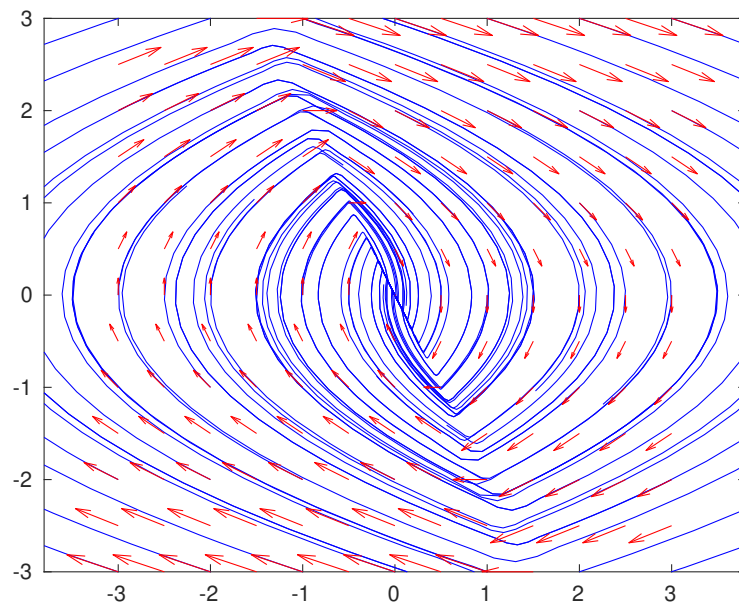# Homework 2

Erivelton Gualter dos Santos

1 Problem

Figure 1: Phase Portrait.

2 Problem

3 Matlab Codes

```matlab
% Erivelton Gualter
%
% 02/04/2019

clear all
close all

a = 2;

figure('Name','Question 1 - Phase Portrait','NumberTitle','off');
hold on; box on;
```

```matlab
13  fun = @(t, x) (eqDer(t, x, a));
14  for x10 = -3:1:3
15      for x20 = -3:1:3
16          [t, y] = ode45(fun, [0 10], [x10 x20]);
17          plot(y(:,1),y(:,2), 'b')
18          axis equal
19      end
20  end
21
22  [x1, x2] = meshgrid(-3:0.5:3, -3:.5:3);
23  x1dot = x2;
24  x2dot = sign(-a*x1-x2);
25  quiver(x1,x2,x1dot, x2dot, 'color', 'red')
26
27  yaxis([-3 3]);
28
29  print('question1','-depsc')
30
31  function out = eqDer(t, x, a)
32      x1 = x(1);
33      x2 = x(2);
34
35      x1d = x2;
36      x2d = sign(-x2-a*x1);
37
38      out = [x1d; x2d];
39  end
```