Math 132 Quiz
8 AM - 9 AM

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

$$\frac{d}{dx}\left((\ln x)^x\right) = \frac{d}{dx}\left(e^{x\ln(\ln x)}\right)$$

$$= e^{x\ln(\ln x)} \cdot \left[\ln(\ln x) + x \cdot \frac{1}{\ln x} \cdot \frac{1}{x}\right]$$

$$= (\ln x)^x \left(\ln(\ln x) + \frac{1}{\ln x}\right)$$

2. If the instantaneous rate of change of a population at time t (in years) is $\ln(2)/6$ times the value of the population at time t, in how many years does the population increase by a factor of 8?

$$\frac{dp}{dt} = \frac{\ln(2)}{6} \cdot p$$

$$\frac{dp}{p} = \frac{\ln(2)}{6}\, dt$$

$$\ln p = \frac{\ln(2)}{6} \cdot t + C$$

$$p = e^{\frac{t}{6}\ln(2)} \cdot e^C$$

$$p = A \cdot 2^{\frac{t}{6}}$$

Need t when $p = 8A$

$$8A = A \cdot 2^{\frac{t}{6}}$$

$$2^3 = 2^{\frac{t}{6}}$$

$$3 = \frac{t}{6}$$

$$t = 18$$