Math 132 Quiz
12 Noon - 1 P.M.

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

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

$$= e^{\tan x \ln x} \cdot \left(\sec^2 x \ln x + \frac{\tan x}{x}\right)$$

$$= x^{\tan x}\left(\sec^2 x \ln x + \frac{\tan x}{x}\right)$$

2. If, at time t (in years), the instantaneous rate of change of the mass of a radioactive substance is $-\ln(2)/5$ times the value of the mass at time t, in how many years is the mass reduced to one-eighth of the initial amount?

$$\frac{dP}{dt} = -\frac{\ln 2}{5}P$$

$$\frac{dP}{P} = -\frac{\ln 2}{5}dt$$

$$\ln P = -\frac{\ln 2}{5}t + C$$

$$P = e^{-\frac{\ln 2}{5}t + C}$$

$$P = e^{-\frac{t}{5}\ln 2} \cdot e^{C}$$

$$P = A \cdot 2^{-\frac{t}{5}}$$

Need t s.t. $P = \frac{1}{8}A$

$$\frac{1}{8}A = A \cdot 2^{-\frac{t}{5}}$$

$$\frac{1}{8} = 2^{-\frac{t}{5}}$$

$$-3 = -\frac{t}{5}$$

$$t = 15$$