

# INTRODUCTION TO MATLAB GRAPHS

ECE516E – ANTENNA & RADIO WAVE PROPAGATION

Thursday, 18 February 2021

# TO DISPLAY A BASIC LINE GRAPH

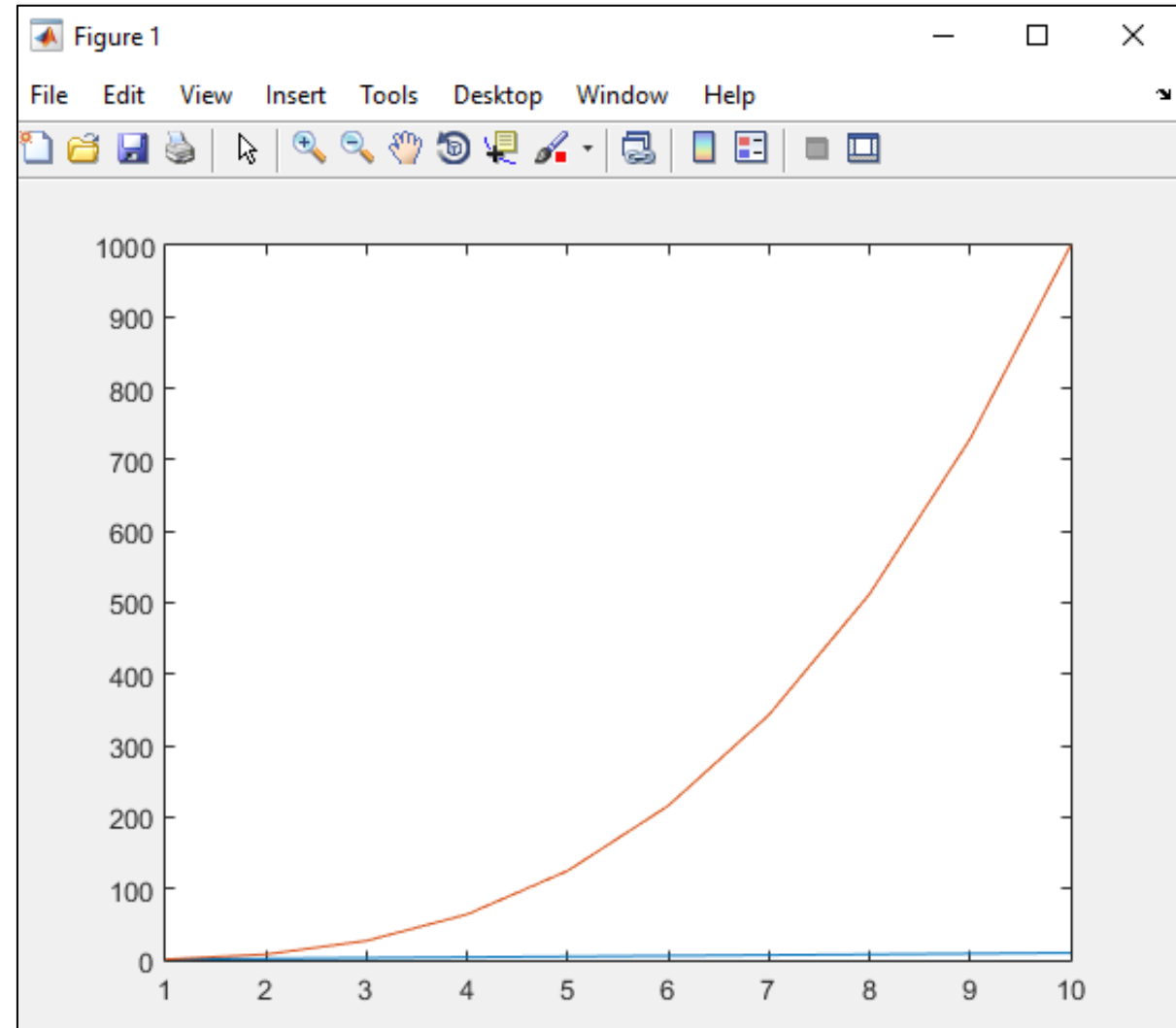
To display a line graph of function  $y = x^3$

Enter

```
x = [1 2 3 4 5 6 7 8 9 10];
```

```
y = x.^3;
```

```
plot(x,y)
```



# TO PLOT A CIRCLE

## Objectives:

- To plot a circle centred at the point (4,3) with a radius equal to 2.
- To use axis equal to use equal data units along each coordinate direction.

