MATH 113 – QUIZ 7  24 OCTOBER 2000

Answer all of the following questions in the space provided. Show all work as partial credit may be given. Answers without justification, even if they are correct, will earn no credit.

1. (2 pts. each) Calculate the derivatives of the following functions.
   (a) \( h(x) = \ln(\sqrt{x^2 - 1}) \)
   (b) \( f(t) = \ln \left( \frac{1 - t}{1 + t} \right) \)

2. (3 pts.) Two cars start moving from the same point. One travels south at 60 mph and the other travels west at 25 mph. At what rate is the distance between the cars changing two hours later?

3. (3 pts.) Find the linearization of the function \( f(x) = (2x^2 + 9)^{1/3} \) at \( x = 3 \).
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1) (a) \( h(x) = \ln \left( \sqrt{x^2 - 1} \right) \)
   \[ = \ln \left( (x^2 - 1)^{\frac{1}{2}} \right) \]
   \[ = \frac{1}{2} \ln (x^2 - 1) \]
   \( h'(x) = \frac{1}{2} \cdot \frac{2x}{x^2 - 1} = \frac{x}{x^2 - 1} \)

(b) \( f(t) = \ln \left( \frac{1-t}{1+t} \right) \)
   \[ = \ln (1-t) - \ln (1+t) \]
   \[ = \frac{1}{1-t} - \frac{1}{1+t} = \frac{2t}{1-t^2} \)

2) 
   \[ \frac{dy}{dt} = 60 \quad \frac{dx}{dt} = 25 \]
   \[ s^2 = x^2 + y^2 \]
   \[ 2s \frac{ds}{dt} = 2x \frac{dx}{dt} + 2y \frac{dy}{dt} \]
   \[ s \frac{ds}{dt} = x \frac{dx}{dt} + y \frac{dy}{dt} \]
   \[ 130 \left( \frac{ds}{dt} \right) = (50)(25) + (120)(60) \]
   \[ \frac{ds}{dt} = 65 \text{ mi/hr} \]

3) \( f(x) = (2x^2 + 9)^{\frac{1}{3}} \)
   \( f'(x) = \frac{1}{3} (2x^2 + 9)^{-\frac{2}{3}} (4x) \)
   \[ f'(3) = \frac{4}{9} \]
   \( L(x) = 3 + \frac{4}{9} (x - 3) \)