

Math 132 Quiz
9 AM - 10 AM

1. Calculate $\frac{d}{dx} \sin(x)^x$.

$$\begin{aligned}\frac{d}{dx} \left((\sin x)^x \right) &= \frac{d}{dx} \left(e^{x \ln(\sin x)} \right) \\ &= e^{x \ln(\sin x)} \cdot \left(\ln(\sin x) + x \cdot \frac{1}{\sin x} \cdot (\cos x) \right) \\ &= \sin(x)^x \left(\ln(\sin x) + x \cot x \right)\end{aligned}$$

2. If the instantaneous rate of change of a population at time t (in years) is $\ln(2)/5$ times the value of the population at time t , in how many years does the population increase by a factor of 16?

$$\begin{aligned}\frac{dp}{dt} &= \frac{\ln(2)}{5} p \\ \frac{dp}{p} &= \frac{\ln(2)}{5} dt \\ \ln p &= \frac{\ln(2)}{5} t + C \\ p &= e^{\frac{\ln(2)}{5} t} \cdot e^C \\ p &= A \cdot 2^{\frac{t}{5}}\end{aligned}$$

$$\begin{aligned}\text{Need } t \text{ s.t. } p &= 16A \\ 16A &= A \cdot 2^{\frac{t}{5}} \\ 16 &= 2^{\frac{t}{5}} \\ \frac{t}{5} &= 4 \\ t &= 20\end{aligned}$$