## Objective

**$r = 2;$**

**$x_c = 4;$**

**$y_c = 3;$**

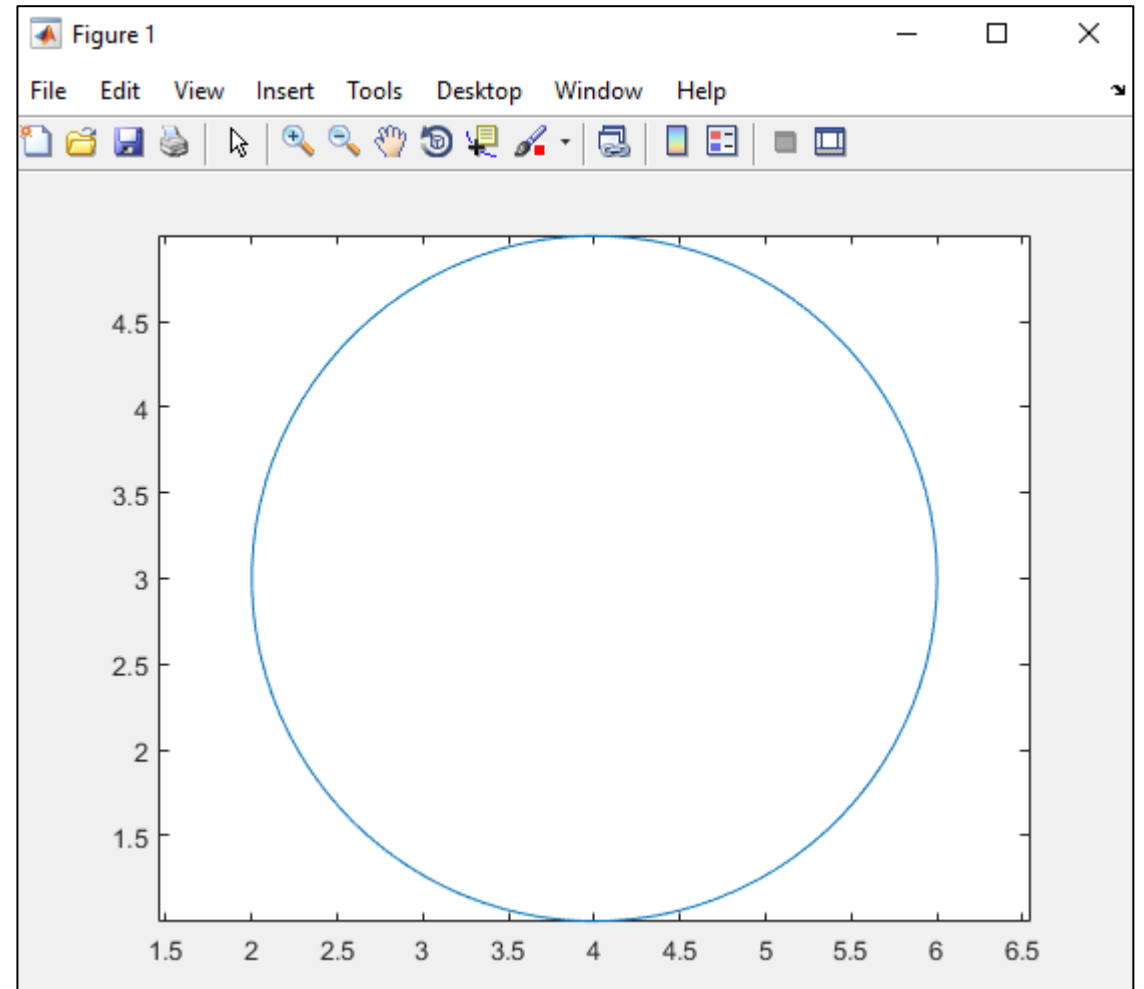
**$\theta = \text{linspace}(0, 2 * \pi);$**

**$x = r * \cos(\theta) + x_c;$**

**$y = r * \sin(\theta) + y_c;$**

**$\text{plot}(x, y)$**

**$\text{axis equal}$**



# PLOT SINGLE LINE GRAPH OF SINUSOIDAL FUNCTION

$$Y(n) = \sin\left(\frac{2\pi n}{100}\right) \text{ for } n = 0, 2, \dots, 100$$

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## Steps:

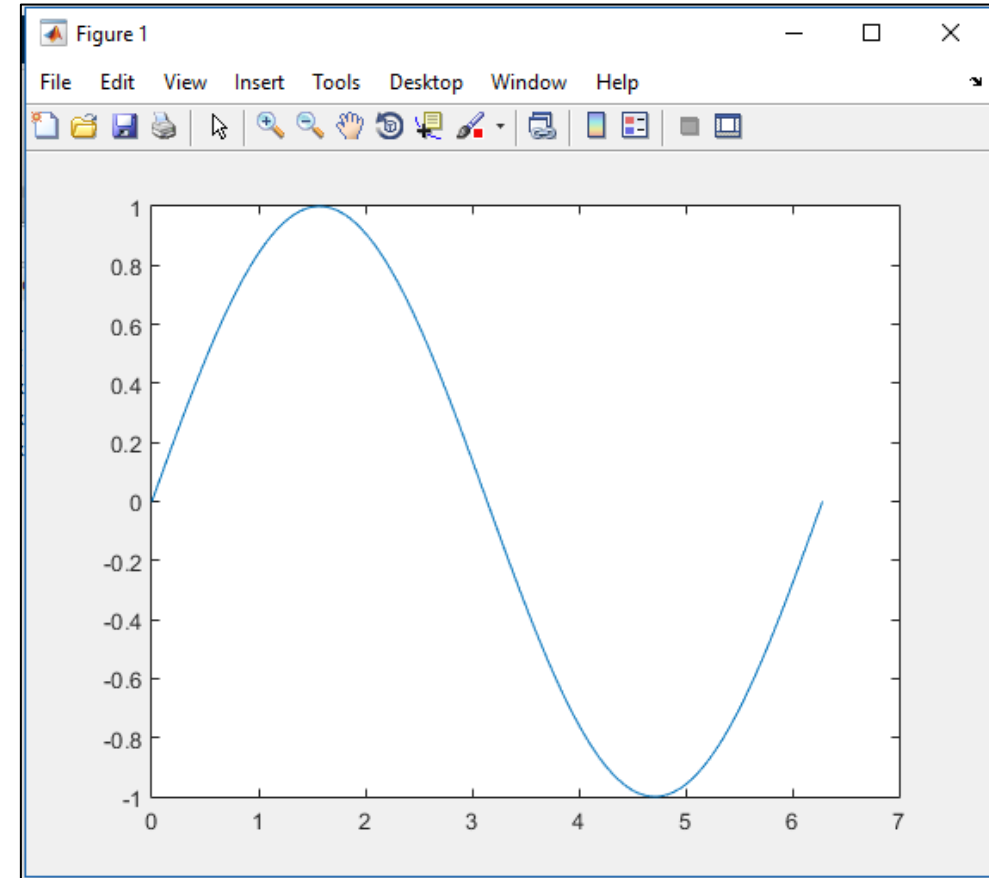
1. Create  $x$  as a vector of linearly spaced values between  $0$  and  $2\pi$  using increment of  $\frac{\pi}{100}$ .
  2. Set  $y(n) = \sin(x(n))$
  3. Plot  $y(n)$  against  $x(n)$
- 

