

Quiz 12

October 14, 2016

Show all work and circle your final answer.

1. If $f(x) = \cosh(\ln x)$, calculate $f'(4)$. Simplify your answer to a rational number $\frac{a}{b}$.

$$f'(x) = \sinh(\ln x) \cdot \frac{1}{x} \quad \text{by chain rule}$$

$$f'(4) = \sinh(\ln 4) \cdot \frac{1}{4}$$

$$= \frac{e^{\ln 4} + e^{-\ln 4}}{2} \cdot \frac{1}{4} = \frac{4 + \frac{1}{4}}{2} \cdot \frac{1}{4} = \boxed{\frac{15}{32}}$$

$$\begin{aligned} \text{OR:} \\ f(x) &= \frac{e^{\ln x} + e^{-\ln x}}{2} \\ &= \frac{x + x^{-1}}{2} \end{aligned}$$

$$f'(x) = \frac{1}{2}(1 - x^{-2})$$

$$f'(4) = \frac{1}{2}(1 - \frac{1}{16}) = \boxed{\frac{15}{32}}$$

2. Suppose the number of Pokemon Go players grows at a rate proportional to the current number of Pokemon Go players. Suppose there were initially (at $t = 0$) 0.5 million players, and 2.5 million players after the first day (at $t = 1$). When will there be 3 million players? (Leave your answer exact.)

Let y be the number of players at time t .

Since $y' = ky$, we know $y = y_0 e^{kt}$.

$$y(0) = .5:$$

$$y(1) = 2.5:$$

$$y(t) = 3:$$

$$y = .5e^{kt}$$

$$2.5 = .5e^k$$

$$k = \ln 5$$

$$3 = .5e^{(\ln 5)t}$$

$$6 = e^{(\ln 5)t}$$

$$\ln 6 = (\ln 5)t$$

$$t = \boxed{\frac{\ln 6}{\ln 5} = \log_5 6}$$