CIEG 675 LAB#1 Due Monday January 11, 2021 by 5pm

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```
close all;
clear all;
```

Part (1)

```
%Make a row vector that starts at 1 and ends at 10 with spacing of
 0.02.
rv_1_1 = 1:0.02:10; %Define starting point, spacing and end point
```

Part (2)

```
%Make a 3x3 2D matrix that has the numbers 1 through 9 for entries.

%First way
%If we want the entries to increase by rows
rv_2_1 = [1:3;4:6;7:9]; %Simple "manual" way, where we define each
 entry
%If we want the entries to increase by columns
rv_2_2 = rv_2_1'; %Transpose of previous matrix

%Alternatively (Second way)
rv_2_3 = 1:9; %Define temporary variable with number from 1 to 9
```

```
%If we want the entries to increase by columns
rv_2_4 = reshape(rv_2_3,3,3); %Reshape previous variable into a 3x3
 matrix
%If we want the entries to increase by rows
rv_2_5 = rv_2_4' %Take transpose of previous matrix
```

```
rv_2_5 =

     1     2     3
     4     5     6
     7     8     9
```

Part (3)

```
%Define a variable from question 2 data that consists of the diagonal
 elements. (multiple ways to do this, explore)
%First way
rv_3_1 = [rv_2_1(1,1) rv_2_1(2,2) rv_2_1(3,3)]; %Simple picking of
 desired elements

%Second way
rv_3_2 = diag(rv_2_1)'; %Built-in function provides the diagonal
 elements of a given matrix. Transpose to get a row vector

%Third way
rv_3_3 = diag(rv_2_1.*eye(3,3))'; %Element-wise multiplication in
 identity matrix to isolate diagonal elements. Use of "diag" to get
 elements in a vector (transpose for line vector)

%Fourth way
temp = reshape(rv_2_1,1,9); %Reshape 3x3 matrix into a 1x9 vector
rv_3_4 = temp(1:4:9) %Take advantage of the relative position of the
 diagonal elements - Use spacing of 4
```

```
rv_3_4 =

     1     5     9
```

Part (4)

```
%Define a second variable from question 2 data that consists of the
 elements in the corners of the matrix.
%First way
rv_4_1 = [rv_2_1(1,1) rv_2_1(1,end) rv_2_1(end,1)
 rv_2_1(end,end)]; %Simple picking of desired elements

%Second way
temp = [1 0 1].*rv_2_1.*[1;0;1]; %Isolate the desired elements and so
 that all others are zeros
```

```
rv_4_3 = find(temp ~= 0)'; %Find the non-zero elements, which are the
 corner elements of the initial matrix

%Third way
temp = [1 0 1; 0 0 0; 1 0 1].*rv_2_1; %Isolate the desired elements
 and so that all others are zeros
rv_4_4 = find(temp ~= 0)' %Find the non-zero elements, which are the
 corner elements of the initial matrix
```

```
rv_4_4 =

     1     3     7     9
```

Part (5)

```
%Define a third variable from question 2 data that consists of the
 middle row.

rv_5_1 = rv_2_1(round(end/2),:) %Isolate only the middle row
```

```
rv_5_1 =

     4     5     6
```

Part (6)

```
%Define a fourth variable from question 2 data that consists of the
 last column.

rv_6_1 = rv_2_1(:,end) %Isolate only the last column
```

```
rv_6_1 =

     3
     6
     9
```

Part (7)

```
%Given the following threebathymetry data sets develop a single
 variable comprised of them that is a 3D matrix, with size 2x2x3.
Survey1 = [1 2; 3 4]; % survey 1
Survey2 = [5 6; 7 8]; % survey 2
Survey3 = [9 10; 11 12]; % survey 3

rv_7_1(:,:,1) = Survey1; %Define the first "layer" of the 3D matrix as
 the survey 1
```

```
rv_7_1(:,:,2) = Survey2; %Define the second "layer" of the 3D matrix
 as the survey 2
rv_7_1(:,:,3) = Survey3; %Define the third "layer" of the 3D matrix as
 the survey 3
rv_7_1
```

```
rv_7_1(:,:,1) =

     1     2
     3     4


rv_7_1(:,:,2) =

     5     6
     7     8


rv_7_1(:,:,3) =

     9    10
    11    12
```

Part (8)

