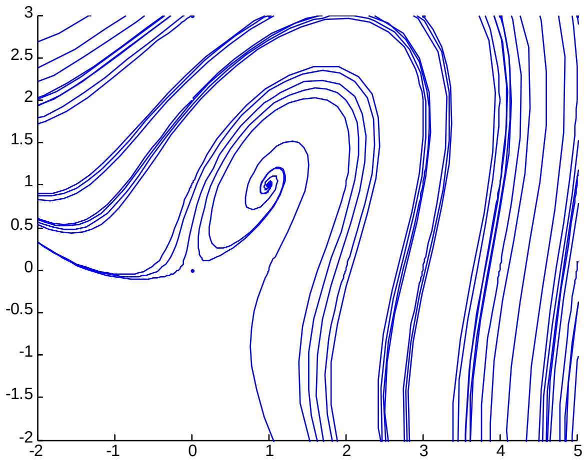
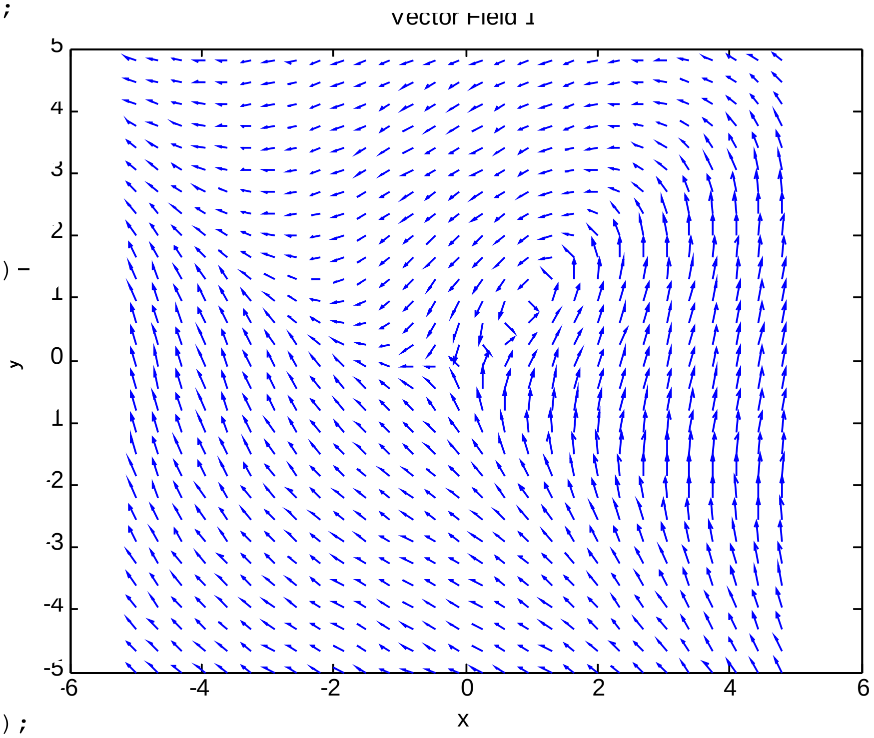
Section 9.3
Problems 1 and 4

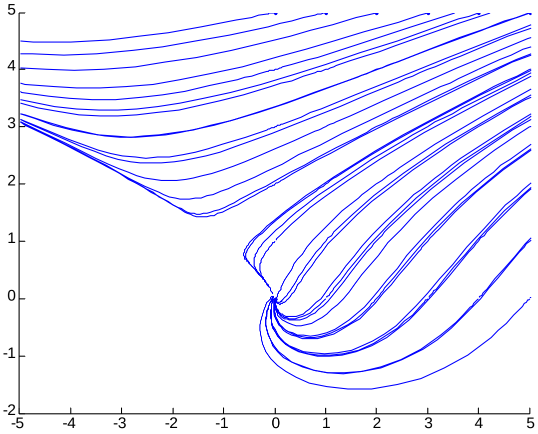


```
%Problem 1
syms x y t
sys1=x-y^2;
sys2=x-2*y+x^2;
[xo,yo]=solve(sys1,sys2,x,y);
disp('Critical points:');
Critical points:
disp([xo,yo])
[                    0,                    0]
[                    1,                    1]
[ -3/2+1/2*i*7^(1/2), -1/2-1/2*i*7^(1/2)]
[ -3/2-1/2*i*7^(1/2), -1/2+1/2*i*7^(1/2)]

figure
[X,Y]=meshgrid(-5:.35:5,-5:.35:5);
A=X-Y.^2;
B=X-Y.*2+X.^2;
C=sqrt((A/2).^2+(B/4.5).^2);
quiver(X,Y,A./C,B./C,.7);
xlabel 'x'
ylabel 'y'
title 'Vector Field 1'
```

