MATH 308 – 531 **Homework 1** **Spring 2016**

Due Thursday, Jan. 27 at the beginning of class.

1. Determine which of the following equations is liear or non linear? If the equation is non linear, circle all the non linear terms.

   (a) $3\dfrac{d^2y}{dt^2} + 4\dfrac{dy}{dt} + 9y = 2\cos t$

   (b) $t\dfrac{dy}{dt} = 3 - y$

   (c) $\dfrac{d^2y}{dt^2} + y\dfrac{dy}{dt} - t^2 = 0$

   (d) $e^{ty}\dfrac{dy}{dt} = 1$

   (e) $t^2\dfrac{dy}{dt} + \sqrt{y}\dfrac{d^3y}{dt^3} = 5t$

2. Determine whether the given function is a solution to the given equation.

   (a) $y = \sin t + t^2$, $\dfrac{d^2y}{dt^2} + y = t^2 + 2$

   (b) $y = 2e^{3t} - e^{2t}$, $\dfrac{d^2y}{dt^2} - y\dfrac{dy}{dt} + 3y = -2e^{2t}$

3. Determine for which values of m the function $y(t) = t^m$ is a solution to the equation $3t^2\dfrac{d^2y}{dt^2} + 11t\dfrac{dy}{dt} - 3y = 0$.

4. (a) Show that the function $y(t) = c_1e^t + c_2e^{-2t}$ is a solution to the equation $\dfrac{d^2y}{dt^2} + \dfrac{dy}{dt} - 2y = 0$ for any choice of the constants c_1 and c_2.

   (b) Determine c_1 and c_2 so that the initial conditions
   $y(1) = 1$, $y'(1) = 0$
   are satisfied.

5. Solve the differentiate equation/initial value problem.

   (a) $\dfrac{dy}{dx} = \dfrac{1 - x^2}{y^2}$

   (b) $y^{-1}dy + ye^{\cos x}\sin x\,dx = 0$

   (c) $(x + xy^2)dx + e^{x^2}ydy = 0$

   (d) $\dfrac{dy}{dx} = 2\sqrt{y+1}\cos x, \quad y(\pi) = 0$

   (e) $\sqrt{y}\,dx + (1 + x)dy = 0, \quad y(0) = 1$