

Math 1121

Homework # 8

#14, #15

#14 $f(x) = 6x^2 - 5x - 1$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{6(x+h)^2 - 5(x+h) - 1 - (6x^2 - 5x - 1)}{h} \\ &= \lim_{h \rightarrow 0} \frac{6(x^2 + 2xh + h^2) - 5x - 5h - 6x^2 + 5x + 1}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{6x^2} + (2xh + 6h^2) - \cancel{5x} - 5h - \cancel{6x^2} + \cancel{5x} + 1}{h} = \lim_{h \rightarrow 0} \frac{12xh + 6h^2 - 5h}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{h}(12x + 6h - 5)}{\cancel{h}} = \lim_{h \rightarrow 0} 12x + 6h - 5 = \underline{12x - 5} \end{aligned}$$

#15 $f(x) = 12/x$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{\frac{12}{x+h} - \frac{12}{x}}{h} \\ &= \lim_{h \rightarrow 0} \frac{\frac{12x}{(x+h)x} - \frac{12(x+h)}{x(x+h)}}{h} = \lim_{h \rightarrow 0} \frac{\cancel{12x} - \cancel{12x} - 12h}{x(x+h)h} \\ &= \lim_{h \rightarrow 0} \frac{-12h}{x(x+h)h} = \lim_{h \rightarrow 0} \frac{-12\cancel{h}}{x(x+h)} \cdot \frac{1}{\cancel{h}} \\ &= \lim_{h \rightarrow 0} \frac{-12}{x(x+h)} = \frac{-12}{x(x+0)} = \boxed{-12/x^2} \end{aligned}$$