6. (12 points) Consider the function \( f(x) = \sin(x^2) \).

(a) Explain what the difference quotient \( \frac{\sin(\sqrt{\pi^2}) - \sin(0)}{\sqrt{\pi}} \) represents.

(b) Write the limit definition for \( f'(\sqrt{\pi}) \) without using the symbol \( f \). No need to numerically evaluate the limit or approximate \( f'(\sqrt{\pi}) \).

(c) Suppose that \( g \) is a new function defined as follows:

\[
g(x) = \begin{cases} 
2f(x) & x < \sqrt{\pi/2} \\
kx + 4 & x \geq \sqrt{\pi/2}
\end{cases}
\]

for \( f(x) \) as above

For what value of \( k \) is the function \( g \) continuous?