

Math 450 (2009) – Homework 1

Due: September 16, 2011.

NAME: _____

1. [20pts] Find the solution of the following initial value problems:

$$y' - \frac{1}{2x} y = \sqrt{x} \quad , \quad y(1) = 4 \quad (1)$$

$$y' + \frac{1}{x} y = \frac{5x}{y^2} \quad , \quad y(1) = 2 \quad (2)$$

$$y'' - 2y' + 5y = 0 \quad , \quad y(0) = 0 \quad , \quad y'(0) = 1 \quad (3)$$

$$y'' + 2y' + y = 1 \quad , \quad y(0) = 1 \quad , \quad y'(0) = 2 \quad (4)$$

2. [5pts] Use the method of Variation of Parameters to find a particular solution of

$$y'' - 2y' + y = x^3 e^x$$

3. [5pts] Let $f(x, y) = y - x^3$. Find that unique curve through $(x, y) = (1, 1)$ that is orthogonal to the level curves of f . Sketch several $f = c$ level curves and the resulting orthogonal curve (just the first quadrant).

4. [10pts] Find a Fundamental Matrix $X(t) \in \mathbb{R}^{2 \times 2}$ of the system

$$\frac{d\mathbf{x}}{dt} = A\mathbf{x}$$

for the following two matrices:

$$A = \begin{bmatrix} -7 & -6 \\ 4 & 7 \end{bmatrix} \quad , \quad A = \begin{bmatrix} -8 & 4 \\ -10 & 4 \end{bmatrix}$$