

Due Thursday, Jan. 26 at the beginning of class.

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

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

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

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

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

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

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

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

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

3. Determine for which values of m the function $y(t) = t^m$ is a solution to the equation

$$3t^2 \frac{d^2 y}{dt^2} + 11t \frac{dy}{dt} - 3y = 0.$$

4. (a) Show that the function $y(t) = c_1 e^t + c_2 e^{-2t}$ is a solution to the equation

$$\frac{d^2 y}{dt^2} + \frac{dy}{dt} - 2y = 0 \text{ for any choice of the constants } c_1 \text{ and } c_2.$$

- (b) Determine c_1 and c_2 so that the initial conditions

$$y(1) = 1, y'(1) = 0$$

are satisfied.

5. A spherical raindrop evaporates at a rate proportional to its surface area. Write a differential equation for the volume of the of the raindrop as a function of time.

6. For the differential equations $\frac{dy}{dt} = \frac{4y}{t}$

(a) Using MatLab, draw its direction field (print and attach your MatLab file to the homework).

(b) Using MatLab, graph a few solutions to the equation.