Choose \( c \) so that \( f \) continuous on \( X \times I \)  

\[ f(x) = \begin{cases} 
  (x^2 + 2x)^c & \text{if } x \leq 2 \\
  x^3 - cx & \text{if } x > 2 
\end{cases} \]

\[ \lim_{x \to 2^-} x^3 - cx = 8 - 2c \]

Next, a right limit must be some \( c \)

\[ \lim_{x \to 2^+} (x^2 + 2x)^c = \frac{2c}{3} + 4 = \frac{2c}{3} + \frac{4}{3} = 2 \]

\[ c = 6 \]

\[ f(x) = (x^2 + 2x)^6 \]

Show there is a \( c \) such that \( f'(c) = \frac{10 \sin(x)}{x^2} \) for \( x > 1000 \)

\[ f(x) = x^2 + 10 \sin(x) \]

Show there is a \( c \) such that \( f(c) = 1000 \) since \( f \) continuous on \( [0, 1000] \), \( f \) exist.