Name: _____ **PID:** _____

1. (3 points) Find the derivative of $f(x) = \dfrac{\cos x}{2x - 8}$.

$$f'(x) = \frac{-\sin x(2x-8) - \cos x \cdot 2}{(2x-8)^2}$$

2. (2 points) Let $f(x) = \frac{\sin(x)}{\sqrt[3]{x}}$, evaluate $\lim_{x\to 0} f(x)$.

$$\lim_{x\to 0} \frac{\sin x}{\sqrt[3]{x}} \cdot \frac{x}{x} = \lim_{x\to 0} \frac{\sin x}{x} \cdot \frac{x}{\sqrt[3]{x}} = \lim_{x\to 0} \frac{x}{\sqrt[3]{x}} = \lim_{x\to 0} x^{2/3} = 0$$

($\frac{\sin x}{x} \to 1$)

3. (2 points) Find where the function $f(x) = |x - 9|$ is not differentiable.

$$f(x) = \begin{cases} x-9 & x > 9 \\ 9-x & x \le 9 \end{cases}$$

$$f'(x) = \begin{cases} 1 & x > 9 \\ -1 & x < 9 \end{cases}$$

at $x = 9$ $\quad f'(9) = \lim_{h\to 0} \dfrac{f(9+h) - f(9)}{h} = \lim_{h\to 0} \dfrac{|9+h-9| - |9-9|}{h}$

$$= \lim_{h\to 0} \frac{|h|}{h} \quad \text{D.N.E.} \quad \text{as} \begin{cases} \lim_{h\to 0^-} \frac{|h|}{h} = \lim_{h\to 0^-} \frac{-h}{h} = -1 \\ \lim_{h\to 0^+} \frac{|h|}{h} = 1 \end{cases}$$