This lab is to be turned in at next week's lab period, on November 9. Present your responses fully and clearly.

1. We now have formulas for derivatives of the inverse trigonometric functions. Compute the following derivatives.

a) $\dfrac{d}{dx}\ \sin^{-1}\left(\dfrac{1}{1+x^2}\right)$ **b)** $\dfrac{d}{dt}\ 3e^{-t}\tan^{-1}(1+e^t)$ **c)** $\dfrac{d}{dx}\ 10^{\sin^{-1}(x)}$

d) $\dfrac{d}{dr}\ \log_2\left(r^3\tan^{-1}(r)\right)$ **e)** $\dfrac{d}{dx}\ \left(\tan^{-1}(x)\right)^x$

2. Fred and Wilma are walking on opposite sides of a 30-foot wide street, headed in opposite directions. Fred's speed is 3 feet per second, and Wilma's is 7 feet per second. At what rate is the distance between them changing 2 seconds after the time when they are directly across the street from each other?

3. A clock has a 3-inch hour hand and a 4-inch minute hand. Find the rate at which the distance between the tip of the hour hand and the tip of the minute hand is changing at 4 o'clock. Express the answer in inches per hour. (Hint: Let A and B be the angles that the hour and minute hand make with the 3:00 position. Express the coordinates of the tips in terms of these angles.)

4. Barney is six feet tall and is standing in the middle of a clear, flat plane. The sun is setting. How fast is Barney's shadow growing, in inches per second, when the sun is 5° above the horizon?

5. A 15-foot ladder is leaning against a wall. The bottom of the ladder is being pulled away from the wall at the rate of 6 inches per second. Let x be the height of the top of the ladder at time t.

a) Find a formula for $\frac{dx}{dt}$ in terms of x only. (Remember that you know the rate at which the bottom of the ladder is moving.)

b) According to the formula, how fast is the top of the ladder moving when it is 9 feet above the ground?

c) According to the formula, how fast is the top of the ladder moving when it is 1 foot above the ground?

d) According to the formula, how fast is the top of the ladder moving when it hits the ground? What happens in reality?

6. A Practice Problem, not to be handed in. A symbol can represent anything you say it represents. When doing derivatives, you have to work with symbols representing constants and symbols representing functions.

a) Compute $\frac{d}{dx}(xe^{-y}+\sin(xz))$, where y and z are constants.

b) Compute $\frac{d}{dy}(xe^{-y}+\sin(xz))$, where x and z are constants.

c) Compute $\frac{d}{dz}(xe^{-y}+\sin(xz))$, where x and y are constants.

d) Compute $\frac{d}{dx}(xe^{-y}+\sin(xz))$, where y and z are functions of x.

e) Compute $\frac{d}{dy}(xe^{-y}+\sin(xz))$, where x and z are functions of y.

f) Compute $\frac{d}{dz}(xe^{-y}+\sin(xz))$, where x and y are functions of z.

g) Compute $\frac{d}{dt}(xe^{-y}+\sin(xz))$, where x, y, and z are functions of t.