

**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** (Linear ODEs). Find the unique solution to the following initial value problem:

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 8y = 0, \quad y(0) = 0, \quad y'(0) = 2$$

**Question 2** (Linear ODEs). Find the unique solution to the following boundary value problem

$$\frac{d^2y}{dt^2} + 4y = 0, \quad y(0) = 1, \quad y'(\pi) = 0$$

sketch the solution for  $t \in (0, \pi)$

**Question 3** (Linear Independence). For each set of functions, determine whether or not the set is linearly independent on the given interval

- a.  $\{t, e^t, te^t\}$  for  $t \in (-\infty, \infty)$
- b.  $\{\cos^2(t), \sin^2(t), \cos(2t)\}$  for  $t \in (0, 2\pi)$
- c.  $\{1, t, \ln(t), t \ln(t)\}$  for  $t \in (0, \infty)$