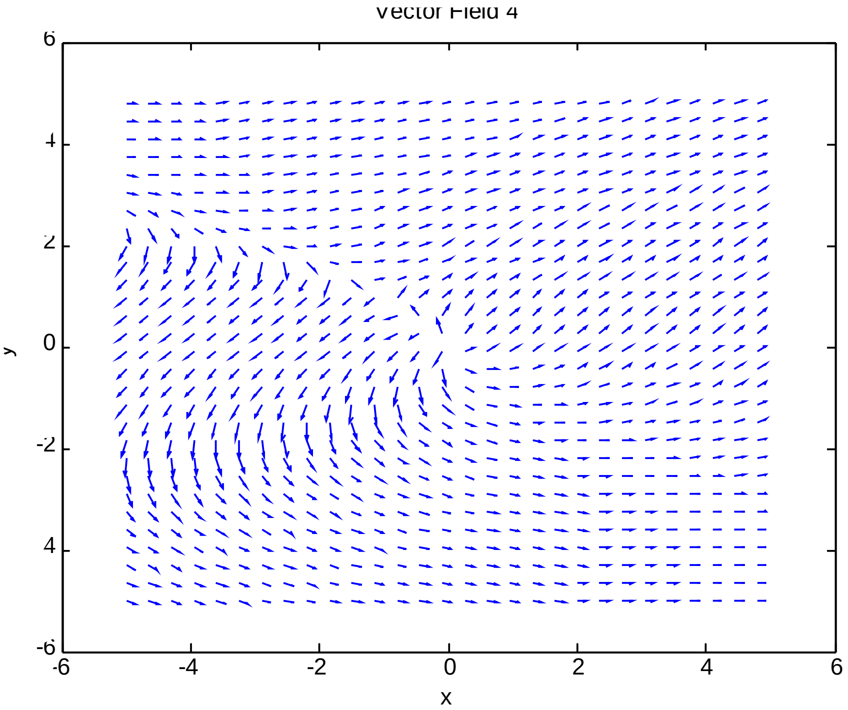


```
f = @(t,x) [x(1)-x(2)^2;x(1)-
2*x(2)+x(1)^2];
figure;
hold on
for a = 0:1:5
 for b = 0:1:5
 [t,xa] = ode45(f, [0 10],
[a b]);
  plot (xa(:,1),xa(:,2))
 [t, xa] = ode45(f, [0 -5],
[a b]);
  plot (xa(:,1),xa(:,2))
 end
end
axis([-2 5 -2 3])
quiver(X, Y, U./L, V./L, .4);
hold off
```

```
%Problem 4
sys3=x+y^2;
sys4=x+y;
[xo,yo]=solve(sys3,sys4,x,y);
disp('Critical points:');
Critical points:
disp([xo,yo])
[  0,  0]
[ -1,  1]

figure
[X,Y]=meshgrid(-5:.35:5,-5:.35:5);
A=X+Y.^2;
B=X+Y;
C=sqrt((A/2).^2+(B/4.5).^2);
quiver(X,Y,A./C,B./C,.7);
xlabel 'x'
ylabel 'y'
title 'Vector Field 4'
```

