Name: Date: 04/26/2017

M20580 L.A. and D.E. Tutorial
Worksheet 11
Sections 2.6, 3.1, 3.2, 3.3

1. Given the differential equation,

$$(y - 3x^2 + 4) + (x + 4y^3 - 2y)\frac{dy}{dx} = 0.$$

(a) Determine if the given differential equation is exact

(b) Find the solution of the differential equation above
Answer: $yx - x^3 + 4x + y^4 - y^2 = c$

2. The differential equation

$$3y^2 - 4x(y^3 + 1) + xy(2 - 3xy)y' = 0$$

(a) is exact.

(b) is homogenenous.

(c) has an integrating factor that is a function of x alone.

(d) has an integrating factor that is a function of y alone.

(e) None of the above.

If you choose (c) or (d), find the integrating factor of the given differential equation.

3. Using the Existence and Uniqueness Theorem for second order linear differential equations, find the maximal interval of existence of the solution to the initial value problem

$$(t^3 - 9t)y'' - 8ty' + (t + 4)y = t^2 - 9, \qquad y(2) = 5, \quad y'(2) = -1.$$

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4. Find the solution of the initial value problem $y'' + 3y' + 2y = 0, \quad y(0) = 1,\ y'(0) = -1$

   Answer: $y(t) = e^{-t}$

5. (a) Find the general solution to the differential equation $y'' - 4y' + 5y = 0$. (i.e., find $y(t) = c_1 y_1(t) + c_2 y_2(t)$ where y_1 and y_2 are solutions to the given differential equation. You don't have to find c_1 and c_2.)

   (b) If $y(t)$ is the solution to the initial value problem $y'' - 4y' + 5y = 0$, $y(0) = 0,\ y'(0) = 1$ then find $y(\pi/2)$.

   Answer: e^{π}