ENGINEERING MATHEMATICS-I
MATLAB

Department of Science and Humanities

MATLAB – Plotting

- To plot the graph of a function, we need to take the following steps:
- Define **x**, by specifying the **range of values** for the variable **x**, for which the function is to be plotted.
- Define the function, **y = f(x).** Call the **plot** command, as **plot(x, y).**
- The **plot** command is used to create two-dimensional plots.
- Following example would demonstrate the concept.
- Let us plot the function $y = 3.5^{-0.5x}\cos(6x)$ for $-2 \leq x \leq 4$.

MATLAB – Plotting, Continued…

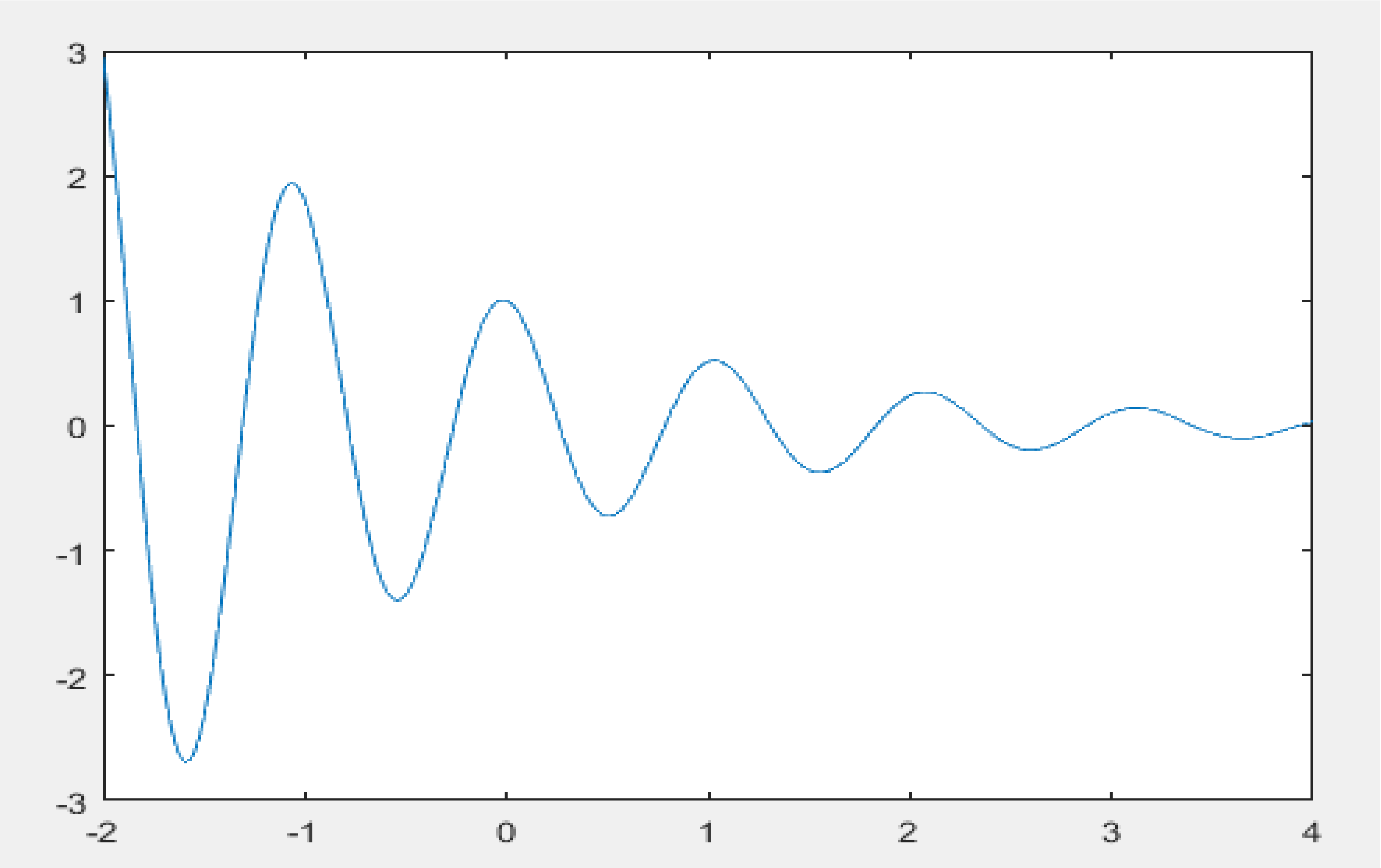
- The script file is as follows:

```
>> x=[-2:0.01:4];     (Here 0.01 is the spacing value)
>> y=3.5.^(-0.5*x).*cos(6*x);
>> plot(x,y)
```

- Here y is plotted as a function of x.