## Matlab Code:

```
x = 0 : pi/100 : 2*pi;
```

```
y = sin(x);
```

```
Plot(x,y)
```



# PLOT MULTIPLE LINE GRAPH OF FUNCTIONS:

Plot the function:

$$y_1(n) = \cos\left(\frac{2\pi n}{100}\right) \text{ and } y_2(n) = \sin\left(\frac{2\pi n}{100}\right)$$

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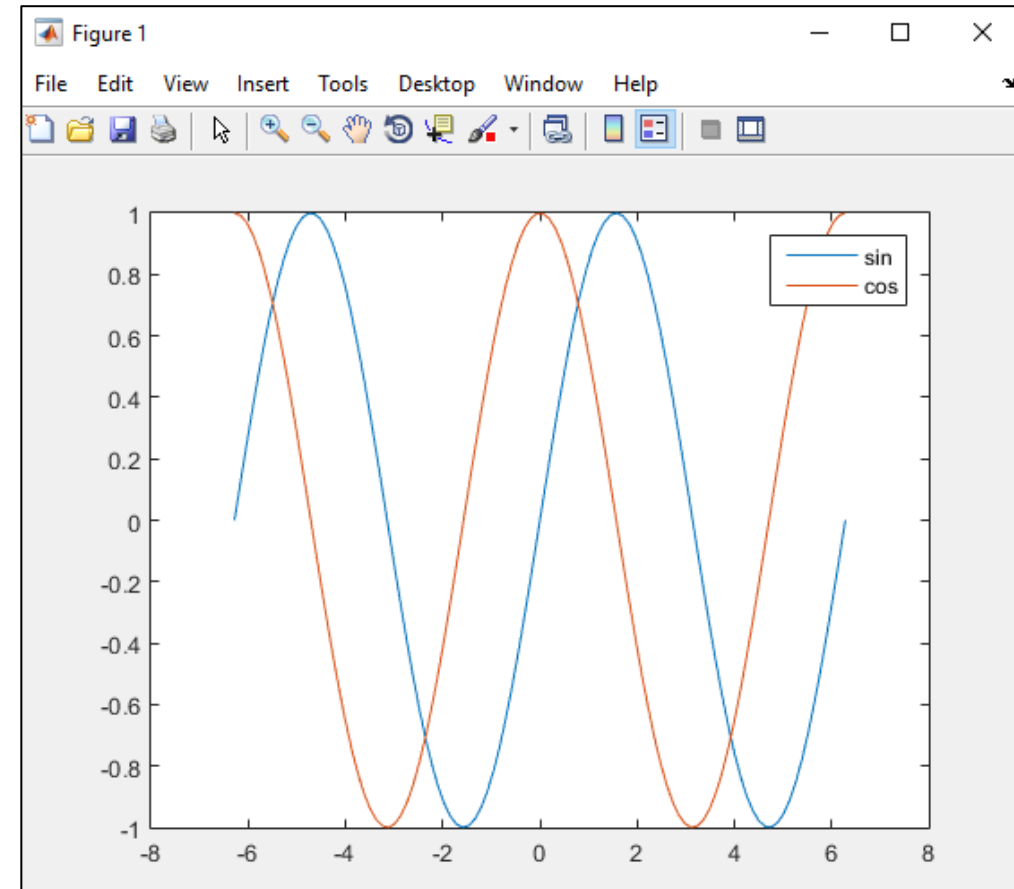
## Steps:

1. Define  $x(n)$  as 100 linearly spaced values between  $-2\pi$  and  $2\pi$ .
2. Define  $y_1(n)$  and  $y_2(n)$  as sine and cosine values of  $x(n)$ .
3. Plot  $y_1(n)$  and  $y_2(n)$  against  $x(n)$

---

## Matlab Code

```
x = linspace(-2*pi,2*pi);  
y1 = sin(x);  
y2 = cos(x);  
plot(x,y1,x,y2)
```



# PLOT LINE GRAPH FROM A SINGLE MATRIX

## Problem:

Define  $y$  as the 8-by-8 matrix returned by the **magic** function and plot.

