# 4512 Homework 4

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## Section 4.3 Problem 3

**Find the equilibrium solutions for the following equation, and determine stability.**

$$\dot{x} = x^2 + y^2 - 1$$
$$\dot{y} = 2xy$$

## Section 4.4 Problem 5

**Find the orbit of the following system.**

$$\dot{x} = y$$
$$\dot{y} = -x$$

## Section 4.7 Problem 10

**Show that every orbit of $\dot{\boldsymbol{x}} = \begin{pmatrix} 0 & 4 \\ -9 & 0 \end{pmatrix} \boldsymbol{x}$ is an ellipse.**

## Section 4.7 Problem 13(a)

**Consider the system**

$$\frac{dx}{dt} = y, \quad \frac{dy}{dt} = x + 2x^3$$

**Show that the equilibrium solution $\mathbf{x = 0, y = 0}$ of the linearized system $\mathbf{\dot{x} = y, \dot{y} = x}$ is a saddle, and draw the phase portrait of the linearized system.**