MATLAB – Plotting, Continued…

- When we run the file, MATLAB displays the following plot:



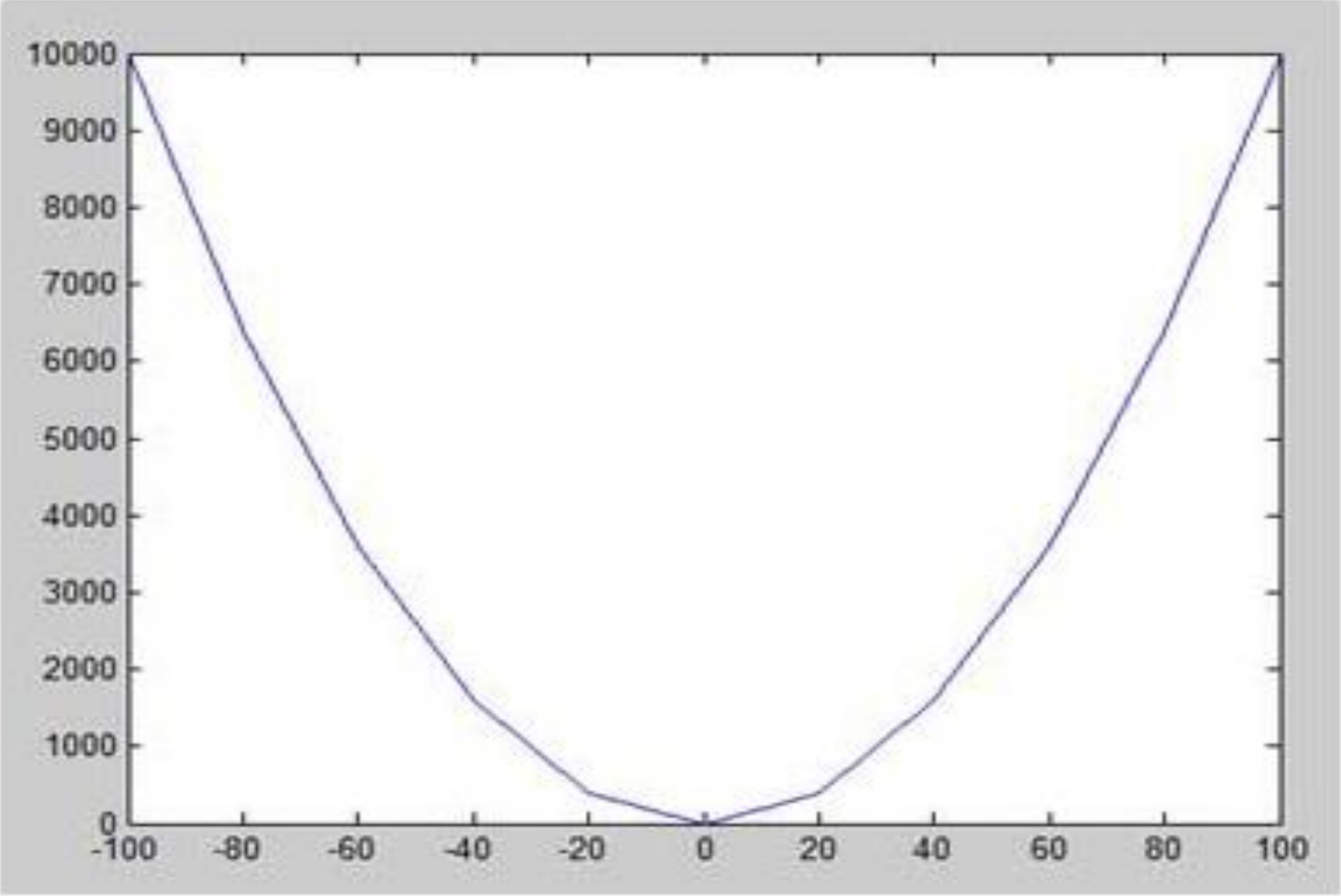
MATLAB – Plotting, Continued…

- Let us take another example to plot the function $y = x^2$.
- In this example, we will draw two graphs with the same function, but in second time, we will reduce the value of increment.
- Note that as we decrease the increment, the graph becomes smoother.
- The script file is as follows:

```
>> x = [-100:20:100];
>> y = x.^2;
>> plot(x, y)
```

MATLAB – Plotting, Continued…

- When we run the file, MATLAB displays the following plot:



MATLAB – Plotting, Continued…

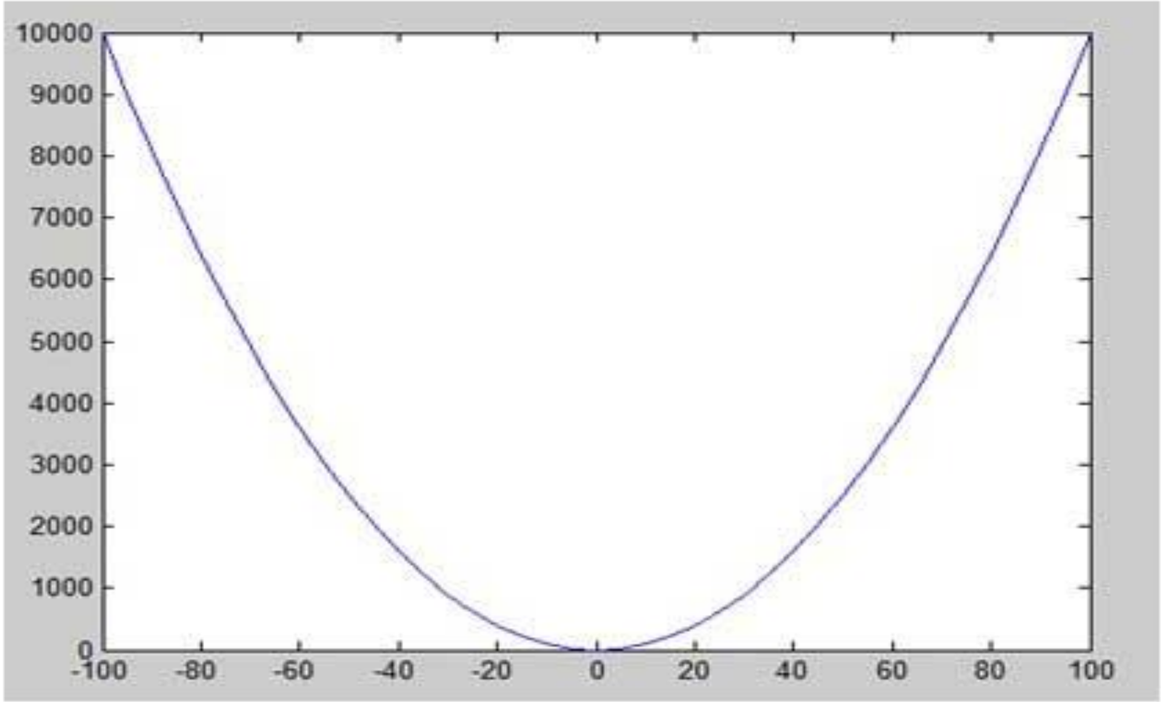
Change the code file a little, reduce the increment to 5.

```
>> x = [-100:5:100];

>> y = x.^2;

>> plot(x, y).
```

