Math 103L: Product, Quotient, and Generalized Power rules (Sections 11.3-4)

These problems are a sample of the kinds of problems that may appear on the final exam. Some answers are included to indicate what is expected. Problems that require a summary statement are marked with [Sum]. The summary statements should be written in complete sentences and they should include the units of measurement for all quantities mentioned in the summary.

1. (Worked Problem: READ IT!) Find the derivatives of the following functions and simplify.
   
   (a) \( f(x) = -(x - 2)^2 + 3 \)
   
   (b) \( s(x) = 3x^2 + 5x + 100 \)
   
   (c) \( r(x) = \frac{3x - 2}{(2x + 5)^2} \)
   
   Answer:

   \[
   
   f'(x) = -2(x - 2) \\
   s'(x) = 6x + 5 \\
   r'(x) = \frac{3(2x + 5)^2 - 2(2x - 5)(2)(3x - 2)}{(2x - 5)^4} = \frac{3(2x + 5) - 4(3x - 2)}{(2x - 5)^3} = \frac{-6x + 23}{(2x - 5)^3}. 
   \]

2. Let \( f(x) = (x^2 - x + 1)^3 \).

   a. Find the derivative \( f'(x) \).
   
   b. Find \( f'(1) \).
3. Find the derivative of the function

\[ f(x) = (x^3 + 4x + 1)(150 - 3x). \]

4. Find the derivative of the function

\[ f(x) = \sqrt{3 - 5x}. \]

5. Find the derivatives of the following functions and simplify.

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

(b) \( s(x) = 3x^2 + 5x + 100 \)

(c) \( r(x) = \frac{3x - 2}{(2x + 5)^2} \)