

Name: _____

Use the **limit definition** to find $f'(x)$ for $f(x) = 7x^2 + x - 11$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\ &= \lim_{h \rightarrow 0} \frac{7(x+h)^2 + x+h - 11 - 7x^2 - x + 11}{h} \\ &= \lim_{h \rightarrow 0} \frac{7(x^2 + 2xh + h^2) + h - 7x^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{7x^2 + 14xh + 7h^2 + h - 7x^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{14xh + 7h^2 + h}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{h}(14x + 7h + 1)}{\cancel{h}} \\ &= 14x + 1 \end{aligned}$$