When you run the file, MATLAB displays the following plot:



MATLAB - Three Dimensional Plots

- Three-dimensional plots display a surface defined by a function in two variables, $g = f(x, y)$.
- To define the function $g = f(x, y)$, we first create a set of (x, y) points over the domain of the function using the **meshgrid** command. Next, we assign the function itself. Finally, we use the **surf** command to create a surface plot.

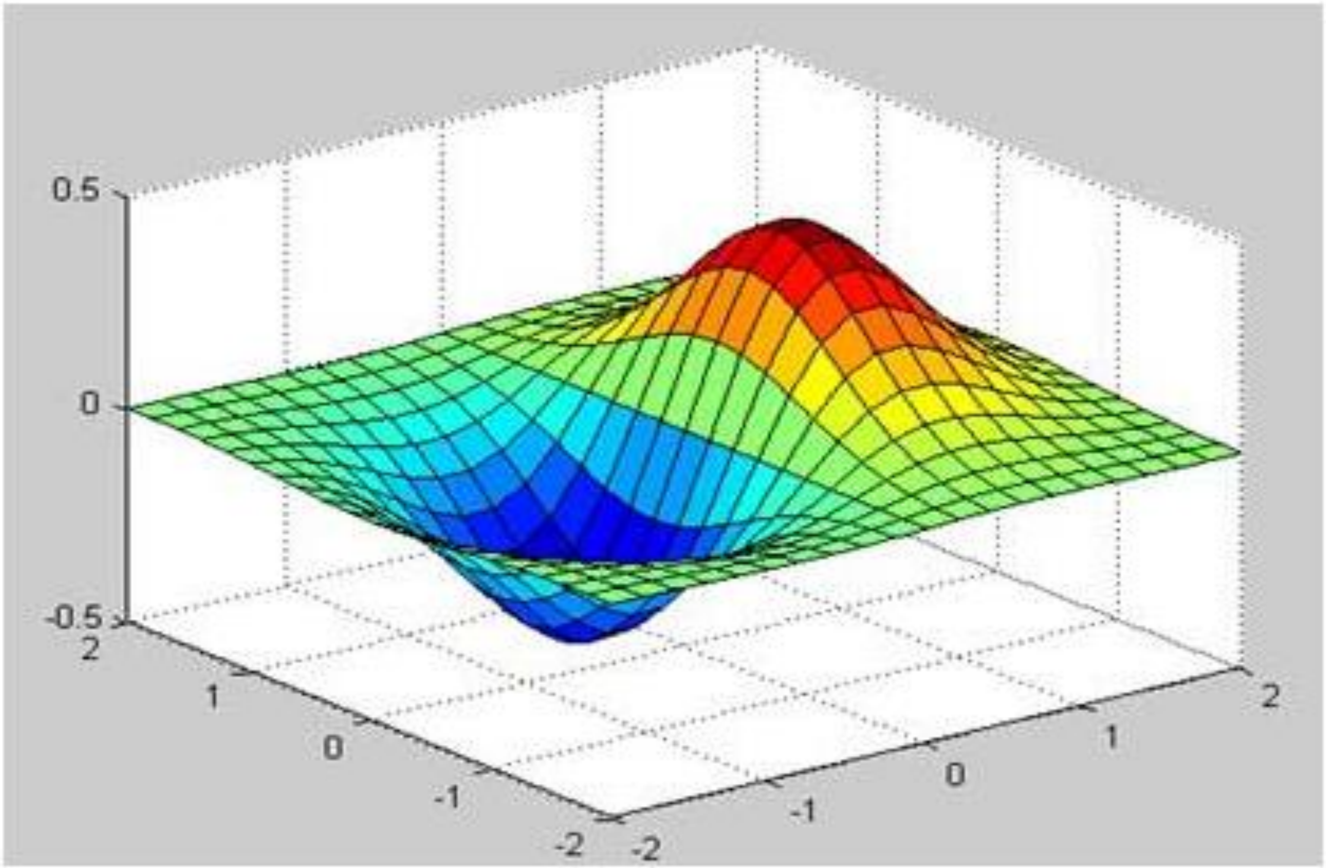
MATLAB - Three Dimensional Plots, Continued…

