1.1 Background

Name: Date: May 21, 2013

P 1. Classify

$$\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0$$

as an ordinary differential equation (ODE) or a partial differential equation (PDE), give the order, and indicate the independent and dependent variables. If the equation is an ordinary differential equation, indicate whether the equation is linear or nonlinear.

P 2. The following differential equation arises in seismology in problem areas involving mechanical vibrations and electrical circuits. Classify

$$5\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 9x = 2\cos 3t$$

as an ordinary differential equation (ODE) or a partial differential equation (PDE), give the order, and indicate the independent and dependent variables. If the equation is an ordinary differential equation, indicate whether the equation is linear or nonlinear.

P 3. Laplace's equation is arises in potential theory, electricity, heat, and aerodynamics. Classify

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

as an ordinary differential equation (ODE) or a partial differential equation (PDE), give the order, and indicate the independent and dependent variables. If the equation is an ordinary differential equation, indicate whether the equation is linear or nonlinear.

P 4. The following differential equation arises in ecology in problem areas involving competition between two species. Classify

$$\frac{dy}{dx} = \frac{y(2-3x)}{x(1-3y)}$$

as an ordinary differential equation (ODE) or a partial differential equation (PDE), give the order, and indicate the independent and dependent variables. If the equation is an ordinary differential equation, indicate whether the equation is linear or nonlinear.

P 13. Write a differential equation that fits the physical description. The rate of change of the population p of bacteria at time t is proportional to the population at time t.

P 14. Write a differential equation that fits the physical description. The velocity at time t of a particle moving along a straight line is proportional to the fourth power of its position x.

P 15. Write a differential equation that fits the physical description. The rate of change in the temperature T of coffee at time t is proportional to the difference between the temperature M of the air at time t and the temperature of the coffee at time t.

P 16. Write a differential equation that fits the physical description. The rate of change of the mass A of salt at time t is proportional to the square of the mass of salt present at time t.

P 17. Write a differential equation that fits the physical description. Two drivers, Alison and Kevin, are participating in a drag race. Beginning from a standing start, they each proceed with a constant acceleration. Alison covers the last 1/4 of the distance in 3 seconds, whereas Kevin covers the last 1/3 of the distance in 4 seconds. Who wins and by how much time?