

**Workshop 2 - Problems**

Mon. June 15, 2009

**Problem 1.** Find the general solution to the system

$$\begin{aligned}\frac{dx}{dt} &= txy \\ \frac{dy}{dt} &= 0\end{aligned}$$

**Problem 2.** The integrating factor for a linear non-homogeneous differential equation is  $t^4$ . What is the general solution to the associated homogeneous differential equation?**Problem 3.** The bifurcation values for

$$\frac{dy}{dt} = f_\mu(y)$$

are  $\mu = -5$ ,  $\mu = -1$ , and  $\mu = 2$ . The differential equation corresponding to  $\mu = 0$  has seven equilibria. How many zeroes  $y = y_0$  does the function  $f_1(y)$  have?**Problem 4.**  $\alpha, \beta, \gamma$  are positive integers such that the differential equation

$$\frac{dy}{dt} = (y-1)^\alpha (y-2)^\beta (y-3)^\gamma$$

has equilibrium solutions of the three kinds (source, sink, and node). What is the smallest possible value for  $\alpha + \beta + \gamma$ ?**Problem 5.** Suppose that  $y_1(t) = t^2 + 1$  is a solution to

$$\frac{dy}{dt} = 2y + b_1(t)$$

and  $y_2(t) = \sin t$  is a solution to

$$\frac{dy}{dt} = 2y + b_2(t).$$

Find **one** solution to

$$\frac{dy}{dt} = 2y + 5b_1(t) - 4b_2(t).$$

