ECE 111 - Homework #2

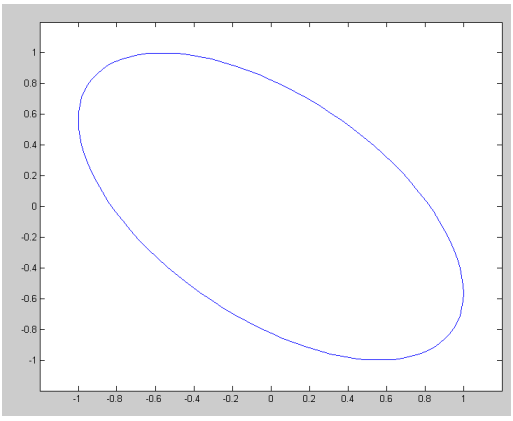
Week #2: Matlab and Trigonometry Due 8am, Tuesday, January 25th

Please submit as a Word or pdf file and email to Jacob_Glower@yahoo.com with header ECE 111 HW#2

Plot the following functions in Matlab

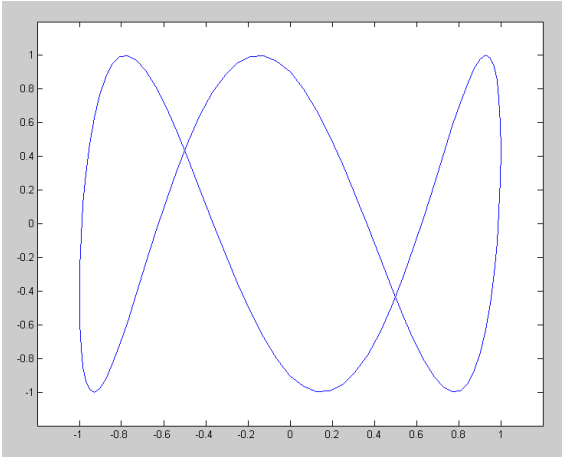
1) sine vs. cosine

```
Q = [0:0.01:1]' * 2*pi;

for i=1:1000
   X = cos(Q);
   Y = sin(Q + 0.01*i);
   plot(X,Y);
   xlim([-1.2,1.2]);
   ylim([-1.2,1.2]);
   pause(0.01);
   end
```



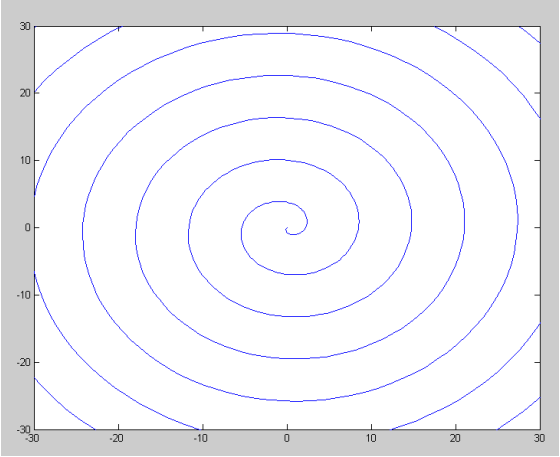
2) Lissajous Figure:

```
Q = [0:0.01:1]' * 2*pi;

for i=1:1000
   X = cos(Q);
   Y = sin(3*Q + 0.01*i);
   plot(X,Y);
   xlim([-1.2,1.2]);
   ylim([-1.2,1.2]);
   pause(0.01);
   end
```



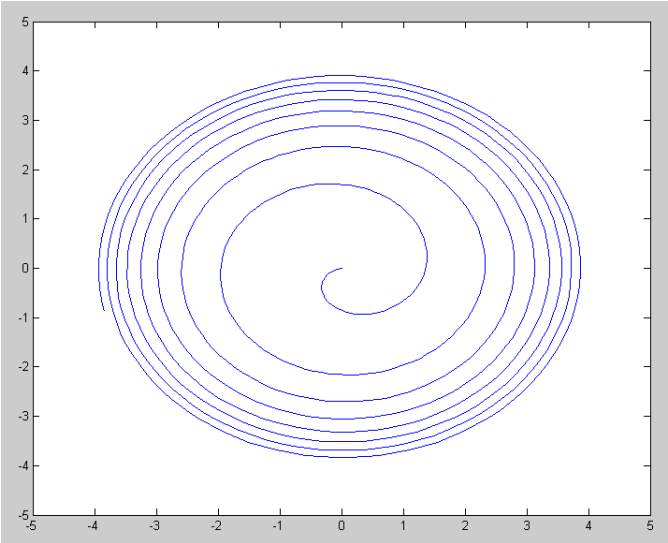
3) Linear Spiral: $r = \theta$

```
Q = [0:0.01:8]' * 2*pi;
for i=1:1000
   r = Q;
   X = r .* cos(Q + 0.05*i);
   Y = r .* sin(Q + 0.05*i);
   plot(X,Y);
   xlim([-30,30]);
   ylim([-30,30]);
   pause(0.01);
   end
```



