Solutions

Math 113: Quiz 2

Instructions: Answer all questions. Show all of your work. Partial credit may be given. The use of calculators is not allowed. Please turn off and put away all mobile electronic devices - accessing these devices between the time you receive your quiz and the time you turn in your quiz constitutes an honor code violation.

1. (*4 pts*) Use the limit definition of a derivative to show that if $f(x) = 2x^2 + 4$ then $f'(x) = 4x$. Be sure to show all necessary explanations and steps carefully. Correct algebra is essential and proper evaluation of limits at the proper steps in your analysis are important here.

$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h\to 0} \frac{2(x+h)^2 + 4 - (2x^2+4)}{h}$$

$$= \lim_{h\to 0} \frac{2x^2 + 4xh + 2h^2 + 4 - 2x^2 - 4}{h}$$

$$= \lim_{h\to 0} \frac{4xh + 2h^2}{h}$$

$$= \lim_{h\to 0} 4x + 2h$$

$$= \boxed{4x}$$

2. (*2 pts*) Find the equation of the line tangent to the function

$$f(x) = -x^3 + x + 1$$

at the point on the graph of $f(x)$ where $x = 1$. *Note: you do not need to compute the derivative of this function using the limit definition.*

$y - f(1) = f'(1)(x-1)$

$f(1) = -1 + 1 + 1 = 1$

$f'(x) = -3x^2 + 1$

$f'(1) = -3 + 1 = -2$

$$\boxed{y - 1 = -2(x-1)}$$

3. (*4 pts*) Find the derivative of the following functions using any method of your choosing.

$f(x) = \sqrt{x} + 3^x$ $\quad f'(x) = \frac{1}{2}x^{-1/2} + 3^x \cdot \ln 3$

$f(x) = \dfrac{x^2+5}{x+1}$ $\quad f'(x) = \dfrac{(x+1)(2x) - (x^2+5)(1)}{(x+1)^2}$

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