**Derek Frank**

**AMS 114**

**Homework #7**

**8.2.2:**

Show that the given system has pure imaginary eigenvalues when :

Given system:

Fixed points:



Jacobian:



Eigenvalues at fixed points:







- All have pure imaginary values.

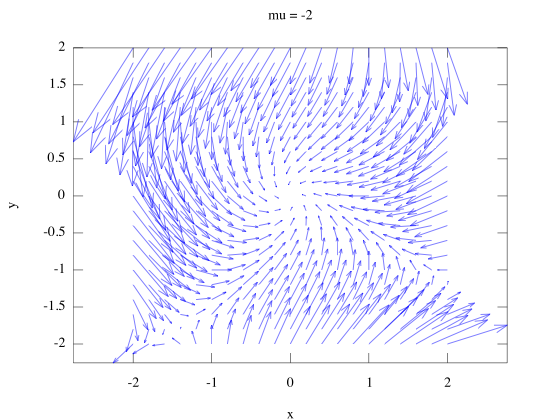
**8.2.3:**

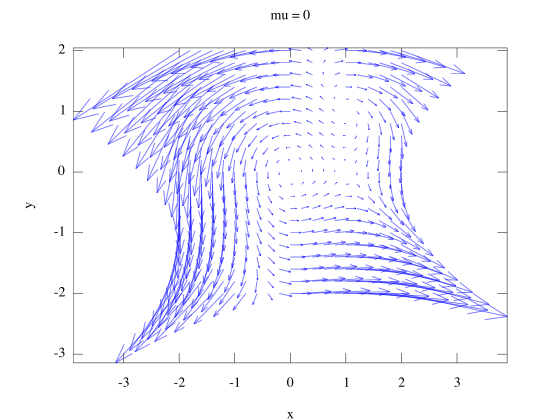
By plotting the phase portraits on the computer, show that the given system undergoes a Hopf bifurcation at . Is it subcritical, supercritical, or degenerate?

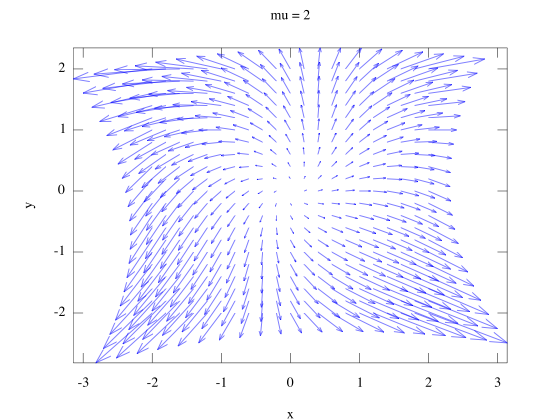
Given system:



Phase portrait:







Classification:

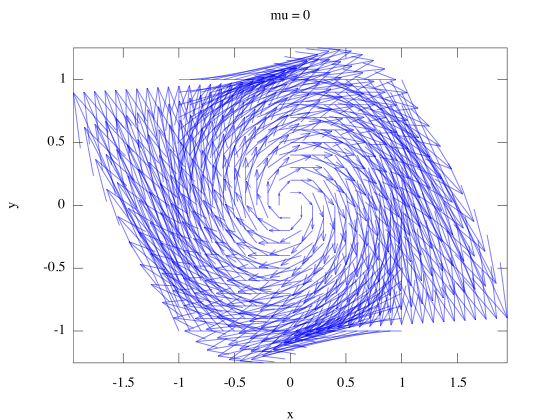
- Degenerate Hopf bifurcation

**8.2.5:**

For the given system, a Hopf bifurcation occurs at the origin when . Plot the phase portrait and determine whether the bifuracation is subcritical or supercritical:

Given system:



Phase portrait:

Classification:

- Subcritical

**Octave Code:**

# prob2a.m

function prob2a

clear

figure(1);

hold off

[x,y] = meshgrid(-2:.2:2);

mu=-2;

x\_dot=-y+(mu.\*x)+(x.\*(y.^2));

y\_dot=x+(mu.\*y)-(x.^2);

h=quiver(x,y,x\_dot,y\_dot);

set(h, "autoscalefactor", 4);

axis("tight");

title("mu = -2");

xlabel("x");

ylabel("y");

fixAxes;

endfunction

# prob3.m

function prob3

clear

figure(1);

hold off

[x,y] = meshgrid(-1:.1:1);

mu=0;

x\_dot=y+(mu.\*x);

y\_dot=-x+(mu.\*y)-((x.^2).\*y);

h=quiver(x,y,x\_dot,y\_dot);

set(h, "autoscalefactor", 5);

axis("tight");

title("mu = 0");

xlabel("x");

ylabel("y");

fixAxes;

endfunction