Define $g_n(x) = \begin{cases} x^n \sin(\frac{1}{x}) & x \neq 0 \\ 0 & x = 0 \end{cases}$

1. Is $g_0(x)$ continuous at $x = 0$?

2. (a) Argue that $g_1(x)$ is continuous at $x = 0$
   (b) Use the definition of the derivative to find $g_1'(0)$

3. (a) Argue that $g_2(x)$ is continuous at $x = 0$
   (b) Use the rules from Calc I to find $g_2'(x)$
   (c) Is $g_2'(x)$ continuous at $x = 0$?