Directions. Show all work to receive credit.

1. The population of moles on a remote island is found to be governed by \( P(t) = \sin(g(t)) \), where \( g(t) \) is a known function. Find the instantaneous rate of change of the mole population when the island's clock struck noon last Friday, if at that moment \( g(t) = \pi/3 \) and \( m'(t) = \pi/6 \).

\[ \frac{\pi}{12} \]

2. Compute each derivative. Make sure that you use parentheses to make your answer clear and correct.

(a) \[ \frac{e^x}{\tan x} \]

\[ \frac{e^x \tan x - e^x \sec^2 x}{\tan^2 x} \]

(b) \[ e^{\sqrt{x}} \]

\[ e^{\sqrt{x}} \cdot \frac{1}{2 \sqrt{x}} \]

or \( e^{\sqrt{x}} \cdot \frac{1}{2} x^{-1/2} \)
3. Compute the limit:

\[ \lim_{x \to 0} \frac{\sin^2 x}{2x \tan x} \]

\[ = \frac{1}{2} \]

\[
\lim_{x \to 0} \frac{\sin x}{2x} \cdot \frac{\cos x}{\tan x} = \frac{1}{2} \lim_{x \to 0} \frac{\sin x}{x} \cdot \cos x = \frac{1}{2} \]

2 pt.
Directions. Show all work to receive credit.

1. The population of moles on a remote island is found to be governed by \( P(t) = \cos(m(t)) \), where \( m(t) \) is a known function. Find the instantaneous rate of change of the mole population when the island’s clock struck noon last Friday, if at that moment \( m(t) = \frac{\pi}{4} \) and \( m'(t) = \frac{\pi}{3} \).

\[
P'(t) = -\sin(m(t)) \cdot m'(t)
= -\sin\left(\frac{\pi}{4}\right) \cdot \frac{\pi}{3}
= -\frac{\pi}{3}\sqrt{2}
\]

2. Compute each derivative. Make sure that you use parentheses to make your answer clear and correct.

(a) \( \frac{\sec x}{x} \)

\[
\left(\frac{\sec x \cdot \tan x}{x}\right)' = \frac{\sec x}{x^2}
\]

(b) \( \cos(\tan x) \)

\[
-\sin(\tan x) \cdot \sec^2 x
\]

5 + 1 if show some work
3. Compute the limit:

\[ \lim_{x \to 0} \frac{\sin(2x)}{x \cos x} \]

\[ = \lim_{x \to 0} \frac{2 \sin x \cos x}{x \cos x} = 2 \lim_{x \to 0} \frac{\sin x}{x} = 2 \]

*Other Way:*

\[ \lim_{x \to 0} \frac{2 \cdot \sin 2x}{2x \cos x} \cdot \frac{1}{\cos x} = 2 \]