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. If you have any questions, please come to the front and ask.

1. Using the definition of the derivative, find $f'(x)$ if $f(x) = \dfrac{8}{x+2}$.

2. Evaluate the following limits. If any of them do not exist, EXPLAIN why not ("because it's undefined" and "denominator is zero" are not sufficient explanations).

(a) $\displaystyle\lim_{x \to 6} \frac{x+1}{x^2 - 1}$

(b) $\displaystyle\lim_{x \to 4} \frac{\sqrt{x} - 2}{x - 4}$

(c) $\displaystyle\lim_{x \to 0} \frac{1}{x^2}$

3.   The cost function for flavored coffee at an upscale coffeehouse is given in dollars by $C(x) = 3x + 160$, where x is the number of pounds of coffee. If coffee can be sold for $7 per pound, how many pounds will have to be sold in order to break even? What will be the revenue at this point?

4.   Find $f'(x)$ if :

a) $f(x) = \left(x^2 - 4x + 2\right)\left(5x + \sqrt[3]{x}\right)$

b) $f(x) = 4x^3 - 3\sqrt{x} - 15x^2 + \dfrac{7}{x}$

5. Suppose that the price in dollars of a stereo system is given by $p(x) = \dfrac{1000}{x^2} + 1000$, where x is the demand (number of stereos sold). Find the marginal revenue when $x = 10$. Then write a sentence describing the meaning of this marginal revenue.

6. Find the equation of the line tangent to $f(x) = \dfrac{(2x-5)(x+7)}{x^2+3}$ at the point where $x = 1$.

7.   Consider the graph of the function $f(x)$ given below.
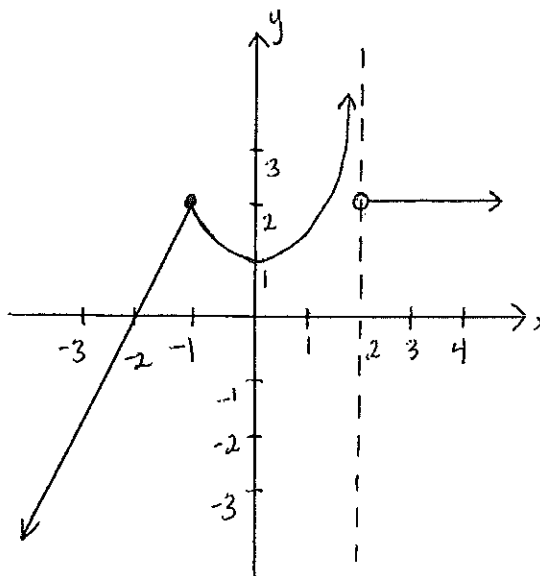
(a)   Find $\lim\limits_{x \to 0} f(x)$.

(b)   Find $\lim\limits_{x \to -1} f(x)$.

(c)   Find $\lim\limits_{x \to 2^-} f(x)$.

(d)   Find $\lim\limits_{x \to 2^+} f(x)$.

(e)   Find $\lim\limits_{x \to 2} f(x)$.

(f)   Find $\lim\limits_{x \to 4} f(x)$.

8.   Consider the function $f(x) = \begin{cases} x+1 & \text{if} & x < 1 \\ x^2 - 3x + 4 & \text{if} & 1 \le x \le 3 \\ 5 - x & \text{if} & x > 3 \end{cases}$. Describe where the

function is continuous and where it is discontinuous. Be sure to fully explain your answers.