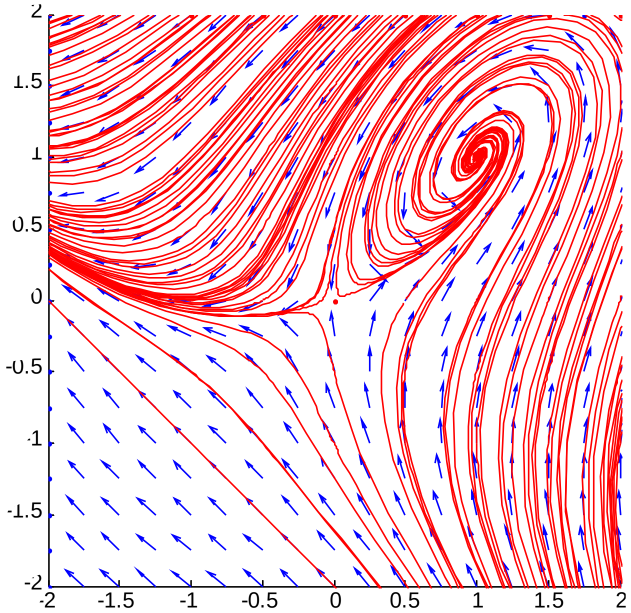


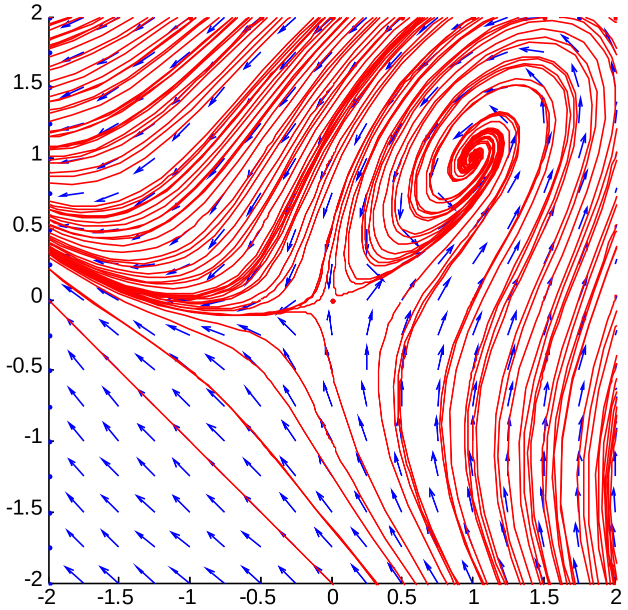
```
f = @(t,x)
[x(1)+x(2)^2;x(1)+x(2)];
figure;
hold on
for a = 0:1:5
 for b = 0:1:5
   [t,xa] = ode45(f, [0 10],
[a b]);
   plot (xa(:,1),xa(:,2))
   [t, xa] = ode45(f, [0 -5],
[a b]);
   plot (xa(:,1),xa(:,2))
 end
end
axis([-5 5 -2 5])
quiver(X, Y, U./L, V./L, .4);
hold off
```

