Instructions

(1) Please submit your written solutions to crowdmark with each problem started on a separate page.
(2) Please list your collaborators on your assignment. It's important to give credit to those you have worked with.

Question 1 (Solutions to Differential Equations).

a. Verify that $y(t) = C_1(t+1) + C_2 e^t$ a two-parameter family of solutions to

$$t\frac{d^2y}{dt^2} - (t+1)\frac{dy}{dt} + y = 0$$

on the interval $(0, \infty)$.

b. Show that

$$y(t) = e^{3t} + te^{3t}$$

is not a solution to

$$\frac{d^2y}{dt^2} - 6\frac{dy}{dt} + 9y = 0$$

on $(-\infty, \infty)$ with the initial values $y(0) = 1$ and $y'(0) = 0$.

Question 2 (1st Order Linear ODEs). Consider the differential operator

$$L[u] = (x^2 + 1)\frac{du}{dx} - 2xu.$$

a. Show that L is a linear differential operator.

b. Find a one parameter family of solutions to

$$L[u] = 0$$

on the interval $(-\infty, \infty)$.

c. Find a particular solution to the initial value problem

$$L[u] = x \qquad\qquad\qquad u(0) = 1$$

on the interval $(-\infty, \infty)$.