

## Practice Exam 3: MAP 2302\*

1. Perform phase plane analysis for the following system:

$$\begin{aligned}\dot{x} &= -2x \\ \dot{y} &= -y\end{aligned}$$

What type of equilibrium point is the origin (node, spiral, stable, unstable, etc)?

2. Find the inverse Laplace transform of the following function in two ways, one of which relies on the Convolution Theorem:

$$\frac{1}{s^2((s-1)^2+1)}$$

3. Solve the following IVP using Laplace transforms:

$$x'' + x = \delta(t-1) + u_2(t), \quad x(0) = x'(0) = 0$$

4. Assume that the solution of the following IVP

$$x'' + t^3 x' + x = (t-2)^2 u_2(t) + e^{4t} t^5, \quad x(0) = x'(0) = 1$$

exists. Denote this solution by  $x(t)$  and assume that it has a Laplace transform  $X(s) = \mathcal{L}\{x(t)\}$ . Show that it satisfies a second order differential equation. Find this equation.

5. Do problem 5.8 # 27.