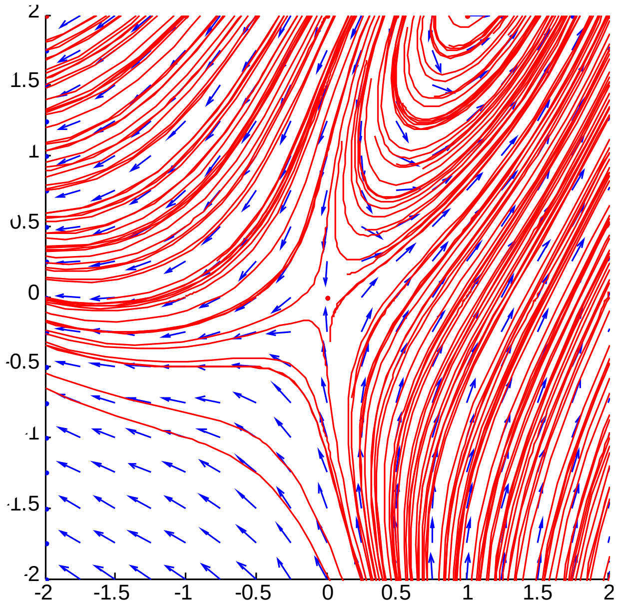


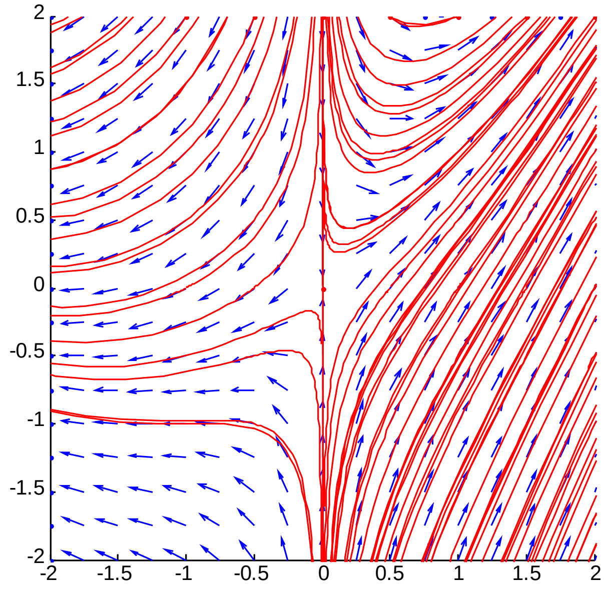
```
%Alpha
[X,Y] = meshgrid(-2:.25:2, -2:.25:2);
A1=X-Y.^2;
B1=X-Y.*2+X.^2;
A4=X+Y.^2;
B4=X+Y;
for al=0:.1:1
figure;
hold on
A=(1-al)*A1+al*A4;
B=(1-al)*B1+al*B4;
C=sqrt(A.^2+B.^2);
quiver(X,Y, A./C,B./C,.5)
axis equal
f=@(t,x)[(1-al)*(x(1)-x(2)^2)+al*(x(1)+x(2)^2);(1-al)*(x(1)-
2*x(2)+x(1)^2)+al*(x(1)+x(2))];
for a=-1:.5:5
for b=-1:.5:5
[t,xa]=ode45(f,[0 10],[a b]);
plot(xa(:,1),xa(:,2),'r');
[t,xa]=ode45(f,[0 -5],[a b]);
plot(xa(:,1),xa(:,2),'r');
end
end
axis([-2 2 -2 2])
title 'Alpha'
end
```

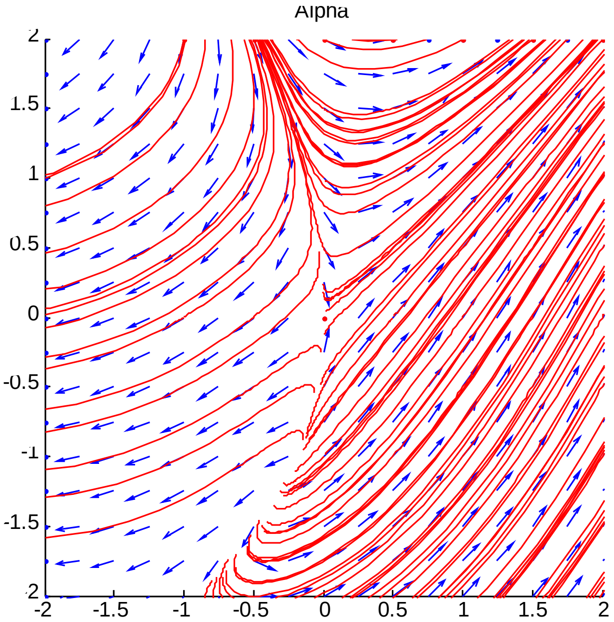
The following graphs represent the transition of System 1 to System 4

