From Times Gone By...

• If \( f(x) = a^x \), then \( f'(x) = \) \underline{\phantom{0}} .

• The inverse function of \( g(x) = 10^x \) is \( g^{-1}(x) = \) \underline{\phantom{0}} . The inverse function of \( h(x) = e^x \) is \( h^{-1}(x) = \) \underline{\phantom{0}} .

• The derivative of a composite function \( f(g(x)) \) is

\[
\frac{d}{dx} f(g(x)) = \underline{\phantom{0}} .
\]

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 \( y = \log(x) \).

<table>
<thead>
<tr>
<th>Derivatives of Logarithmic Functions</th>
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<tbody>
<tr>
<td>The derivative of ( f(x) = \ln(x) ) is</td>
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**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 \( x = 3 \).