```
%Define a variable that has entries extending from 1 to 8 and then
 also includes entries extending from 15 through 24.

rv_8_1 = [1:8 15:24] %First we include the entries from 1 to 8 and
 then append to that the entries from 15 to 24
```

```
rv_8_1 =

  Columns 1 through 13

     1     2     3     4     5     6     7     8    15    16    17
 18    19

  Columns 14 through 18

    20    21    22    23    24
```

Part (9)

```
%Make a time vector that extends from 0:100 by ¼ s intervals.
 (Suppress output)
rv_9_1 = 0:1/4:100; %Define starting point, increment and last point
```

Part (10)

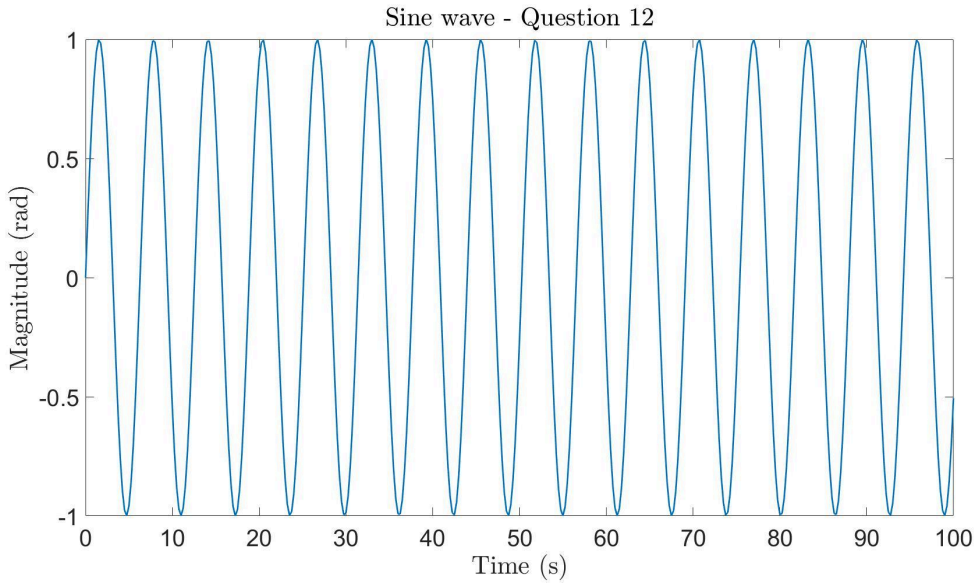
```
%Make a column vector that extends from-30 to 30 by increments of 0.2.
 (Suppress output)
rv_10_1 = [-30:0.2:30]'; %Define starting point, increment, last point
 and use transpose to get a column vector
```

Part (11)

```
%Make a column vector that goes from 100 to 0 in descending order.
 (Suppress output)
rv_11_1 = [100:-1:0]; %Define starting point, negative increment and
 last point
```

Part (12)

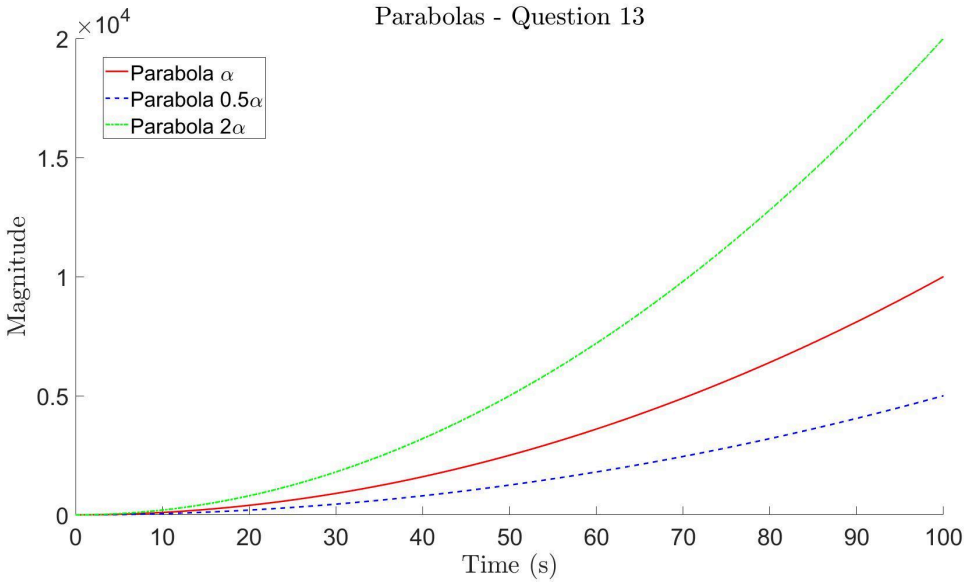
```
%Make a sine wave of your choice and plot it as a function of time (or
 you can use the sine wave from question 5).

