Name

- No calculators allowed.
- Show sufficient work to justify each answer.
- You have 12 minutes for this quiz.

1. (3 points each) Differentiate the following functions.

   (a) \( g(x) = \sec (x^3 + 10x) \)

   \[
   g'(x) = \sec (x^3 + 10x) \tan (x^3 + 10x) \cdot (3x^2 + 10)
   \]

   or write \( g(x) = \frac{1}{\cos (x^3 + 10x)} \)

   or \( g(x) = (\cos (x^3 + 10x))^{-1} \)

   before taking derivative

   (b) \( f(\theta) = e^{2\theta} \cos 5\theta \)

   \[
   f'(\theta) = (e^{2\theta})' \cos 5\theta + (e^{2\theta}) (\cos 5\theta)'
   \]

   \[
   f'(\theta) = 2e^{2\theta} (\cos 5\theta) + e^{2\theta} (-5 \sin 5\theta)
   \]

   \[
   f'(\theta) = 2e^{2\theta} \cos 5\theta - 5e^{2\theta} \sin 5\theta
   \]
2. (4 points) One of the points on the graph of \( f(x) = e^{-5x} \) has the property that the line tangent to the curve at that point is perpendicular to the line \( y = 5x + 3 \). Find in simplified form the \( y \)-coordinate for this point.

\[
f'(x) = -5e^{-5x}
\]

Any line perpendicular to the line \( y = 5x + 3 \) must have slope \(-\frac{1}{5}\) (the neg. reciprocal of 5).

So solve for \( x \) in the equation:

\[
-\frac{1}{5} = -5e^{-5x}
\]

\[
\frac{1}{5} = e^{-5x}
\]

\[
\ln\left(\frac{1}{5}\right) = \ln(e^{-5x})
\]

\[
\ln(1) - \ln(25) = -5x
\]

\[
0 - \ln(25) = -5x
\]

\[
x = \frac{\ln(25)}{5}
\]

So \( y = f\left(\frac{\ln(25)}{5}\right) = e^{-5 \left(\frac{\ln(25)}{5}\right)} = e^{-\ln(25)} = e^{\ln(25)} = 25 \).