From Times Gone By...

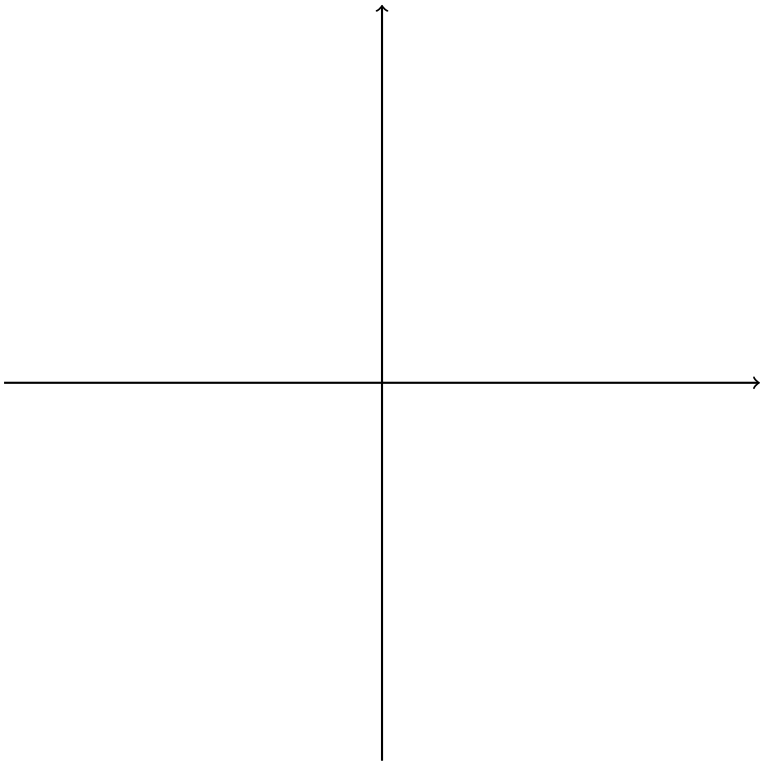
- If $f(x) = a^x$, then $f'(x) =$ _____.
- The inverse function of $g(x) = 10^x$ is $g^{-1}(x) =$ _____. The inverse function of $h(x) = e^x$ is $h^{-1}(x) =$ _____.
- The derivative of a composite function $f(g(x))$ is

$$\frac{d}{dx} f(g(x)) = \_\_\_\_\_.$$

Sketch!

Question

1. On the axes below, draw $f(x) = \ln(x)$, then sketch its derivative. Your answer should look like (part of) a curve you know pretty well....



Derivative of $\ln(x)$

Consider the equation $y = \ln(x)$.

Question

2. (a) Solve this equation for x.

   (b) Use implicit differentiation to find $\frac{dy}{dx}$ in terms of y.

(c) Use the relationship in question 2a to find the derivative of $\ln(x)$ in terms of x only.

Derivative of $\log(x)$

Question

3. Do all the above for $y = \log(x)$.

Derivatives of Logarithmic Functions

The derivative of $f(x) = \ln(x)$ is

$$f'(x) = \frac{d}{dx}\ln(x) = \_\_\_\_\_$$

The derivative of $f(x) = \log(x)$ is

$$f'(x) = \frac{d}{dx}\log(x) = \_\_\_\_\_$$

Questions

4. Differentiate the following functions:

   (a) $f(x) = \ln(2x + 6)$

(b) $g(x) = \log(x^2)$

(c) $h(x) = \ln(x^3)$

(d) $y = 6x^2 e^x \ln(x)$

5. Find the equation of the tangent line to the curve $f(x) = 6x \ln x$ at $x = 3$.