t_vector = rv_9_1; %Use the time vector from Question 9
rv_12_1 = sin(t_vector); %Use the sin built-in function to calculate
 the sine of the time vector elements in radians
figure(1) %Create new figure with the number (1)
f1 = plot(t_vector,rv_12_1,'linewidth',2); %Plot the sine vector wrt
 the time vector and use a line width of 2
title('Sine wave - Question
 12','fontsize',12,'interpreter','latex') %Define the title of the
 figure, change the font size to 12 and set interpreter to Latex
 (optional)
xlabel('Time (s)','fontsize',12,'interpreter','latex') %Define the
 horizontal axis label of the figure, change the font size to 12 and
 set interpreter to Latex (optional)
ylabel('Magnitude (rad)','fontsize',12,'interpreter','latex') %Define
 the vertical axis label of the figure, change the font size to 12 and
 set interpreter to Latex (optional)
%Increase your figure pixel resolution and font sizes
Gx = gcf;
Gx.Position(3:4) = Gx.Position(3:4)*5;
Ax = gca;
Ax.FontSize = Ax.FontSize *3;
```



Part (13)

```
%Make a parabola of your choice (?=??2) and plot it.  Then overlay two
 more parabolas on the same axes using 0.5?and 2?.
%Change the Color and LineType for each. Add a legend to the plot.

t_vector = rv_9_1; %Use the time vector from Question 9
a = 1; %Define the alpha of our choice
rv_13_1 = a*t_vector.^2; %Initial parabola
rv_13_2 = 0.5*a*t_vector.^2; %Parabola with 0.5*a
rv_13_3 = 2*a*t_vector.^2; %Parabola with 2*a

figure(2) %Create new figure with the number (2)
hold on; %Use "hold on" to plot all three parabolas on the same plot
plot(t_vector,rv_13_1,'r-','linewidth',2); %Plot the first parabola
 (a) vector wrt the time vector and use a line width of 2
plot(t_vector,rv_13_2,'b--','linewidth',2); %Plot the second parabola
 (0.5a) vector wrt the time vector and use a line width of 2
plot(t_vector,rv_13_3,'g-.','linewidth',2); %Plot the third parabola
 (2a) vector wrt the time vector and use a line width of 2
title('Parabolas - Question
 13','fontsize',12,'interpreter','latex') %Define the title of the
 figure, change the font size to 12 and set interpreter to Latex
 (optional)
xlabel('Time (s)','fontsize',12,'interpreter','latex') %Define the
 horizontal axis label of the figure, change the font size to 12 and
 set interpreter to Latex (optional)
ylabel('Magnitude','fontsize',12,'interpreter','latex') %Define the
 vertical axis label of the figure, change the font size to 12 and set
 interpreter to Latex (optional)
legend('Parabola \alpha','Parabola 0.5\alpha','Parabola
 2\alpha','location','best')
%Increase your figure pixel resolution and font sizes
```

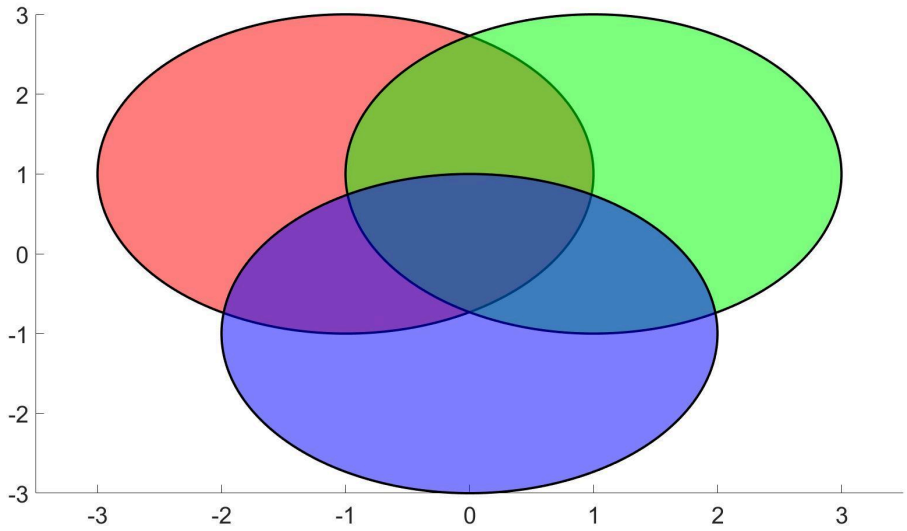
```
Gx = gcf;
Gx.Position(3:4) = Gx.Position(3:4)*5;
Ax = gca;
Ax.FontSize = Ax.FontSize *3;
```



Part (14)

