3-6

1. (Warm-up)A 12-foot ladder is leaning against a wall. Let x denote the distance of the base of the ladder from the wall, and let θ be the angle between the ladder and the wall.

   (a) How fast does the angle θ change with respect to x?

   (b) I compute that $d\theta/dx \approx 0.1$ when $x = 7$. What does this mean in language your parents can understand? Feel free to express your answer in terms of degrees instead of radians.

2. Vera says she is not a huge fan of logarithms so rewrites the function $\boxed{y = \ln x}$ as $\boxed{x = e^y}$. Is this ok? Is it really the same function?

3. Find $\dfrac{dy}{dx}$ implicitly for $x = e^y$ and write your answer in terms of x. (You will want to use # 2 above).

4. Find $\dfrac{dy}{dx}$ implicitly for $x = a^y$ and write your answer in terms of x. (You will want to use # 2 above)

Congratulations, you just derived the formulas for the derivatives of logarithms.

Using the formulas you just derived (and possibly the chain rule and/or the quotient rule and/or the product rule...) find the derivatives of each of the following:

5. $f(x) = (\ln x)^{7/2}$

6. $f(x) = \ln(\sqrt{x})$

7. $f(x) = \ln(3x + 1)$

8. Consider $y = \ln\left(\frac{x^2-2}{3-x}\right)^3$

   (a) Without actually taking the derivative, list the rules you would need to do so.

   (b) Use rules of logarithms, expand the right-hand side and then take the derivative.