## Enter

**Y = magic(8)**

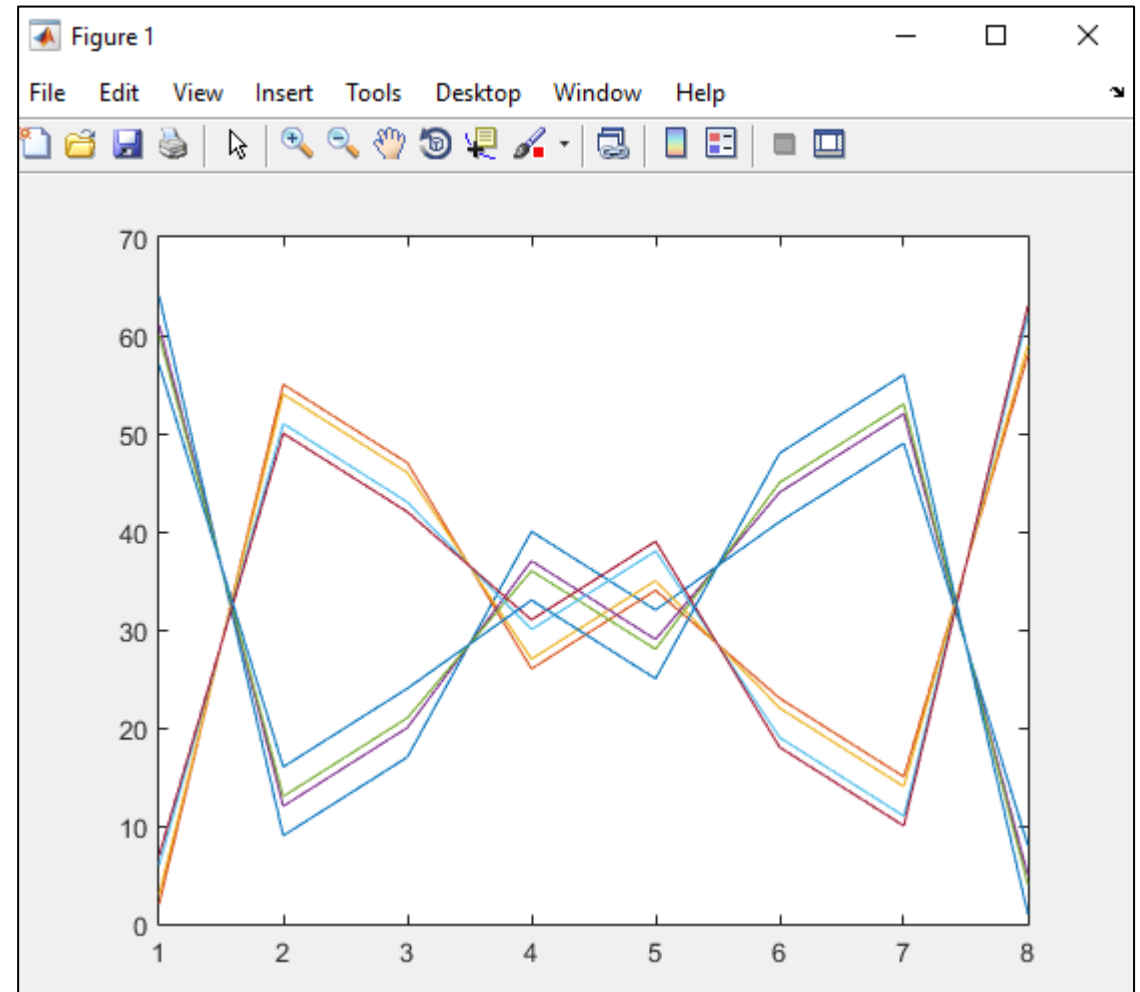
**Plot(Y)**

```
>> Y = magic(8)
```

```
Y =
```

64	2	3	61	60	6	7	57
9	55	54	12	13	51	50	16
17	47	46	20	21	43	42	24
40	26	27	37	36	30	31	33
32	34	35	29	28	38	39	25
41	23	22	44	45	19	18	48
49	15	14	52	53	11	10	56
8	58	59	5	4	62	63	1

```
>> plot(Y)
```



# PLOTTING USING LINE STYLES

## Steps:

1. Plot three sine curves with a small phase shift between each line.
2. Use the default line style for the first line.
3. Specify a dashed line style for the second line
4. Specify a dotted line style for the third line.

## Enter

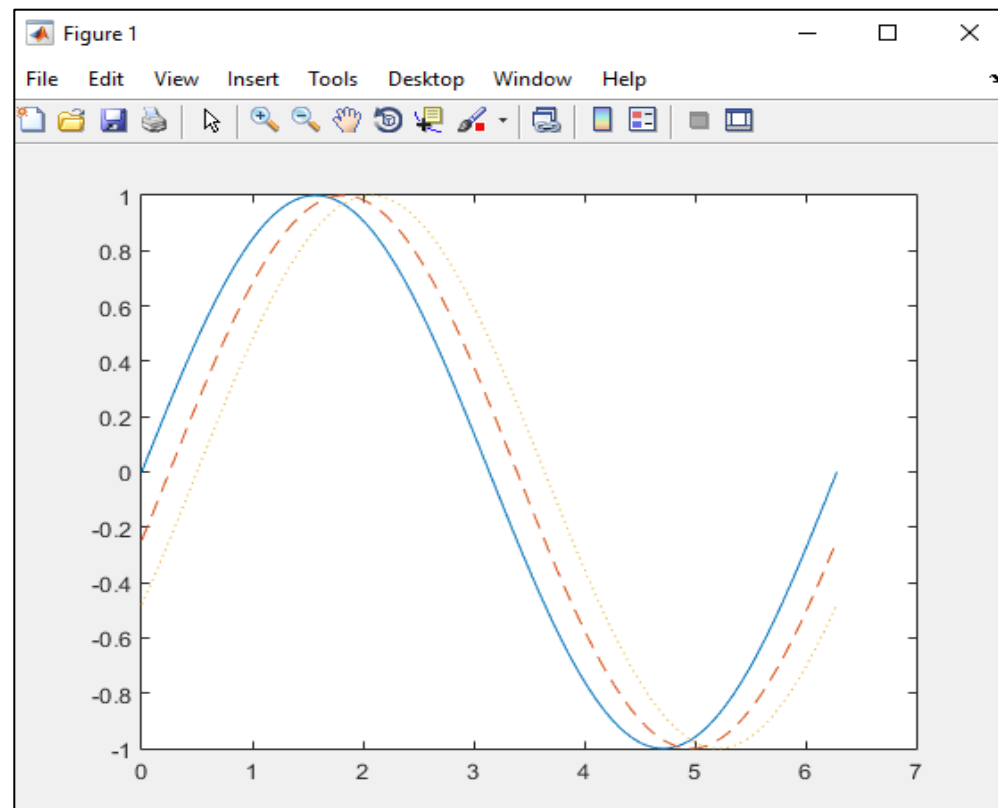
```
x = 0:pi/100:2*pi;
```

```
y1 = sin(x);
```

```
y2 = sin(x-0.25);
```

```
y3 = sin(x-0.5);
```

```
plot(x,y1,x,y2,'--',x,y3,':')
```



