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** 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....

\[
\begin{array}{c}
| \hline \\
\hline \\
\hline 
\end{array}
\]

**Derivative of \( \ln(x) \)**

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

1. Solve this equation for \( x \).

2. Use implicit differentiation to find \( \frac{dy}{dx} \) in terms of \( y \).
3. Use the relationship in question 1 to find the derivative of \( \ln(x) \) in terms of \( x \) only.

**Derivative of \( \log(x) \)**

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

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

1. Differentiate the following functions:

   (a) \( f(x) = \ln(2x + 6) \)
(b) \( g(x) = \log(x^2) \)

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

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

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