

Homework 4

Instructions: Write your solutions on paper or a writing tablet, scan it and upload it to canvas. The file must be in pdf extension. Show neat and complete work and make sure that your scan is legible. Label your solutions and make sure they are in increasing order.

1. Find the general solution for $y''' + 2y'' + 2y' = 0$.
2. Suppose the characteristic equation for an ODE is $(r-1)^2(r-2)^2 = 0$.
 - (a) Find such a differential equation.
 - (b) Find its general solution.
3. Consider a mass and spring system with a mass $m = 3$, spring constant $k = 12$, and damping constant $c = 12$.
 - (a) Set up and find the general solution of the system.
 - (b) Is the system underdamped, overdamped or critically damped?
 - (c) If the system is not critically damped, find a c that makes the system critically damped.
4. A mass of 2 kilograms is on a spring with spring constant k newtons per meter with no damping. Suppose the system is at rest and at time $t = 0$ the mass is kicked and starts traveling at 2 meters per second. How large does k have to be to so that the mass does not go further than 3 meters from the rest position?
5. Find a **general** solution of $y'' - 4y' + 4y = e^{2x}$.
6. Solve the initial value problem:

$$y'' + 9y = \cos(3x) + \sin(3x) \text{ for } y(0) = 2, y'(0) = 1 \quad (1)$$

7. (a) Using variation of parameters find a particular solution of $y'' - 2y' + y = e^x$
- (b) Find a particular solution using undetermined coefficients.
- (c) Are the two solutions you found the same?