- The following example demonstrates the concept:
- Let us create a 3D surface map for the function $z = xe^{-(x^2+y^2)}$
- The script file is as follows:

```
>> [x,y] = meshgrid(-2:.2:2);
>> z = x.* exp(-x.^2 - y.^2);
>> surf(x,y,z)
```

MATLAB - Three Dimensional Plots, Continued…

- When we run the file, MATLAB displays the following 3-D map:



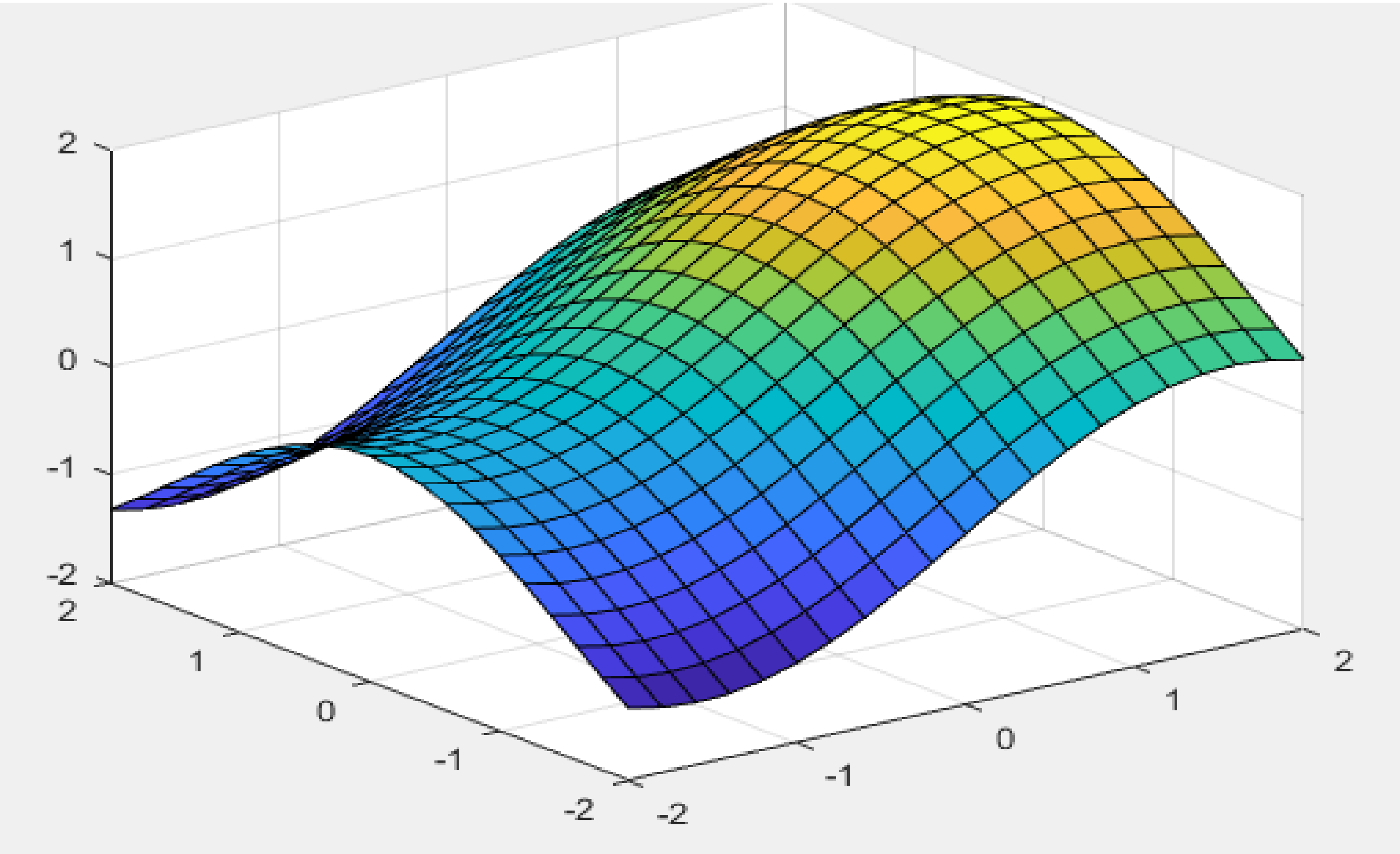
MATLAB - Three Dimensional Plots, Continued…

- Let us consider another example to create a 3D surface map for the function $z = \sin x + \cos y$
- The script file is as follows:

```
>> [x,y] = meshgrid(-2:.2:2);
>> z=sin(x)+cos(y);
>> surf(x,y,z)
```

MATLAB - Three Dimensional Plots, Continued…

- When we run the file, MATLAB displays the following 3-D map:



