

Due 4/17/2026, 11:30 a.m.

Solve the following problems and staple your solutions to this cover sheet. (Computer outputs must be put in the appropriate place in the solution, not attached as an appendix. You may physically cut and paste the output in the problem or allow appropriate space in the printout to add your hand written work.)

For the next two problems, draw the phase line portraits of each first order ODE and determine if the given pair are qualitatively equivalent or not.

1. $\frac{dx}{dt} = -1 + 5x - x^2, \frac{dy}{dt} = y(1 - y)$

2. $\frac{dx}{dt} = x(1 + x^2), \frac{dy}{dt} = y(1 - y^2)$

For the next three problems, (a) Discuss the phase line portrait structure of each 1st order ODE, (b) Determine all bifurcation points, if any, and draw the bifurcation diagram, and (c) Classify the type of bifurcation, if possible.

3. $\frac{dx}{dt} = x^2 - \mu^2$

4. $\frac{dx}{dt} = x(x^2 - 1 - \mu)$

5. $\frac{dx}{dt} = \mu x + x^3 - x^5$

6. Chap 6, Exer 1(a). Note: Show the animation command (Manipulate or Animate) along with one (or more) graphs.

7. Chap 6, Exer 1(b). Note: Show the animation command (Manipulate or Animate) along with one (or more) graphs.

8. Chap 6, Exer 4(a).

9. Chap 6, Exer 4(b).

10. Free Points.