# PLOTTING USING LINE STYLE, COLOUR & MARKER

## Steps

- Plot three sine curves with a small phase shift between each signal.
- Use a red line with no markers for the first sine curve.
- Use a blue dashed line with circle markers for the second sine curve.
- Use only cyan star markers for the third sine curve.

## Matlab Code

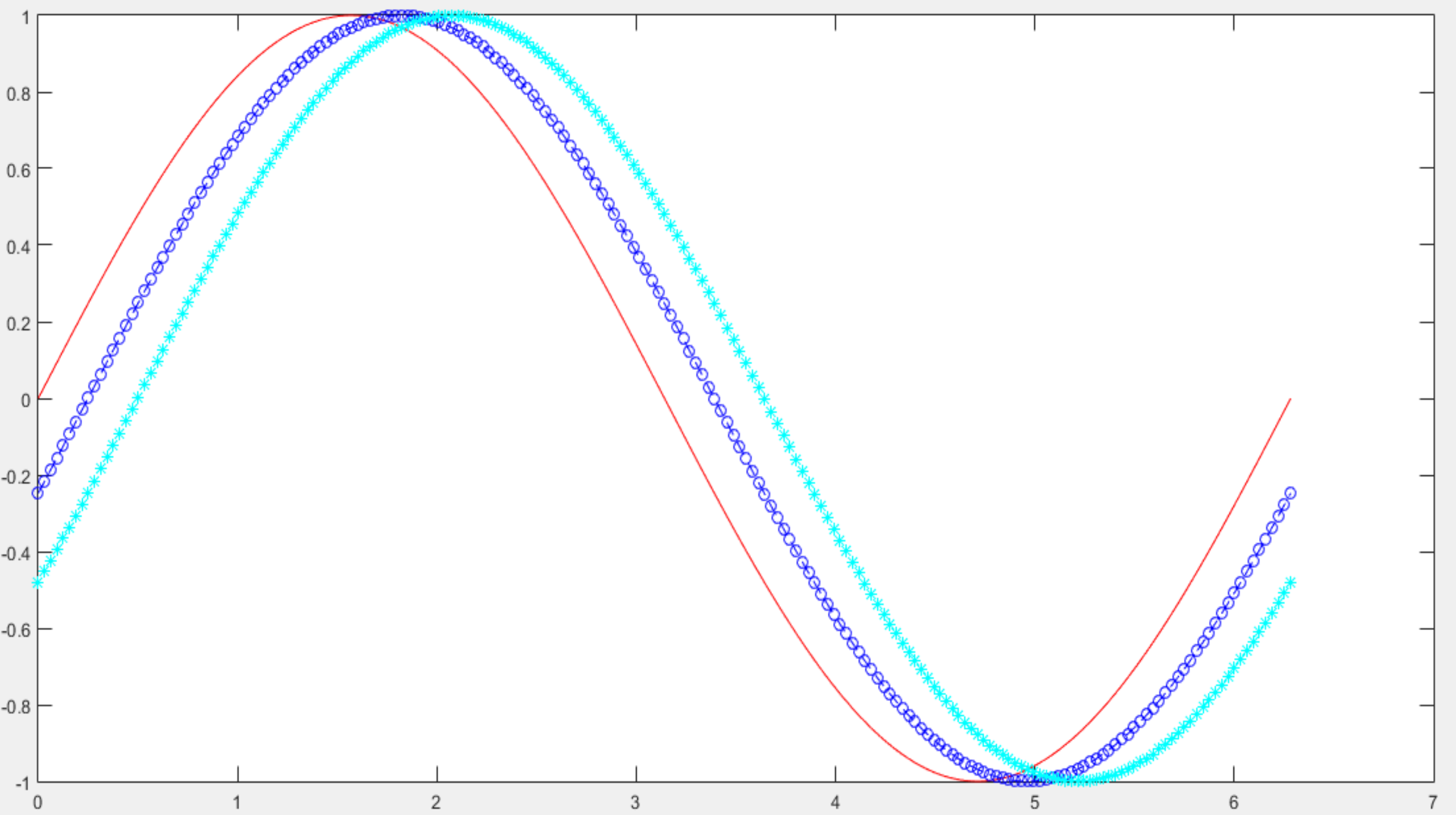
```
x = 0 : pi/10 : 2*pi;
```

```
y1 = sin(x);
```

```
y2 = sin(x-0.25);
```

```
y3 = sin(x-0.5);
```

```
plot(x,y1,'r',x,y2,'b--o',x,y3,'c*')
```