MATLAB - Three Dimensional Plots, Continued…

- Let us consider another example to create a 3D surface map for

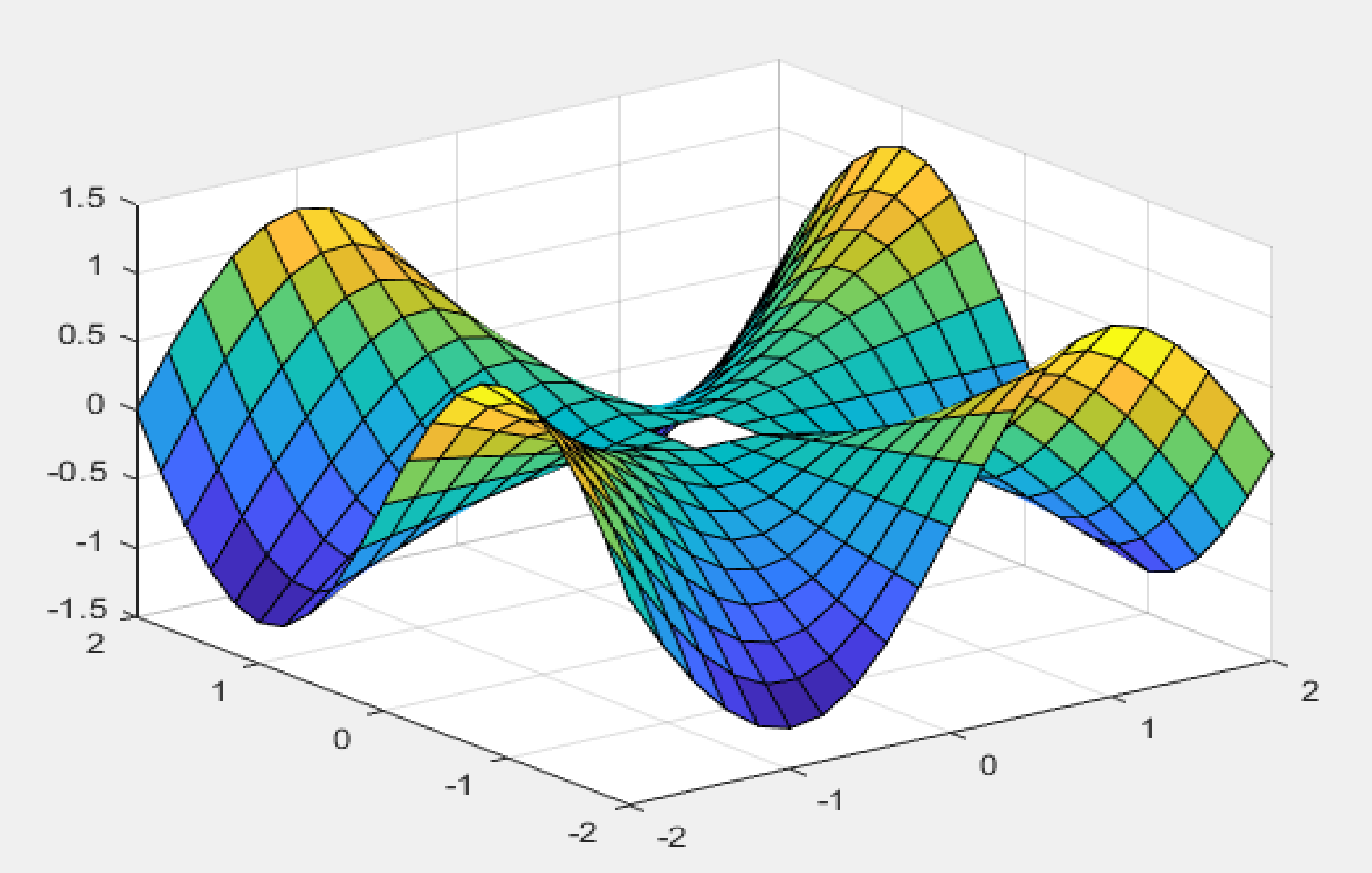
  the function $z = \frac{xy(x^2-y^2)}{x^2+y^2}$.

- The script file is as follows:

```
>> [x,y] = meshgrid(-2:.2:2);
>> z=x.*y.*(x.^2-y.^2)./(x.^2+y.^2);
>> surf(x,y,z)
```

MATLAB - Three Dimensional Plots, Continued…

- When we run the file, MATLAB displays the following 3-D map:



