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

\[
\frac{d}{dx} f(g(x)) = \text{__________}.
\]

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

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

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

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

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

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