

Test Total

Name _____

Exam 1 Ordinary Differential Equations
23 September 2009 For full credit, show your work and use correct notation

Dr. Kreider

1. Consider the ODE $y'(x) = x\sqrt{y+1}$.

10 pts

a) Write a specific initial condition for which this ODE is guaranteed to have a unique solution.

b) Write a specific initial condition for which this ODE may not have a unique solution.

2. Solve this differential equation: $(x^3y^2 + x^3) \frac{dy}{dx} = y$ with initial condition $y(1) = 1$.

12 pts

Page 1: 22

Name _____

3. Solve this initial value problem: $(y^2 - x^2)dx + 2xydy = 0$ with $y(1) = 3$.

12 pts

4. Solve this linear initial value problem: $(x + 2)^2y' + 8y + 4xy = 12$ with $y(0) = 1$.

12 pts

Name _____

5. At the Pepperoni Palais, pizzas are prepared at room temperature (70°) and placed in a 1000° oven to bake. After 5 minutes, the pizza's temperature is 100° . How many minutes will it take the pizza to reach the serving temperature of 160° ? Newton's Law of Cooling is $T(t) = T_m + (T_0 - T_m)e^{-kt}$.

10 pts

6. Solve the problem $(x^2 + y^2)dx + xydy = 0$.

12 pts

Name _____

7. A population of 100 Tibetan Mango-Sucking Yaks is introduced into Northeast Ohio. After 2 years, there are 140 of the yaks. They reproduce according to the exponential growth model $Y(t) = Y_0 e^{kt}$. How many years will it take for the population to triple to 300?

10 pts

8. A magnetically charged particle of mass m is placed at the top of a cylinder of glycerin (a thick liquid). It falls through the liquid to a magnetically charged base at the bottom that attracts the particle. Write the differential equation that describes the velocity of the particle if the gravitational force is mg , the resistance force due to the glycerin is proportional to the square of the velocity, and the magnetic force is proportional to the velocity. Use a downward pointing coordinate system (down is positive) and pay attention to plus/minus signs. Do not solve the differential equation.

10 pts

Name _____

9. Solve the initial value problem $y' + 2y = y^2$ with $y(0) = 1$.

12 pts

Page 5: 12