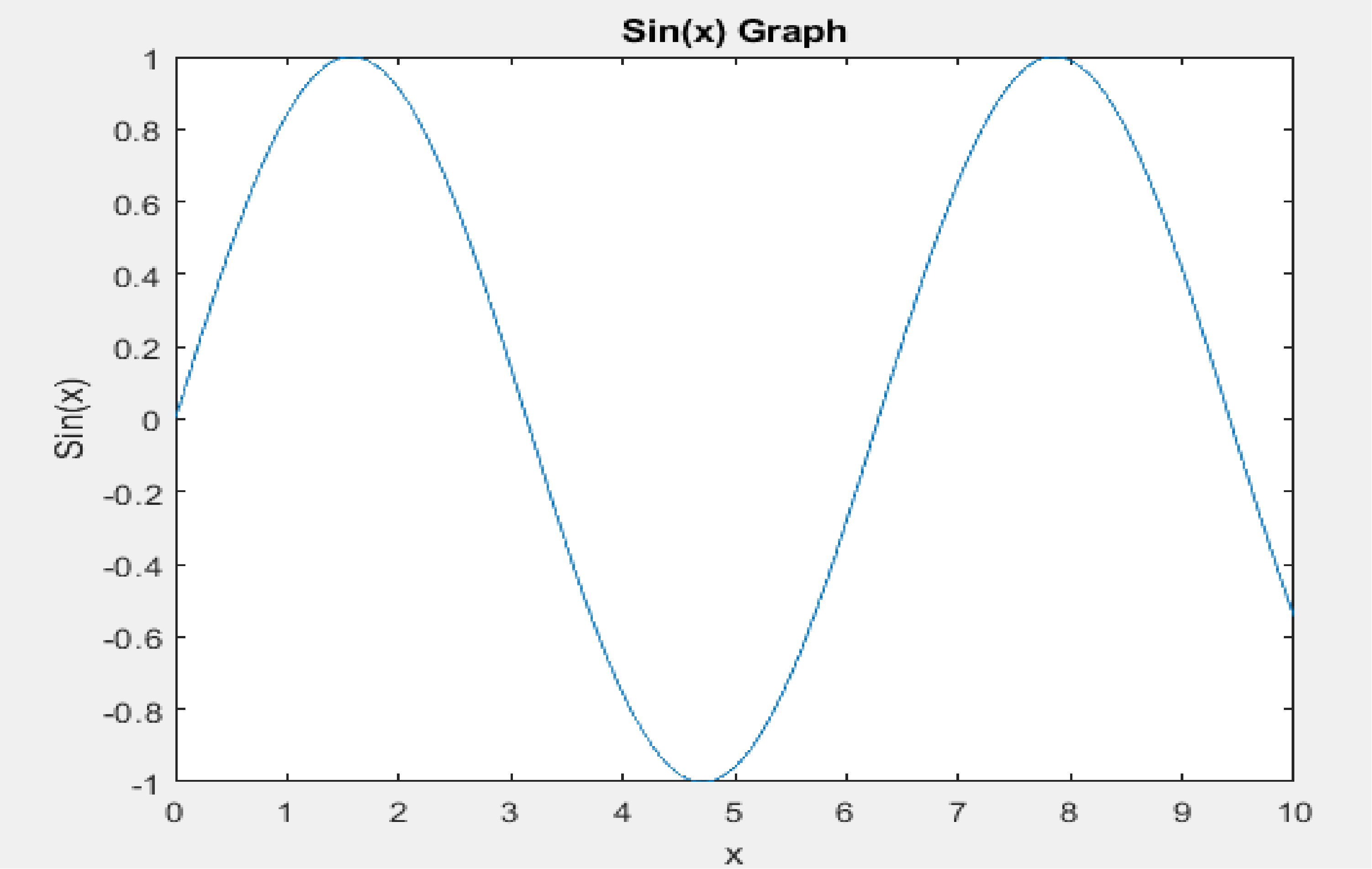
Adding Title and Labels on the Graph

- Using MATLAB we can add title, labels along the x-axis and y-axis of the graph.
- The **xlabel** and **ylabel** commands generate labels along x-axis and y-axis.
- The **title** command allows you to put a title on the graph.
- The script file is as follows:

```
>> x = [0:0.01:10];
>> y = sin(x);
>> plot(x, y), xlabel('x'), ylabel('Sin(x)'), title('Sin(x) Graph')
```

Adding Title and Labels on the Graph

- When we run the file, MATLAB displays the following plot:



MATLAB – Polar Plots

- To plot a curve in polar coordinates, we use the following command:
- **polarplot(theta,rho)**. Here **theta** is the angle in radians and **rho** is the radius value for each point.
- Following example would demonstrate the concept.
- Let us plot the curve $r = sin2\theta cos2\theta$.