4) Log Spiral: $r = \ln(\theta + 1)$

```
Q = [0:0.01:8]' * 2*pi;
for i=1:1000
   r = log(Q + 1);
   X = r .* cos(Q + 0.05*i);
   Y = r .* sin(Q + 0.05*i);
   plot(X,Y);
   xlim([-5,5]);
   ylim([-5,5]);
   pause(0.01);
   end
```



f(x) = 0: Newton's Method

5) Use Newton's method to find the solutions to problem #4 for homework set #1

$$y = x\cos(2x) \quad \text{and} \quad y = x^2 - 1$$

or

$$x\cos(2x) - (x^2 - 1) = 0$$

Solution near -1.6:

```
>> x1 = -2;
>> y1 = x1*cos(2*x1) - (x1^2 - 1)

y1 =   -1.6927

>> x2 = -1.5;
>> y2 = x2*cos(2*x2) - (x2^2 - 1)

y2 =    0.2350

>> x3 = x2 - (x2-x1) / (y2-y1)*y2

x3 =   -1.5610

>> y3 = x3*cos(2*x3) - (x3^2 - 1)

y3 =    0.1241

>> x4 = x3 - (x3-x2) / (y3-y2)*y3

x4 =   -1.6291

>> y4 = x4*cos(2*x4) - (x4^2 - 1)

y4 =   -0.0360

>> x5 = x4 - (x4-x3) / (y4-y3)*y4

x5 =   -1.6138

>> y5 = x5*cos(2*x5) - (x5^2 - 1)

y5 =    0.0035

>> x6 = x5 - (x5-x4) / (y5-y4)*y5

x6 =   -1.6152

>> y6 = x6*cos(2*x6) - (x6^2 - 1)

y6 =  8.3332e-005
```

answer: x = -1.6152

Solution near + 1.6:

answer: x = 0.8961

```
>> x1 = 1.6;
>> y1 = x1*cos(2*x1) - (x1^2 - 1)

y1 =   -3.1573

>> x2 = 1.7;
>> y2 = x2*cos(2*x2) - (x2^2 - 1)

y2 =   -3.5336

>> x3 = x2 - (x2-x1) / (y2-y1)*y2

x3 =    0.7609

>> y3 = x3*cos(2*x3) - (x3^2 - 1)

y3 =    0.4582

>> x4 = x3 - (x3-x2) / (y3-y2)*y3

x4 =    0.8687

>> y4 = x4*cos(2*x4) - (x4^2 - 1)

y4 =    0.1012

>> x5 = x4 - (x4-x3) / (y4-y3)*y4

x5 =    0.8993

>> y5 = x5*cos(2*x5) - (x5^2 - 1)

y5 =   -0.0118

>> x6 = x5 - (x5-x4) / (y5-y4)*y5

x6 =    0.8961

>> y6 = x6*cos(2*x6) - (x6^2 - 1)

y6 =  2.2637e-004
```

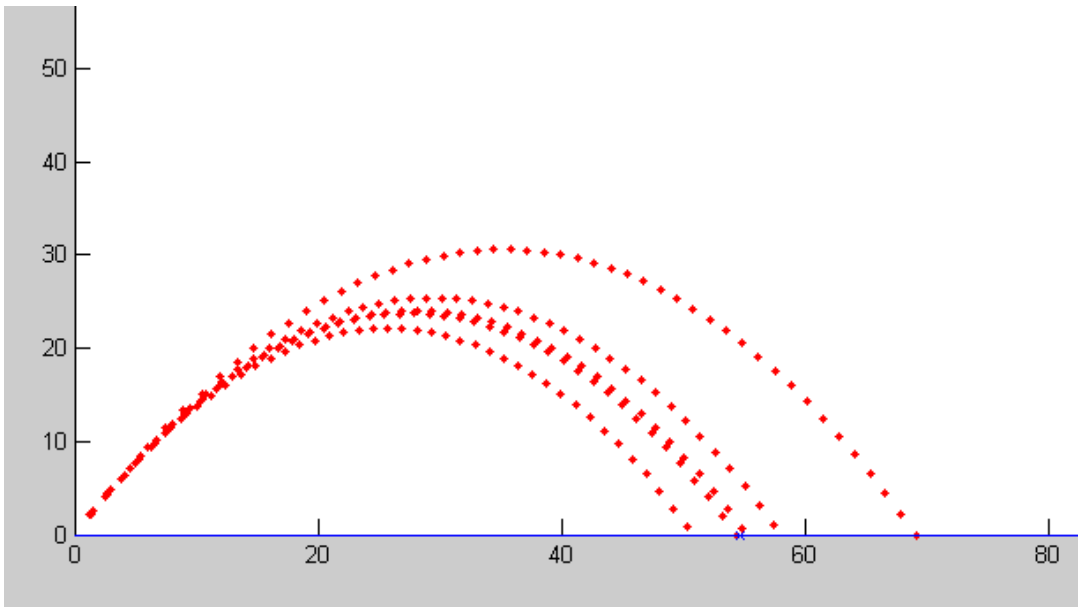
f(x) = 0: Shoot Game:

Pick a random number from 50 to 100 for your target.

Pick a random number from 30 to 70 for your firing angle

6) Use trial and error to find the initial velocity (X) to fire a tennis ball to hit the target (result is zero)

```
>> Target = 50*rand + 50

Target =   54.6428

>> Angle = 50*rand + 20

Angle =   59.2963

>> Shoot(30,Angle,Target)

ans =  -14.4655

>> Shoot(25,Angle,Target)

ans =    3.7603

>> Shoot(27,Angle,Target)

ans =   -3.4390

>> Shoot(26,Angle,Target)

ans =    0.1822

>> Shoot(26.2,Angle,Target)

ans =   -0.5389
```



7) Repeat using Newton's method to find the initial velocity (X) to fire the tenis ball to hit the target

```
>> x1 = 30;
>> y1 = Shoot(x1, Angle, Target)

y1 =  -14.4655

>> x2 = 25;
>> y2 = Shoot(x2, Angle, Target)

y2 =    3.7603

>> x3 = x2 - (x2-x1) / (y2-y1)*y2

x3 =   26.0316

>> y3 = Shoot(x3, Angle, Target)

y3 =    0.0685

>> x4 = x3 - (x3-x2) / (y3-y2)*y3

x4 =   26.0507

>> y4 = Shoot(x4, Angle, Target)

y4 = -4.7224e-004
```