You have 60 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 \( f(x) = \sqrt{x - 4} \).

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) \( \lim_{x \to 3} \frac{x^2 + 2x + 1}{x + 3} \)

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

   (c) \( \lim_{x \to 2} \frac{1}{\sqrt{x^2 - 4}} \)
3. The total cost of producing $x$ packages of cookies is $C(x) = \frac{1}{20} x^2 + 3x + 33$ dollars. All $x$ packages will be sold if the price is set at $p(x) = \frac{1}{5} (45 - x)$ dollars per package.

   a) Find an equation for profit when $x$ packages of cookies are produced and sold.
   b) \textbf{Estimate} the profit gained from the production and sale of the 11th package.
   c) Find the \textit{actual} profit from the 11th package.

4. Find $f''(x)$ (do not simplify!) if:

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

   b) $f(x) = \frac{x^2}{16} + \frac{2}{x} - x^2 + \frac{1}{3x^2} + \frac{x}{3}$
5. Find the equation of the line tangent to the graph of the function \( f(x) = (3x+1)(2x^2 - 4)(5x^3 + 2x - 1) \) at the point where \( x = 0 \).

6. Consider the graph of the function \( f(x) \) given below.

(a) For what values of \( x \) is \( f(x) \) discontinuous?
(b) Find \( \lim_{x \to 1} f(x) \).
(c) Find \( \lim_{x \to 0} f(x) \).
(d) Find \( \lim_{x \to 2} f(x) \).
(e) Find \( \lim_{x \to 5} f(x) \).
(f) Find \( \lim_{x \to 5^-} f(x) \).
7. Carefully graph the function \( f(x) = \begin{cases} 
3 & \text{if } x \leq 0 \\
x^2 + 2 & \text{if } 0 < x < 2 \\
-2x + 10 & \text{if } 2 \leq x 
\end{cases} \). Does this function have any discontinuities, and if so where?

8. A bakery can produce small wedding cakes at a cost of $80 apiece. Sales figures indicate that if the cakes are sold for \( x \) dollars each, approximately \( 300 - x \) cakes will be sold during the May-September wedding season. Find an equation for profit, and determine the price and number of cakes that will maximize profit. What will be the maximum profit?