Contents

Extra Credit Project

```
%By Ian Hall, Math 246, Section 0221 (9:00 Peng Gao), Due May 12
clear all
syms t x u
for u = -2:2
    u
    A = [2*u u-1; u+1 0]
    [xi, R] = (eig(sym(A)))
    %The trace is zero, so it can be ignored below
    p_z = x^2+det(A)
    d = -det(A)
    disp('--------------------------')
end
%The following ivp's are of the form ivp = 'Dx=(2*u)*x+(u-1)*y, Dy=(u+
%Matlab will not let me put all the following in one for loop defing u
%I had to split it up into 5 graphs.
```

```
u =

    -2


A =

    -4    -3
    -1     0


xi =

[ 2-7^(1/2), 2+7^(1/2)]
[         1,         1]



R =
```

```
[ -2+7^(1/2),          0]
[          0, -2-7^(1/2)]


p_z =

x^2-3


d =

     3

--------------------------

u =

    -1


A =

    -2    -2
     0     0


xi =

[ -1,  1]
[  1,  0]


R =

[  0,  0]
[  0, -2]


p_z =

x^2
```

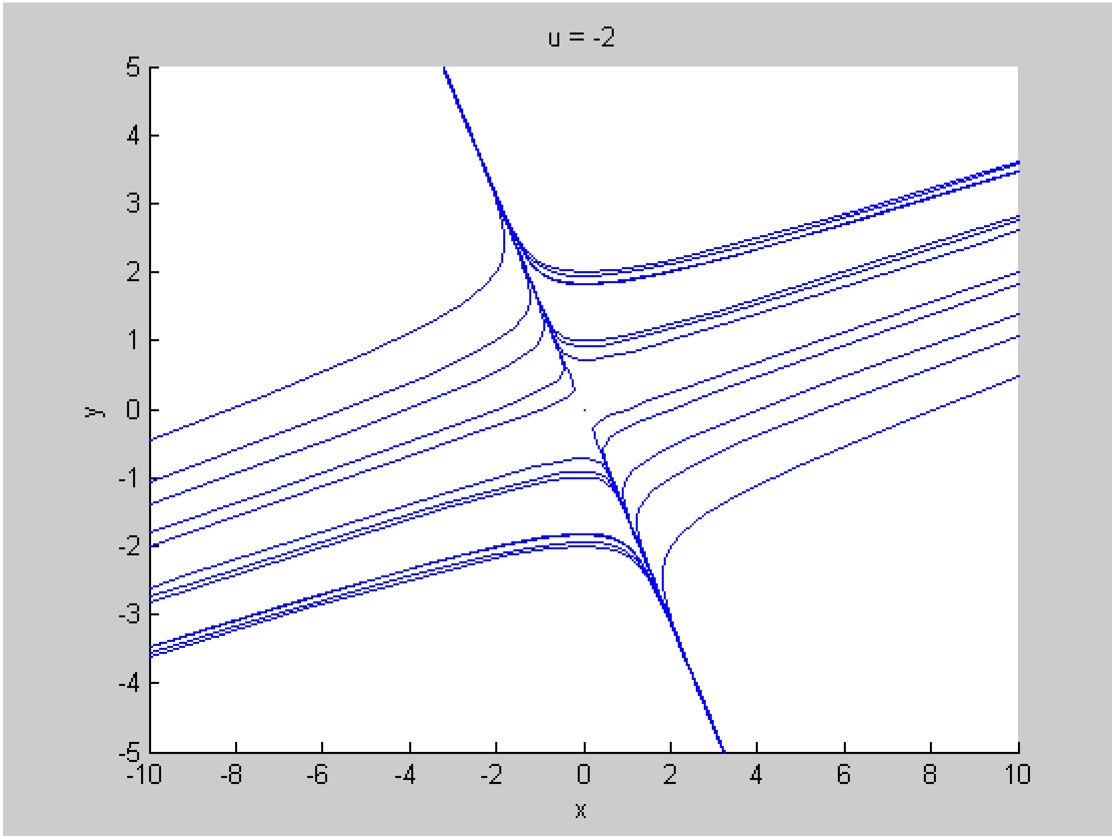
```
d =

     0

-------------------------

u =

     0


A =

     0    -1
     1     0


xi =

[          1,          1]
[ -sqrt(-1),  sqrt(-1)]



R =

[          i,          0]
[          0, -sqrt(-1)]



p_z =

x^2+1



d =

    -1

-------------------------

u =

     1
```

```
     1


A =

     2     0
     2     0


xi =

[ 1, 0]
[ 1, 1]



R =

[ 2, 0]
[ 0, 0]



p_z =

x^2



d =

     0

--------------------------

u =

     2


A =

     4     1
     3     0


xi =
```

```
[ 2/3+1/3*7^(1/2), 2/3-1/3*7^(1/2)]
[               1,               1]


R =

[ 2+7^(1/2),         0]
[         0, 2-7^(1/2)]


p_z =

x^2-3


d =

     3

--------------------------
```

