Common Mistakes in Midterm 2

The following are common mistakes seen in the first and last problems of Midterm #2. The wrong things are in red.

1. Finding derivatives
   
   (a) Misunderstanding notation for trigonometric functions
      
      Right: \( \sin^2 t = (\sin t)^2 \)
      Wrong: \( \sin^2 t = \sin(t^2) \)
      Wrong: \( \cos(t^2) = (\cos t)^2 \)
   
   (b) No thing special
   
   (c) At some point, we need to find derivative of \( \frac{\ln x - x}{e^{2x}} \) using quotient rule where \( f = \ln x - x \) and \( g = e^{2x} \).
      
      Here is the most common incorrect result:
      \[
      \frac{\frac{1}{x} - 1, e^{2x} - \ln x - x.2, e^{2x}}{(e^{2x})^2}.
      \]
      
      The right result should be
      \[
      \frac{(\frac{1}{x} - 1), e^{2x} - (\ln x - x).2, e^{2x}}{(e^{2x})^2}.
      \]
      
      So do not forget to put parentheses around complicated functions when you applying rules.

   (d) At some point, people need to find \( \frac{d}{dy} (xy) \)
      
      Right: \( \frac{d}{dx} (xy) = y + x \frac{dy}{dx} \), product rule and then chain rule.
      Wrong: \( \frac{d}{dx} (xy) = xy \frac{dy}{dx} \)

4. • In this problem, when finding critical points people need to solve the equation:
   \[ e^{-x}(1 - x) = 0. \]
   
   A lot of people got the solution \( x = 0 \). I guess people had problem dealing with \( e^{-x} = 0 \). One way to go over this is to remember that \( e^a > 0 \), where you can put anything in the \( a \) . The same thing holds if you replace \( e \) by some positive number \( a \), namely \( a^a > 0 \). So \( e^{-x} = 0 \) has no solution.
   
   • Also to classify the critical point (in this case \( x = 1 \)) using the first derivative test, testing derivative of \( f'(x) \) at 0 and 2 is mathematically not enough (1pts off).