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Math 12
Test 2
Spring 2013

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 $f(x)=\frac{x^2}{x^2-4}$. Find all intervals where $f(x)$ is concave up and where it is concave down (interval notation, please). List the inflection points.

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) $f(x)=\frac{6x^2-11x-2}{3x^2-5x-2}$

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

c) $f(x)=\frac{4}{x-6}+4$

3. Suppose that at price p, demand for a certain product is given by $q(p) = \frac{(p-100)^2}{2}$.

a) Find the price elasticity of demand when price is \$20. Is demand elastic or inelastic at this price?

b) Give an example of a product in the correct price range that might behave as described in (a).

c) If the price of \$20 decreases by 10%, describe how demand will change.

4. Determine where the function $f(x) = x^3 - 9x^2 + 24x - 19$ is increasing and where it is decreasing, and where it is concave up and concave down. Find all extrema and inflection points. Then sketch the graph.

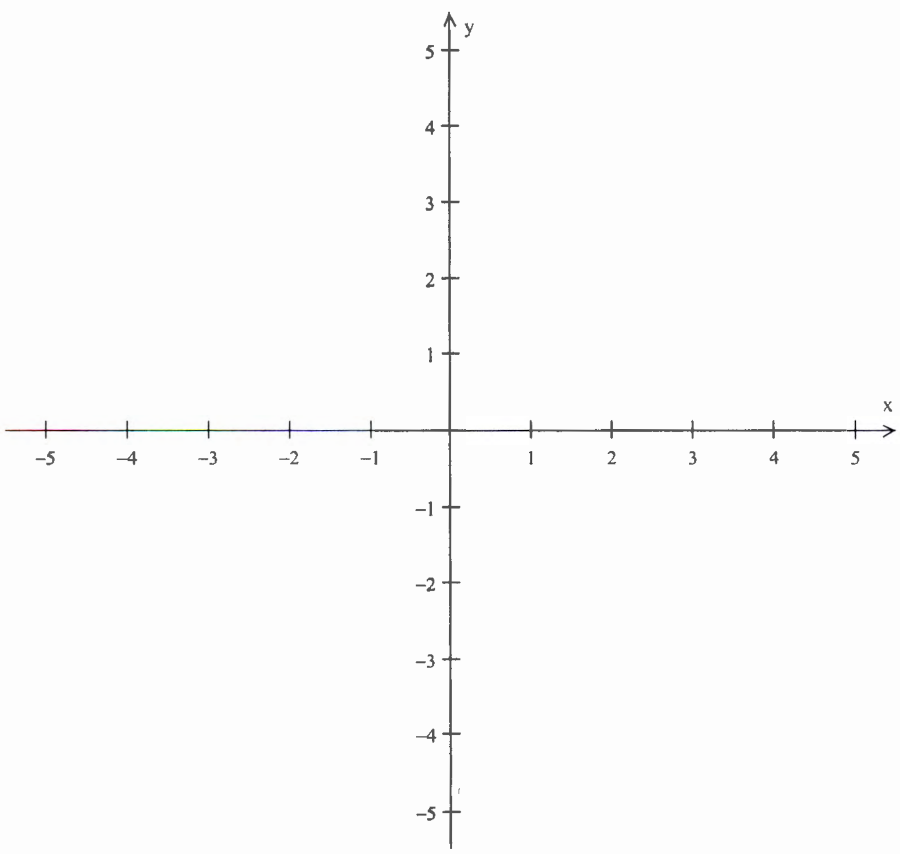
5. Find all absolute extrema of $f(x) = \dfrac{x}{x^2+1}$ on the interval $[0,2]$.

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) $\lim_{x\to-\infty} f(x) = -2$, $\lim_{x\to 2^+} f(x) = \infty$, and $f(x)$ is defined for all x.

b) $f'(x) < 0$ when $x < -3$ and when $x > 2$, $f'(x) = 0$ when $-1 < x < 2$, and $f'(x) > 0$ when $-3 < x < -1$.

c) $f''(x) < 0$ when $x < -4$, but $f''(x) > 0$ when $-4 < x < -1$ and when $x > 2$.



7. In a factory, the output Q is given by the equation $Q = 60K^{\frac{1}{3}}L^{\frac{2}{3}}$ units, where K is the capital investment in thousands of dollars, and L is the size of the labor force in worker hours. If output is kept constant, at what rate is capital investment changing at a time when $K = 8$, $L = 1000$, and L is increasing at the rate of 25 worker hours per week?

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?