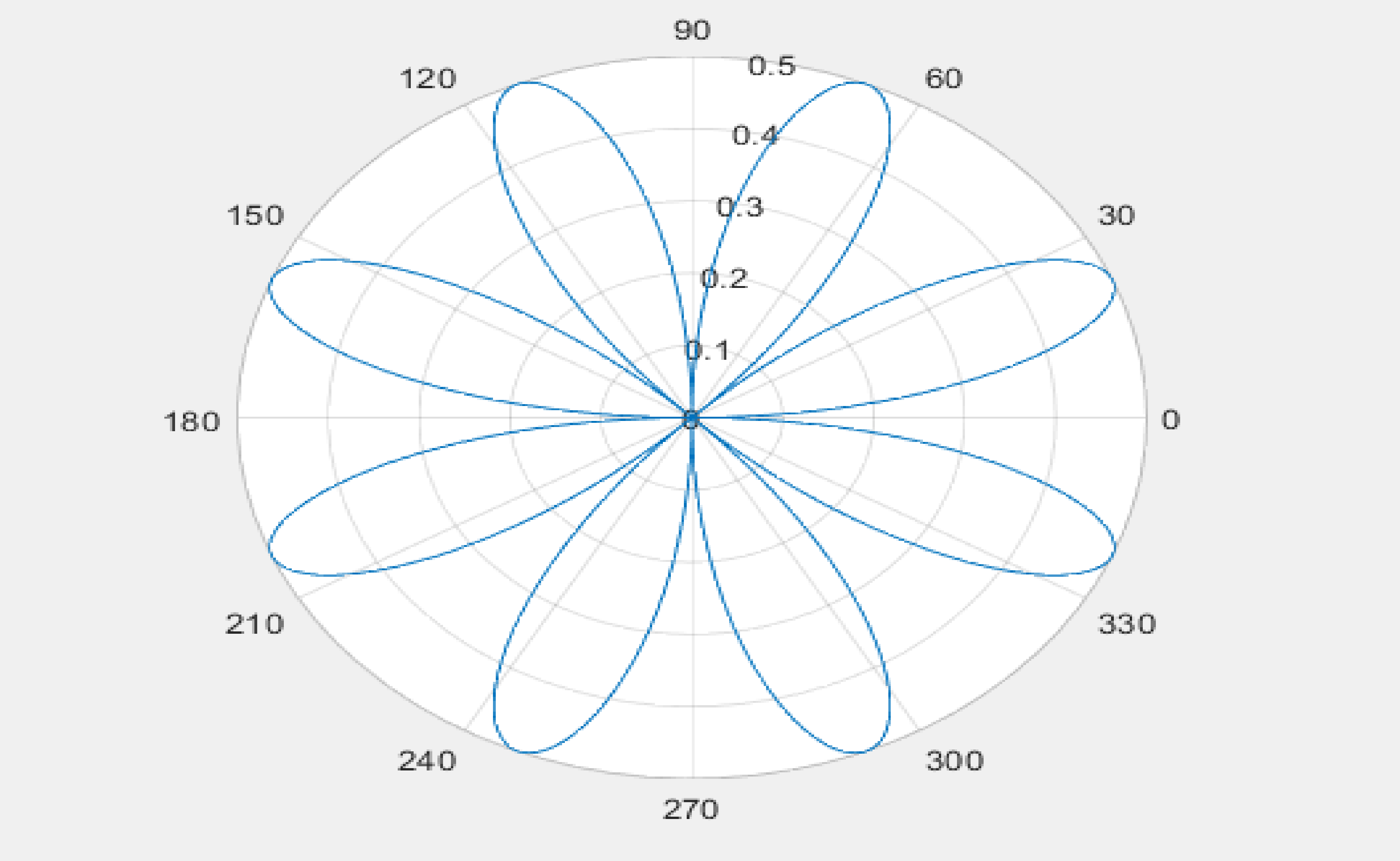
MATLAB – Polar Plots, Continued…

- The script file is as follows:

```
>> theta = 0:0.01:2*pi;
>> rho = sin(2*theta).*cos(2*theta);
>> polarplot(theta,rho)
```

MATLAB – Polar Plots, Continued…

- When we run the file, MATLAB displays the following plot:



MATLAB – Polar Plots, Continued…

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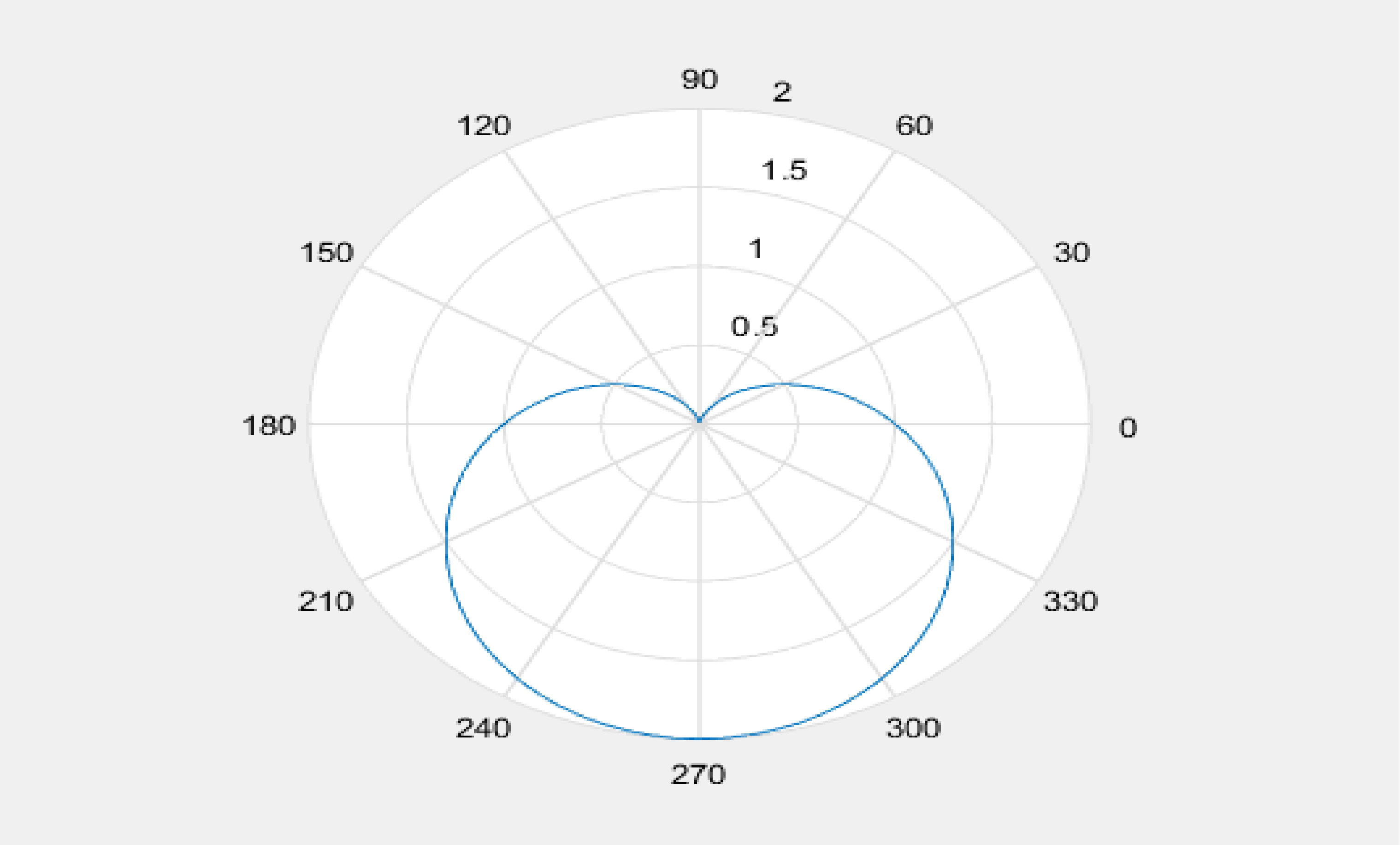
- Consider another example:
- Plot the curve $r = 1 - sin\theta$
- The script file is as follows:

```
>> theta = 0:0.01:2*pi;
>> rho = 1 - sin(theta);
>> polar(theta, rho)
```