```
%Write commands to generate the figure shown below.
%You may not use any built in matlabfunction for generating circles.
 You are likely to need some other functions though.
%Perhaps fliplr, fill, and the attribute facealpha might help.  The
 circle centers are at (-1,1), (1,1), and (0,-1).
%The radius is 2.  The linewidth is 3.

t_vector = 0:0.01:2*pi; %Angles from 0 to 360 deg
radius_14 = 2; %Definition of radius as a variable to make the code
 robust to changes

%First, we will create the three circle polygons
%Circle #1 - center (-1,1)
c1_x = -1; %Definition of x-coordinate of first circle center as a
 variable to make the code robust to changes
c1_y = 1; %Definition of y-coordinate of first circle center as a
 variable to make the code robust to changes
%We will use polar coordinates to create the circles
x1 = c1_x + radius_14*cos(t_vector); %X-coordinates of the points of
 the first circle derived from the polar coordinates
y1 = c1_y + radius_14*sin(t_vector); %Y-coordinates of the points of
 the first circle derived from the polar coordinates

%Circle #2 - center (1,1)
c2_x = 1; %Definition of x-coordinate of second circle center as a
 variable to make the code robust to changes
```

```
c2_y = 1; %Definition of y-coordinate of second circle center as a
 variable to make the code robust to changes
%We will use polar coordinates to create the circles
x2 = c2_x + radius_14*cos(t_vector); %X-coordinates of the points of
 the second circle derived from the polar coordinates
y2 = c2_y + radius_14*sin(t_vector); %Y-coordinates of the points of
 the second circle derived from the polar coordinates

%Circle #3 - center (0,-1)
c3_x = 0; %Definition of x-coordinate of third circle center as a
 variable to make the code robust to changes
c3_y = -1; %Definition of y-coordinate of third circle center as a
 variable to make the code robust to changes
%We will use polar coordinates to create the circles
x3 = c3_x + radius_14*cos(t_vector); %X-coordinates of the points of
 the third circle derived from the polar coordinates
y3 = c3_y + radius_14*sin(t_vector); %Y-coordinates of the points of
 the third circle derived from the polar coordinates

figure(3) %Create new figure with the number (3)
hold on; %Use "hold on" to plot all three circles on the same plot
fill(x1,y1,'r','linewidth',3) %Plot the first circle, fill in the
 inside with the desired color (red) and set line width to 3
fill(x2,y2,'g','linewidth',3) %Plot the second circle, fill in the
 inside with the desired color (green) and set line width to 3
fill(x3,y3,'b','linewidth',3) %Plot the third circle, fill in the
 inside with the desired color (blue) and set line width to 3
alpha(0.5) %Set Transparency for All Graphics Objects to half (0.5)
axis([-3.5 3.5 -3 3]) %Define manually the axes limits to match the
 ones in the given plot
%Increase your figure pixel resolution and font sizes
Gx = gcf;
Gx.Position(3:4) = Gx.Position(3:4)*5;
Ax = gca;
Ax.FontSize = Ax.FontSize *3;
```



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