Calculus I, Quiz 3, 2/9/7

Name:

**Question 1**

Using the various derivative rules, compute the derivatives of the following functions:

- \( a(x) = 4x^3 - 6x^5 + 4x^{-4} - x^{1/2} \)
- \( b(x) = \frac{x^2 - 1}{x^3 + 1} \)
- \( c(x) = (1 + x + x^2)^{100} \)

**Question 2**

Let functions \( f(x) \) and \( g(x) \) obey the following properties:

\[ f(3) = 4, \quad f'(3) = -2, \quad g(3) = -5, \quad g'(3) = -1. \]

- Find the equation of the tangent line to the curve \( y = f(x)g(x) \) at \( x = 3 \).
- Let \( p(x) = f^3(x) + g^3(x) \).
  - Find \( p'(3) \).
- Let \( q(x) = \frac{f(x)}{g(x)} \).
  - Find \( q'(3) \).

**Question 3**

The function \( m(x) \) is defined by the following formulas:

- If \( x < 1 \), then \( m(x) = (x - 1)^2 \)
- If \( x \geq 1 \), \( m(x) = x^2 + 2x - 3 \)

Sketch the graph of the function \( m \) and its derivative on one graph. Also determine the domains and ranges of the functions \( m \) and \( m' \). Show that \( m \) is everywhere continuous. Also explain why \( m \) is not everywhere differentiable.