# ADDING TITLE AND AXIS LABELS

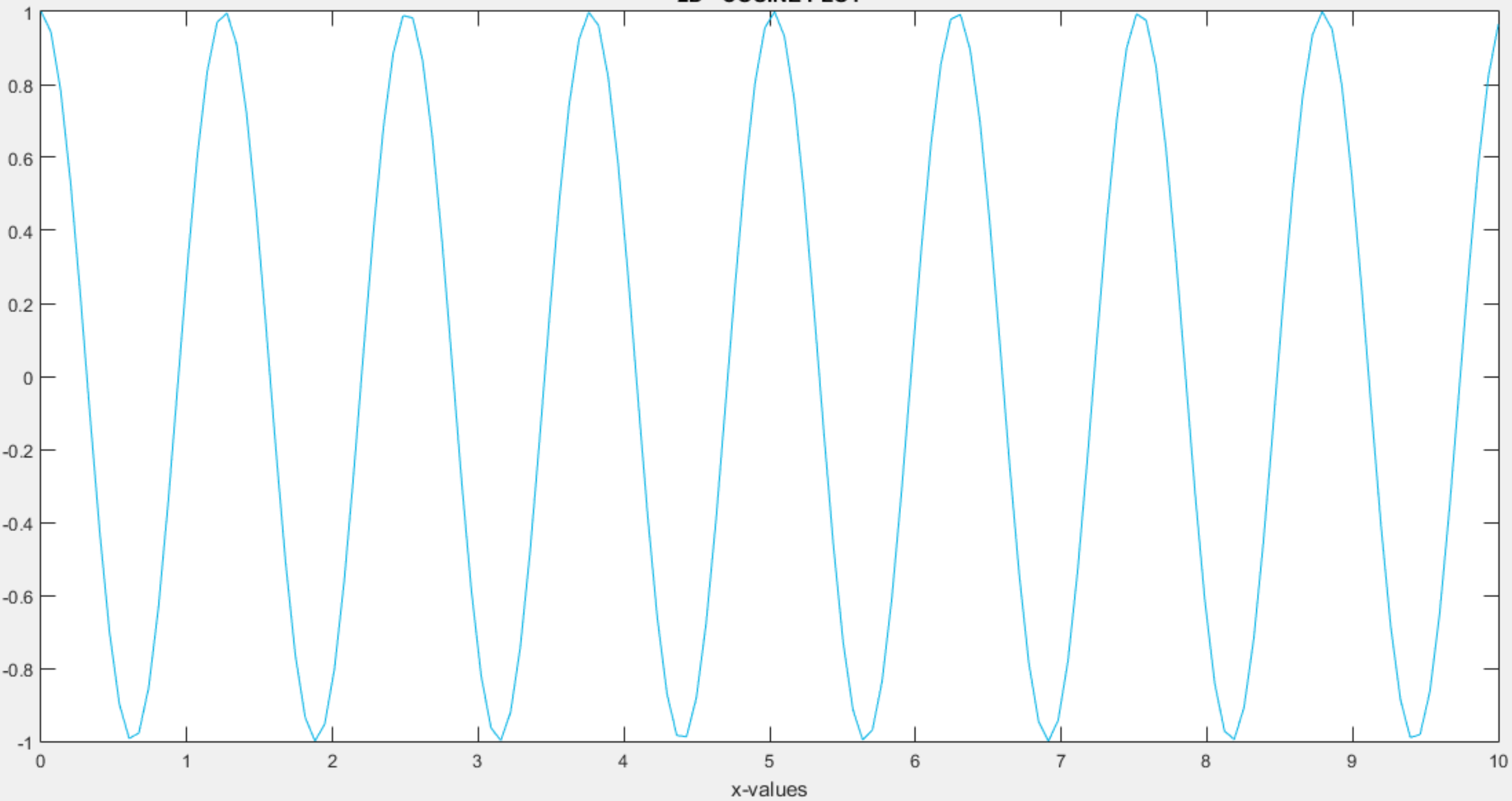
## Objective:

- Use the linspace function to define x as a vector of 150 values between 0 and 10. Define y as cosine values of x.
- Create a 2-D line plot of the cosine curve.
- Change the line colour to a shade of blue-green using an RGB colour value.
- Add a title and axis labels to the graph using the title, xlabel, and ylabel functions.

## MATLAB CODE:

```
x = linspace(0,10,150);  
y = cos(5*x);  
plot(x,y,'Color',[0,0.7,0.9]);  
title('2-D Cosine Plot');  
xlabel('x-values');  
ylabel('cos(5x)')
```

2D - COSINE PLOT



# 3D PLOTS

- Set  $\mathbf{x(n)}$  with 50 values between  $\mathbf{0}$  and  $\mathbf{10\pi}$ .
- Set  $\mathbf{st(n)}$  and  $\mathbf{ct(n)}$  as vectors of sine and cosine of  $\mathbf{x(n)}$
- Use **plot3** function to display graph.
- Label axes; insert title; and turn on grid.

## ENTER

```
t = 0:pi/50:10*pi;
```

```
st = sin(t);
```

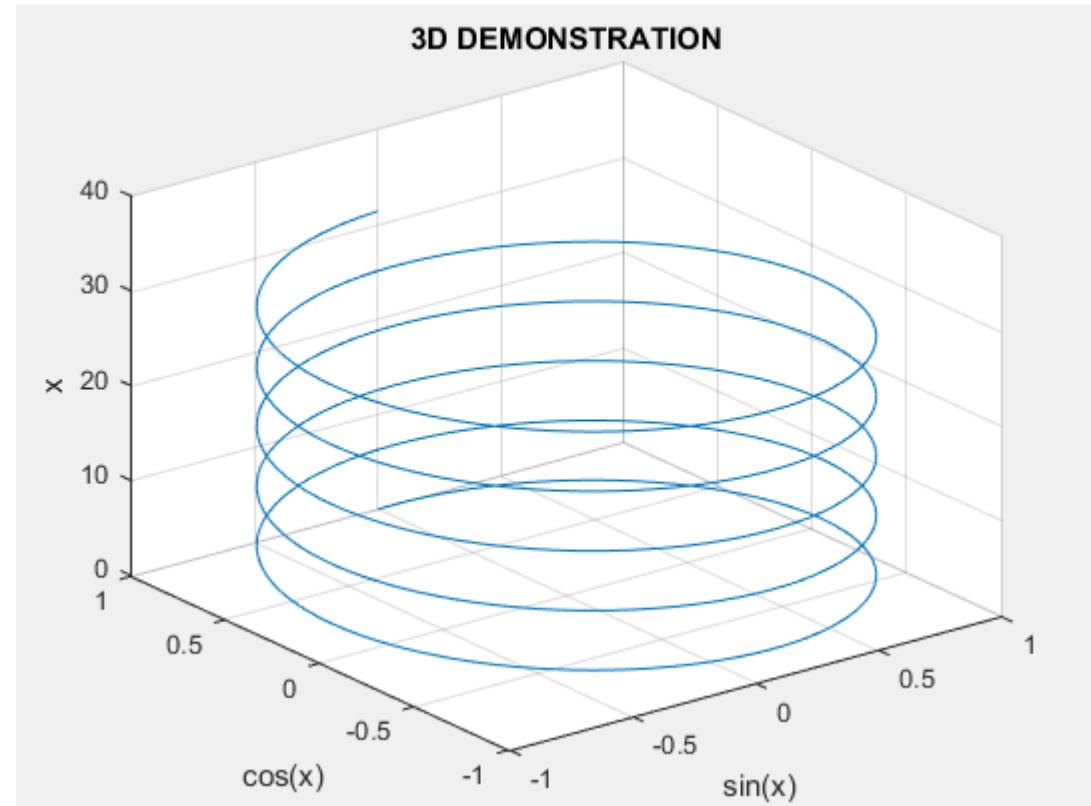
```
ct = cos(t);
```

```
plot3(st, ct, t);
```

```
xlabel('sin(t)');
```

```
ylabel('cos(t)');
```

```
title('3D DEMONSTRATION')
```



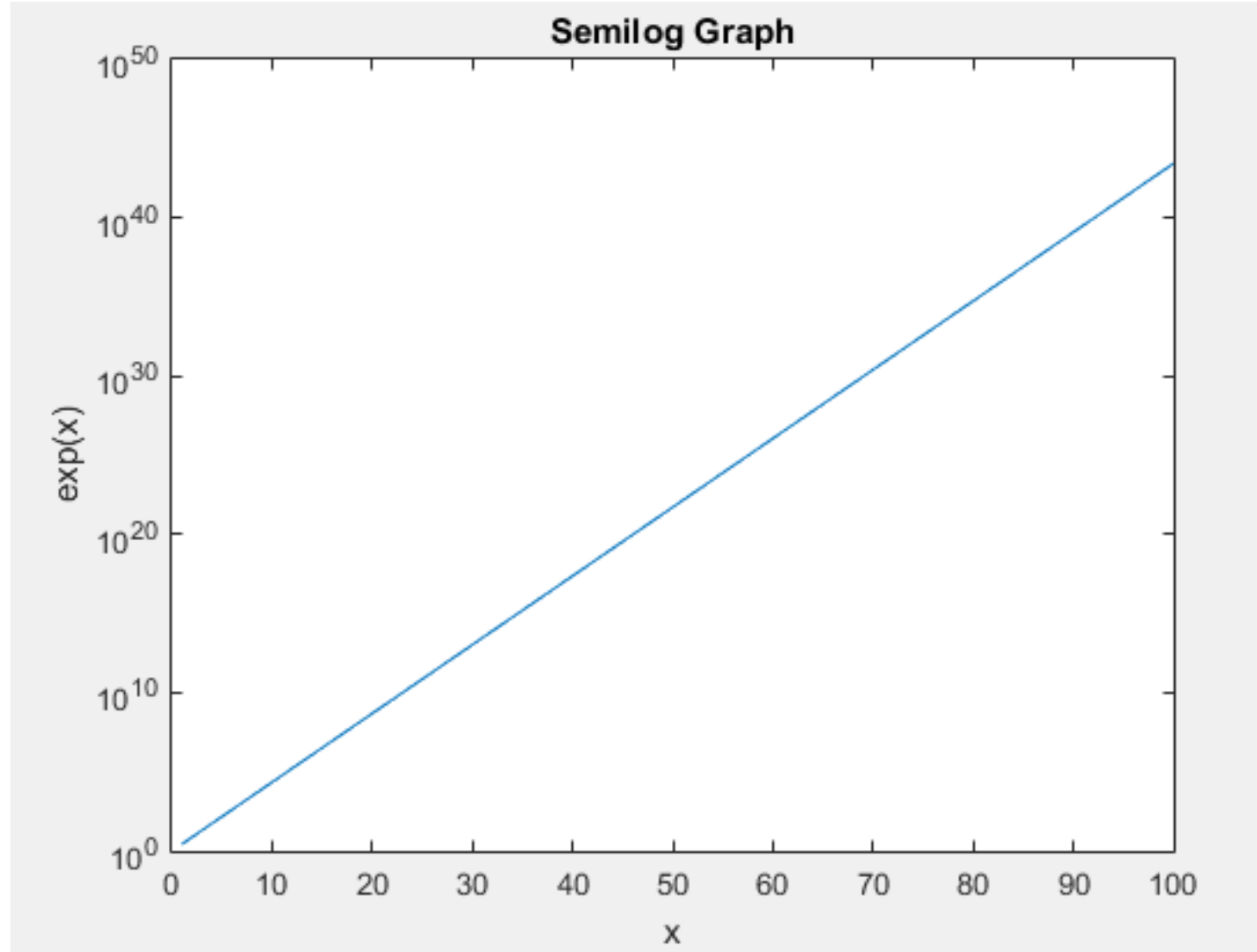
# SEMILOG GRAPH

## Problem

1. Set  $x(n)$  with values 1,2, ... 100
2. Set  $y(n) = e^{x(n)}$
3. Plot  $y(n)$  against  $x(n)$

## MATLAB CODE

```
x = 1:100;  
y = exp(x);  
Semilogy(x,y);  
xlabel('x');  
ylabel('exp(x)');  
title('Semilog Graph')
```



# LOG-LOG GRAPH

## STEPS

1. Generate  $x(n) = 1, 2, \dots, 100$
2. Set  $y(n) = x(n)^3$
3. Plot  $y(n)$  against  $x(n)$  on a log-log graph
4. Label the axis and insert title

## MATLAB CODE

```
x=1:100;
```

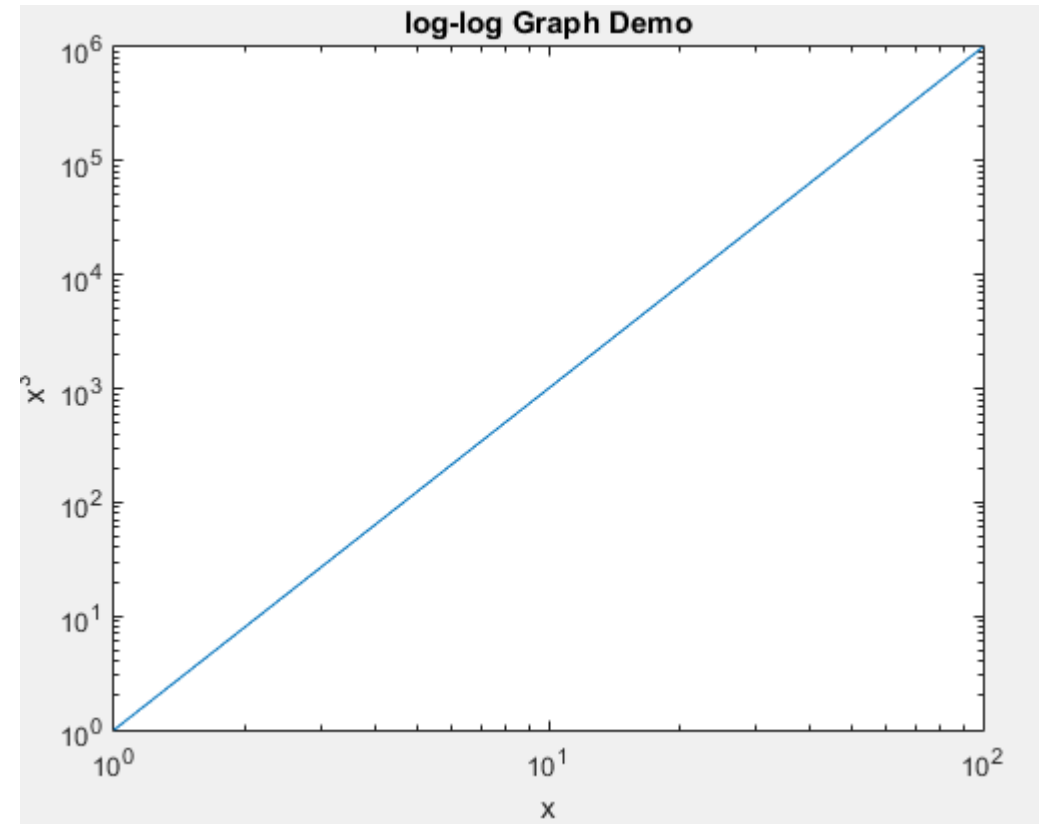
```
y=x.^3;
```

```
loglog(x,y)
```

```
xlabel('x');
```

```
ylabel('x^3');
```

```
title('log-log Graph Demo')
```



# SURF PLOTS

**surf(X,Y,Z)** plots the values in matrix Z as heights above a grid in the x-y plane defined by X and Y.

**Z** is used for the colour data, so colour is proportional to height.

## ENTER

```
x = 1:0.5:10;
```

```
y = 1:20
```

```
[X,Y] = meshgrid(x,y);
```

```
Z = sin(X) + cos(Y);
```

```
C = X.*Y;
```

```
surf(X,Y,Z,C)
```

```
colorbar
```

