

Evaluate/simplify the following:

• $\ln(e^5) = 5$

• $e^{\ln(5)} = 5$

e^x and $\ln(x)$ are inverse functions

And if you're feeling ambitious...

• $\frac{d}{dx}(5^x)$

(Hint: try rewriting 5^x in terms of another function.)

$$\begin{aligned} \frac{d}{dx} 5^x &= \frac{d}{dx} e^{\ln 5 \cdot x} \\ &= e^{\ln 5 \cdot x} \frac{d}{dx} (\ln 5 \cdot x) \\ &= e^{\ln 5 \cdot x} (\ln 5) \\ &= (\ln 5) (e^{\ln 5})^x \\ &= (\ln 5) \cdot 5^x \end{aligned}$$

Can write $y = 5^x$

$$\ln y = \ln(5^x)$$

$$\ln y = x \cdot \ln 5$$

Notice $5^x = (e^{\ln 5})^x$

$$= e^{\ln 5 \cdot x}$$

$$\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$$

Inner: $g(x) = \ln 5 \cdot x$

Outer: $f(x) = e^x$