

5. [12 points] Consider the nonlinear system

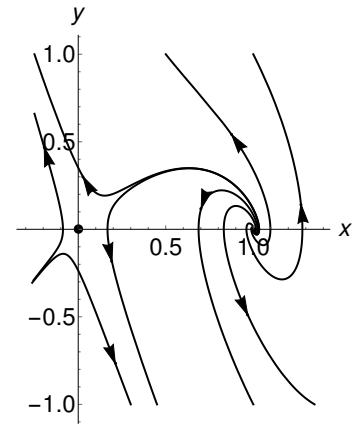
$$x' = y, \quad y' = -3x - 2y + r x^2.$$

Four possible phase portraits for this system are shown along the right side of the page.

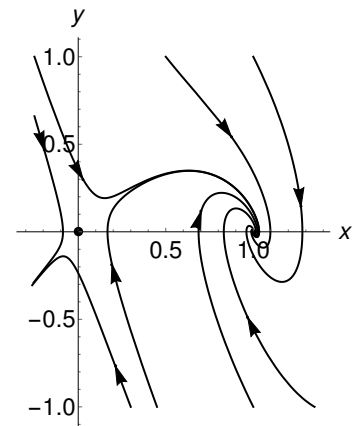
a. [4 points] If one of the graphs is to match this system, what is the value of the parameter r ? Why?

b. [8 points] Given the value of r you found in (a), which, if any, of the phase portraits could be that for this system? Why?

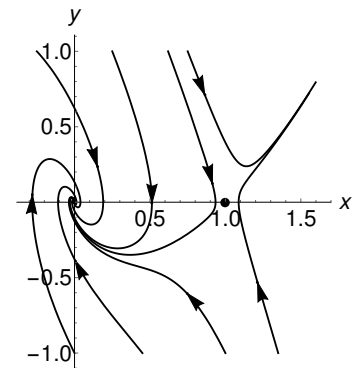
Portrait 1:



Portrait 2:



Portrait 3:



Portrait 4:

