

Math 116 - Quiz 3**Name:** _____

Answer the following questions showing all work. 5 points each.

1. Let $\frac{dy}{dx} = 2x - y$. Sketch a slope field for this differential equation. Is $y = 2x$ a solution to the differential equation? Why or why not?

2. Is $y = e^{e^x}$ a solution to $\frac{dy}{dx} = \ln(y^y)$? [HINT: It may help to simplify first. Think about exponent rules.]

3. Let $\frac{dq}{dt} = q^2t$ and assume $q(0) = 1$. Using Euler's method with a Δt step of .5, estimate $q(1)$.

4. The most interesting man in the world wants a refreshing beer after a long day of wrestling tigers. Unfortunately, his liquid nitrogen chamber has no beer in it. So he puts a room temperature ($70^{\circ}F$) Dos Equis in. One second later, the temperature has already dropped to $69^{\circ}F$. Set up and solve a differential equation to determine how long the beer needs to be before it is cold enough to drink (the most interesting man in the world prefers his beers to be $34^{\circ}F$). You may assume Newton's Law of Cooling¹ and his liquid nitrogen chamber is kept at a chilly $-350^{\circ}F$.

5. BONUS: Willy Wonka's 1000 gallon chocolate swimming pool starts with 100 gallons of water in it with a chocolicity (chocolate concentration) of 20 grams of chocolate per gallon. Fresh water is flowing into the tank at a rate of 10 gallons per minute, while 1 gallon of the mixed chocolate water leaks out every minute. What will the chocolicity of the water in the tank be when the tank is full?

¹The rate of change of the temperature of a body is directly proportional to the difference between the temperature of the body and the temperature of the surrounding air.