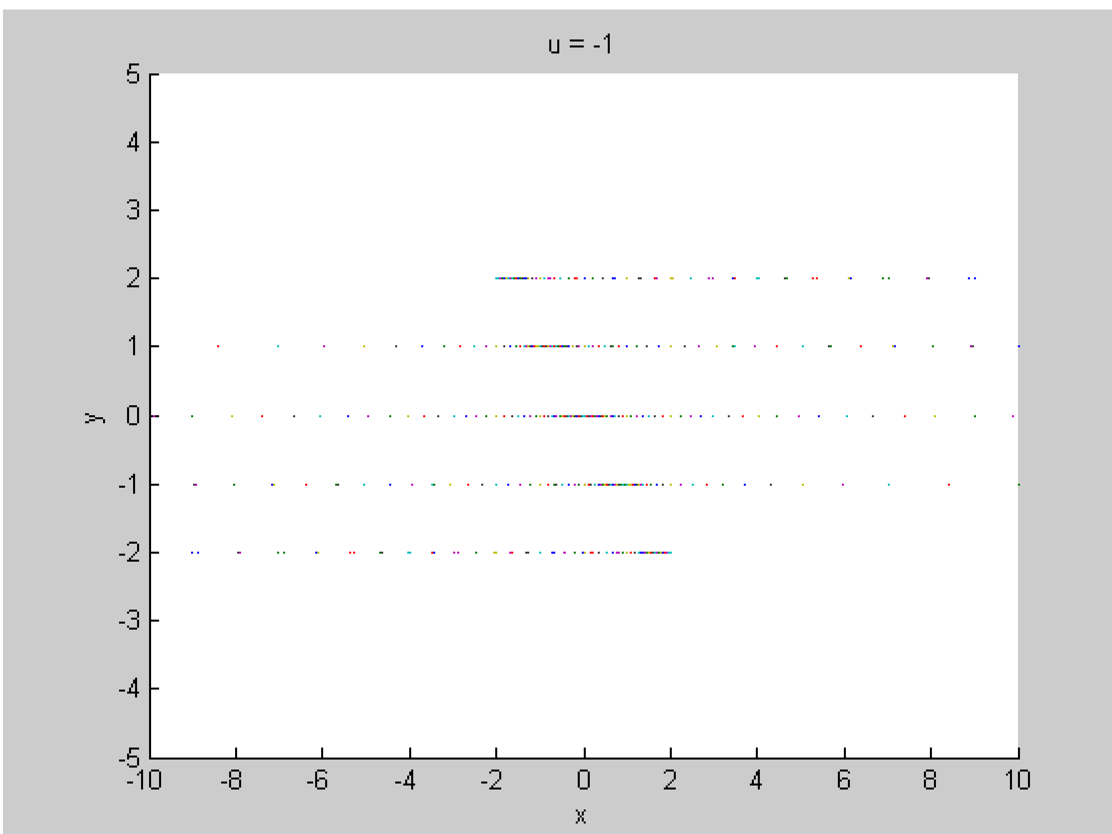
u = -2

```
ivp = 'Dx=(-4)*x+(-3)*y, Dy=(-1)*x, x(0)=a, y(0)=b';
[x, y]=dsolve(ivp, 't');
xf=@(t, a, b) eval(vectorize(x));
yf=@(t, a, b) eval(vectorize(y));
figure; hold on
t = -4:0.1:4;
for a = -2:2
    for b = -2:2
        plot(xf(t, a, b), yf(t, a, b))
    end
end
hold off
xlabel 'x'
ylabel 'y'
title 'u = -2'
axis([-10 10 -5 5])
%The characteristic of this graph is x^2-3. This has two simple real r
%(-3 and 3), which are on opposite sides of 0, so it is a saddle.  Als
%is 0 and d is positive (3), so it is a saddle.
```



