Exponentials and Logarithms to the base *b*

+2 Rhino Participation Bonus Due Tuesday, 2/27 Name ______________________________

1. Suppose you forget the rule for differentiating the function for $y = b^x$ but you remember $\frac{d}{dx}e^{kx} = ke^{kx}$ and the inverse property $e^{\ln w} = w$ and the Bob Barker property. Write b^x as a power of *e*.

   a. $b^x = e^{\ln b^x}$

   $= e^{\square \cdot x}$ Use the Bob Barker property to complete the box.

   b. Differentiate with respect to *x*.

   $$\frac{d}{dx}b^x = \frac{d}{dx}e^{\square \cdot x} = \square$$ Use this differentiation rule.

   c. Replace any expression involving *e* raised to a power with an equivalent expression involving *b*. (Use part 1a)

   $$\frac{d}{dx}b^x = \square$$ Involves *b*, *x*, and other stuff but not *e* and not *y*.

2. Suppose you forget the rule for differentiating the function for $y = \log_b x$ but you remember $\frac{d}{dx}\ln u = \frac{1}{u} \cdot \frac{du}{dx}$ and the inverse property $b^{\log_b w} = w$. In addition, you have what you did in #1 and know implicit differentiation.

   a. Use the inverse property to write this in exponential form without logarithms. Complete the box.

   $y = \log_b x$

   $b^y = b^{\log_b x}$

   $b^y = \square$

   b. Differentiate with respect to *x*. Use the chain rule. Remember *y* is a function of *x*. Use the rule in 1c.

   $\frac{d}{dx}b^y = \frac{d}{dx}\square$

   $\square = \square$

   c. Solve for $\frac{dy}{dx}$. Replace any expression involving b^y with an equivalent expression. (Use part 2a)

   $$\frac{dy}{dx} = \square$$ Involves *b*, *x*, and other stuff but not *e* and not *y*.