1. I'm tired of doing all the work around here. It's your turn. You're going to show that

$$\frac{d}{dx}\ln(x) = \frac{1}{x}.$$

Start with the equation $y = \ln(x)$.

1. Solve this equation for x.

2. Take an implicit derivative with respect to x, and solve for dy/dx.

3. Now convert dy/dx into an expression that only involves x. (Tah dah!)

2. Compute $\frac{d}{dx}\ln\left(x + e^{3x}\right)$.

3. Compute $\frac{d}{dx}\ln(\cos(x))$ and simplify your expression.

4. How can we compute $\frac{d}{dx}5^x$?

1. Rewrite $5^x = e^{ax}$ for a certain constant a. Your job is to find a!

2. Now compute $\frac{d}{dx}5^x$ by taking the derivative of e^{ax} instead.

3. Rewrite your previous answer so that the letter e does not appear.

5. Derive a formula for $\frac{d}{dx}\log_5(x)$. You can either use a change of base formula, or you can repeat the technique used to find the derivative of $\ln(x)$. Heck, do it both ways.

6. Suppose you wish to differentiate

$$f(x) = x^x.$$

The tool to use is called logarithmic differentiation.

Start with the equation $y = x^x$.

1. Apply the natural logarithm to both sides of the equation and simplify.

2. Take an implicit derivative with respect to x, and solve for dy/dx.

3. Now convert dy/dx into an expression that only involves x. (Tah dah!)

7. Differentiate $f(x) = x^{\sin(x)}$.

8. We wish, for whatever bizarre reason, to compute dy/dx if

$$y = \frac{(x^2+1)(x+3)^{1/2}}{x-1}.$$

One can use the product and quotient rules. But logarithmic differentiation can be a useful tool instead. known as logarithmic differentiation.

1. Take the natural logarithm of both sides of the equation.

2. Use log rules such as $\ln(AB) = \ln(A) + \ln(B)$ to expand the right-hand side of this equation

3. Compute (implicitly) dy/dx and solve for dy/dx.

4. Convert the expression for dy/dx so that it only involves x, and there are no appearances of y.