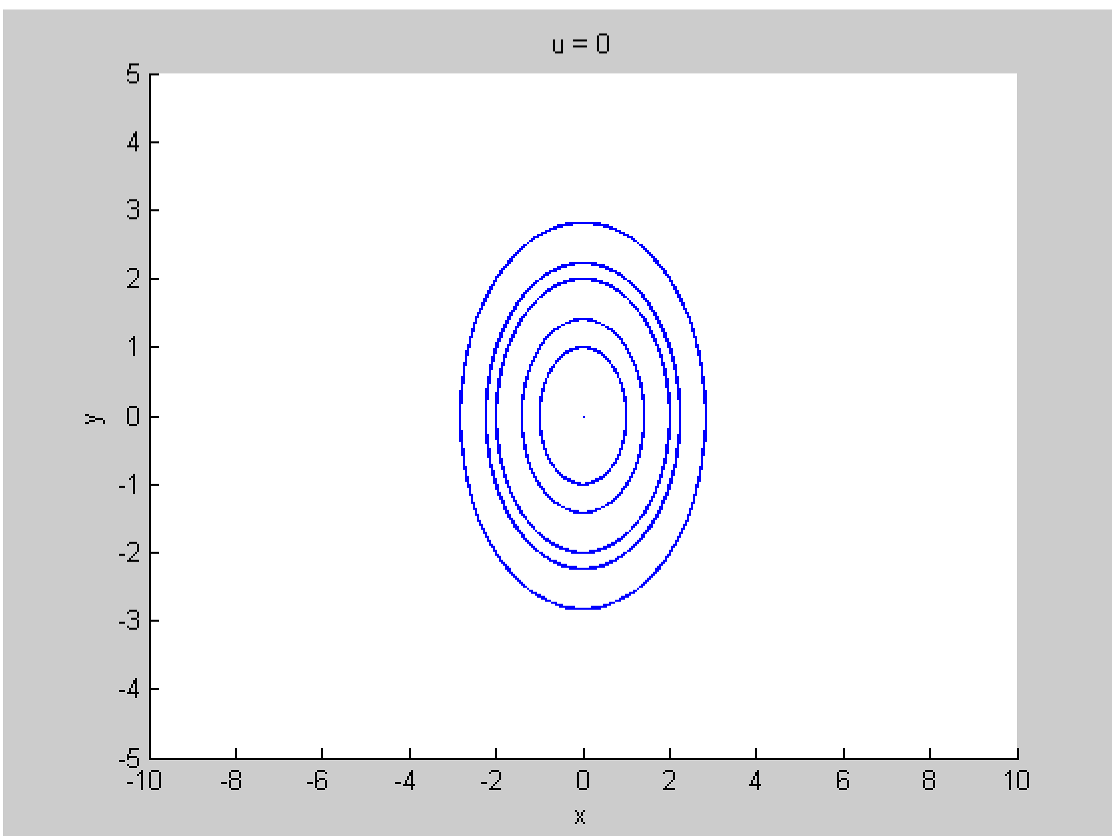
u = -1

```
ivp = 'Dx=(-2)*x+(-2)*y, Dy=(0)*x, x(0)=a, y(0)=b';
[x, y]=dsolve(ivp, 't');
xf=@(t, a, b) eval(vectorize(x));
yf=@(t, a, b) eval(vectorize(y));
figure; hold on
t = -4:0.1:4;
for a = -2:2
    for b = -2:2
        plot(xf(t, a, b), yf(t, a, b))
    end
end
hold off
xlabel 'x'
ylabel 'y'
title 'u = -1'
axis([-10 10 -5 5])
%To get the graph, we are computing Dy/Dx, which in this case turns ou
%be 0. Thus, we have a series of horizontal lines for a graph.The
%characteristic of this graph is x^2 so d is 0. This has double real r
%(0 and 0), so u is 0, and a_{12} is  negative (-2), so it is a
%counter-clockwise shear.
```



