(x) = \dfrac{x}{(2x-1)^3}$, list the intervals where f is increasing, where it is decreasing, where it is concave up and where it is concave down. Do not sketch the graph.

5. The student radio station, KMNR, has surveyed the listening habits of students between 5:00 pm and midnight. The percentage of the student population listening to the station x hours after 5:00 pm is $f(x) = \frac{1}{8}\left(-2x^3 + 27x^2 - 108x + 240\right)$. At what time is the smallest percentage of the student population listening, and at what time is the largest percentage listening?

6. Sketch the graph of a function $f(x)$ so that all conditions below are satisfied. Be sure your graph is big enough so I can see it and it is properly labeled.

    a) $f(x)$ is defined for all x except $x = 2$.
    b) $f'(x) < 0$ when $x < 2$ and when $x > 4$, but $f'(x) > 0$ when $2 < x < 4$.
    c) $f''(x) < 0$ when $0 < x < 2$ and when $2 < x < 5$, but $f''(x) > 0$ when $x < 0$ and when $x > 5$.
    d) $\lim_{x \to \infty} f(x) = 0$.

7. Find the equation of the line tangent to $x\sqrt{y+1} = y\sqrt{x+1}$ at the point $(3,3)$.

8. A manufacturing company has total fixed costs of \$1200, material and labor costs combined are \$2 per unit, and the demand equation is $p = \dfrac{100}{\sqrt{q}}$, where p is the price per unit and q is the number of units. How many units should be produced in order to maximize profit?