Solutions to Quiz 9

MATH 139-01 and -02
Tuesday, October 7, 2003

Be sure to show your work. Unsupported answers receive no credit.

1. Determine whether each function is continuous at \( x = 2 \). State in each case whether it is or it isn’t continuous at \( x = 2 \).

   \( a \) \( f(x) = x^2 - 4 \)
   
   \( b \) \( f(x) = \frac{1}{x^2 - 4} \)

   

   \( c \) \( d \)

   ![Graphs of functions](graphs.png)

   **Solution:** (a) is continuous everywhere because it is a polynomial. (b) is not continuous at \( x = 2 \) because it is not defined at \( x = 2 \). (c) is not continuous at \( x = 2 \) because \( \lim_{x \to 2} f(x) \) does not exist. (d) is not continuous at \( x = 2 \) because the limit value and the function value are different.

2. Use the definition of the derivative to show that the derivative of \( f(x) = 3x - 2 \) is 3.

   **Solution:**

   \[
   f'(x) = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} \\
   = \lim_{h \to 0} \frac{[3(x + h) - 2] - [3x - 2]}{h} \\
   = \lim_{h \to 0} \frac{3x + 3h - 2 - 3x + 2}{h} \\
   = \lim_{h \to 0} \frac{3h}{h} \\
   = \lim_{h \to 0} 3 \\
   = 3.
   \]