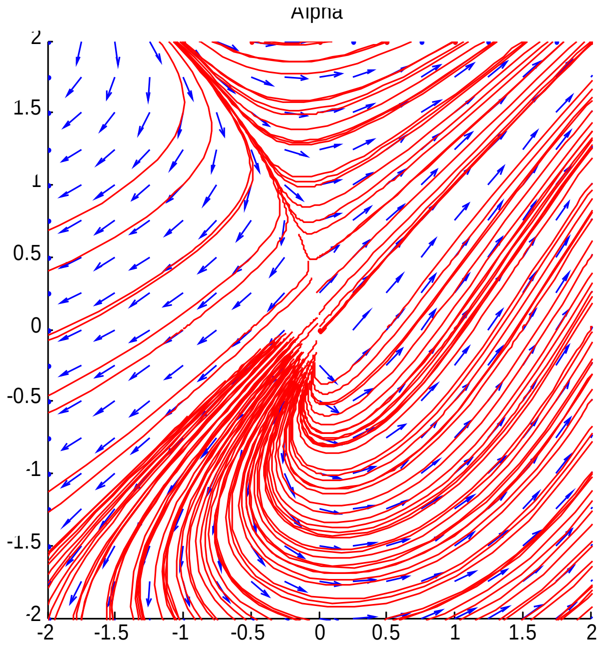

Alpha

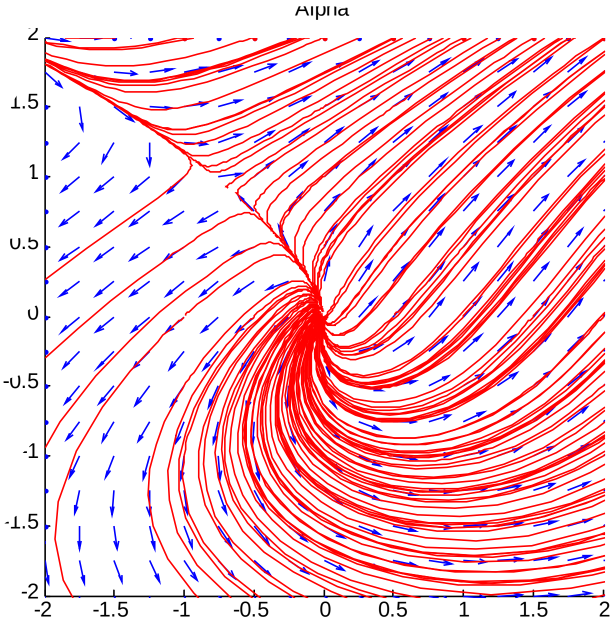

Alpha

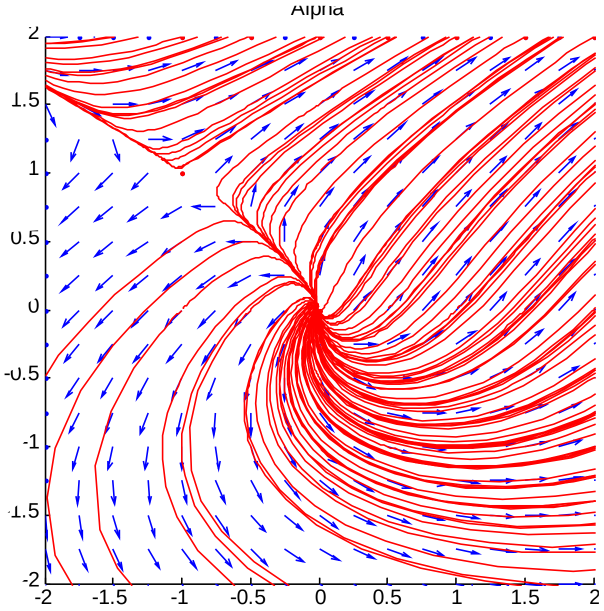

Alpha


Alpha









(I deleted the graphs that did not show much visible change)