

Math 131 - Quiz 5

September 27, 2023

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (5 points) Let $f(x) = 3x^2 + 5x$. Use the limit definition of derivative (not our differentiation rules) to find $f'(x)$.

$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{[3(x+h)^2 + 5(x+h)] - [3x^2 + 5x]}{h} \\
 &= \lim_{h \rightarrow 0} \frac{\cancel{3x^2} + 6xh + 3h^2 + \cancel{5x} + 5h - \cancel{3x^2} - \cancel{5x}}{h} \\
 &= \lim_{h \rightarrow 0} \frac{6xh + 3h^2 + 5h}{h} = \lim_{h \rightarrow 0} (6x + 3h + 5) \\
 &= \boxed{6x + 5}
 \end{aligned}$$

2. (5 points) Let $f(x) = 3x^2 + 4\sqrt{x} = 3x^2 + 4x^{1/2}$

- (a) Use our differentiation rules to determine $f'(x)$.

$$f'(x) = 6x + 2x^{-1/2}$$

- (b) Find an equation of the line tangent to the graph of f at the point where $x = 4$.

$$m = f'(4) = 6(4) + 2(4)^{-1/2} = 24 + 1 = 25$$

$$\text{Point: } x = 4, y = f(4) = 3(4)^2 + 4\sqrt{4} = 48 + 8 = 56$$

$$\text{Line: } y - 56 = 25(x - 4) \quad \text{or} \quad y = 25x - 44$$