

### Math 2326, Test III

Name \_\_\_\_\_

1. Find the general solution:

$$w'' + 5w' + 4w = 34\sin(t)$$

answer:  $w(t) = C_1e^{-4t} + C_2e^{-t} + 3\sin(t) - 5\cos(t)$

2. Find all 4 of the equilibrium points of the nonlinear system:

$$\begin{aligned}\frac{dx}{dt} &= 2x - x^2 - xy \\ \frac{dy}{dt} &= 3y - y^2 - 2xy\end{aligned}$$

and classify any two of them a source, sink, saddle point, spiral source, spiral sink, or center.

answer:  $(0, 0)$  is source,  $(0, 3)$  is sink,  $(2, 0)$  is sink,  $(1, 1)$  is saddle

3. Find the Laplace transform of the solution to:  
 $y'' + 5y' + 4y = 34\sin(t)$ , with  $y(0) = 0, y'(0) = 0$

answer:  $L(y) = \frac{34}{(s^2+1)(s^2+5s+4)}$

4. Find the inverse Laplace transform of  $F(s) = \frac{e^{-3s}}{s^2+1}$

answer:  $f(t) = u_3(t)\sin(t - 3)$

5. Solve **using Laplace transforms**:  
 $y' + 4y = 0$ , with  $y(0) = 3$

answer:  $y(t) = 3e^{-4t}$