**MATH 246 Homework 3.1**
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**Directions:**

- Work should be done neatly and on separate paper.
- Enough work must be shown so that the steps you are taking is clear.

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1. Show that the pair $x_1(t) = \cos(2t) + \sin(2t)$ and $x_2(t) = \sin(2t)$ form a solution to the system

$$x_1' = 2x_1 - 4x_2$$
$$x_2' = 2x_1 - 2x_2$$

2. Rewrite $2y'' + ty' - y = \sin t$ with $y(0) = 1$, $y'(0) = -1$ as a first-order system with initial value.

3. Rewrite $y''' + 2y'' - y' + 3y = 1$ as a first-order system with three variables.

4. Tank 1 has volume of 200 Liters and Tank 2 has volume 100 Liters. Initially both are full with Tank 1 containing salt at 2 g/L and Tank 2 containing salt at 3 g/L The Tank 1 mixture is flowing from Tank 1 to Tank 2 at 5 L/min while the Tank 2 mixture is flowing from Tank 2 to Tank 1 at 3 L/min. Fresh water is flowing into Tank 1 at 6 L/min while the Tank 1 mixture flows out to a drain at 4 L/min. Water at 4 g/L is flowing into Tank 2 at 7 L/min while the Tank 2 mixture flows out to a drain at 9 L/min. Let $x_1$ represent the amount of salt in Tank 1 at time $t$ and $x_2$ represent the amount of salt in Tank 2 at time $t$. Draw a tank picture for this situation and write down the corresponding system with initial values.