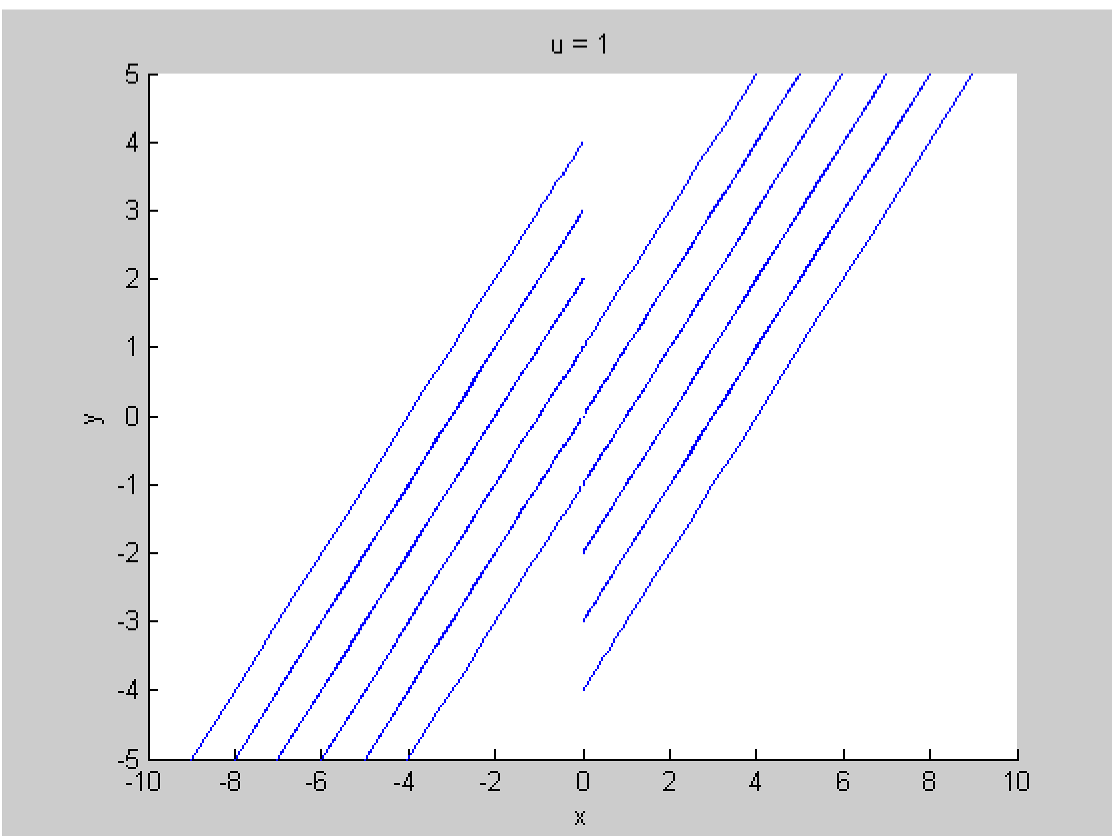
u = 0

```
ivp = 'Dx=(0)*x+(-1)*y, Dy=(1)*x, x(0)=a, y(0)=b';
[x, y]=dsolve(ivp, 't');
xf=@(t, a, b) eval(vectorize(x));
yf=@(t, a, b) eval(vectorize(y));
figure; hold on
t = -4:0.1:4;
for a = -2:2
    for b = -2:2
        plot(xf(t, a, b), yf(t, a, b))
    end
end
hold off
xlabel 'x'
ylabel 'y'
title 'u = 0'
axis([-10 10 -5 5])
%The characteristic of this graph is x^2+1 which has a conjugate pair
%roots. u is 0 and d is negative so it is a center and a_{21} is posit
%counter-clockwise center.
```



u = 1

```
ivp = 'Dx=(2)*x+(0)*y, Dy=(2)*x, x(0)=a, y(0)=b';
[x, y]=dsolve(ivp, 't');
xf=@(t, a, b) eval(vectorize(x));
yf=@(t, a, b) eval(vectorize(y));
figure; hold on
t = -4:0.1:4;
for a = -2:2
    for b = -2:2
        plot(xf(t, a, b), yf(t, a, b))
    end
end
hold off
xlabel 'x'
ylabel 'y'
title 'u = 1'
axis([-10 10 -5 5])
%To get the graph, we are computing Dy/Dx, which in this case turns ou
%be 1. Thus, we have a series of lines with a slope of 1 for a graph.T
%characteristic of this graph is x^2 so d is 0. This has double real r
%(0 and 0), so u is 0, and a_{21} is  positive (2), so it is a
%counter-clockwise shear.
```



u = 2

```
ivp = 'Dx=(4)*x+(1)*y, Dy=(3)*x, x(0)=a, y(0)=b';
[x, y]=dsolve(ivp, 't');
xf=@(t, a, b) eval(vectorize(x));
yf=@(t, a, b) eval(vectorize(y));
figure; hold on
t = -4:0.1:4;
for a = -2:2
    for b = -2:2
        plot(xf(t, a, b), yf(t, a, b))
    end
end
hold off
xlabel 'x'
ylabel 'y'
title 'u = 2'
axis([-10 10 -5 5])
%The characteristic of this graph is x^2-3. This has two simple real r
%(-3 and 3), which are on opposite sides of 0, so it is a saddle. Alsc
%is 0 and d is positive (3), so it is a saddle.
```