

MTH 351/651  
Quiz #5

1. Consider the system of differential equations

$$\begin{aligned}\frac{dx}{dt} &= f(x, y), \\ \frac{dy}{dt} &= g(x, y).\end{aligned}$$

where  $f, g$  are continuous functions satisfying

$$\begin{aligned}\lim_{y \rightarrow \infty} f(x, y) &= \infty, \\ \lim_{y \rightarrow \infty} g(x, y) &= -\infty.\end{aligned}$$

The figure below is a plot of the curves satisfying  $f(x, y) = 0$  and  $g(x, y) = 0$ .

- On this figure indicate any fixed points.
- On this figure indicate the direction of the flow in the regions bounded by the curves  $f(x, y) = 0$  and  $g(x, y) = 0$ .
- Sketch a phase portrait on top of this figure. You should include enough solution trajectories so that all possible qualitatively different solution curves are represented.