MATLAB – Polar Plots, Continued…

- When we run the file, MATLAB displays the following plot:



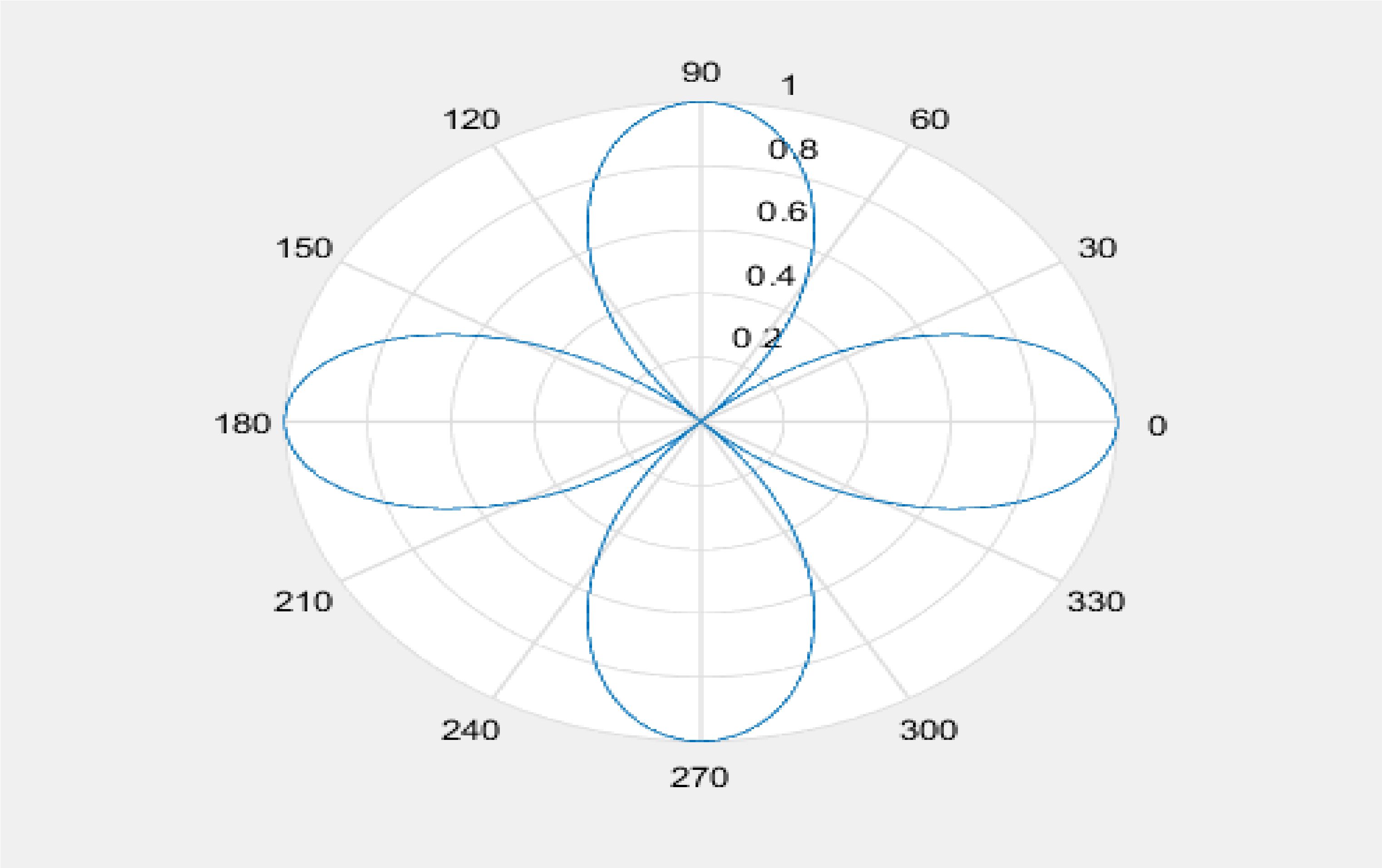
MATLAB – Polar Plots, Continued…

- Consider another example:
- Plot the curve $r = cos2\theta$
- The script file is as follows:

```
>> theta = 0:0.01:2*pi;
>> rho = cos(2*theta);
>> polar(theta, rho)
```

MATLAB – Polar Plots, Continued…

➢ When we run the file, MATLAB displays the following plot:



MATLAB – Parametric Plots

- To plot a parametric curve, we use the following command:
- **fplot3(xt,yt,zt)**, which plots the parametric curve xt=x(t), yt=y(t), and zt=z(t) over the default interval $-5 < t < 5$.
- Following example would demonstrate the concept.
- Let us plot a parametric curve: x=sin(t); y=cos(t); z=t over the default parameter range [-5 5].

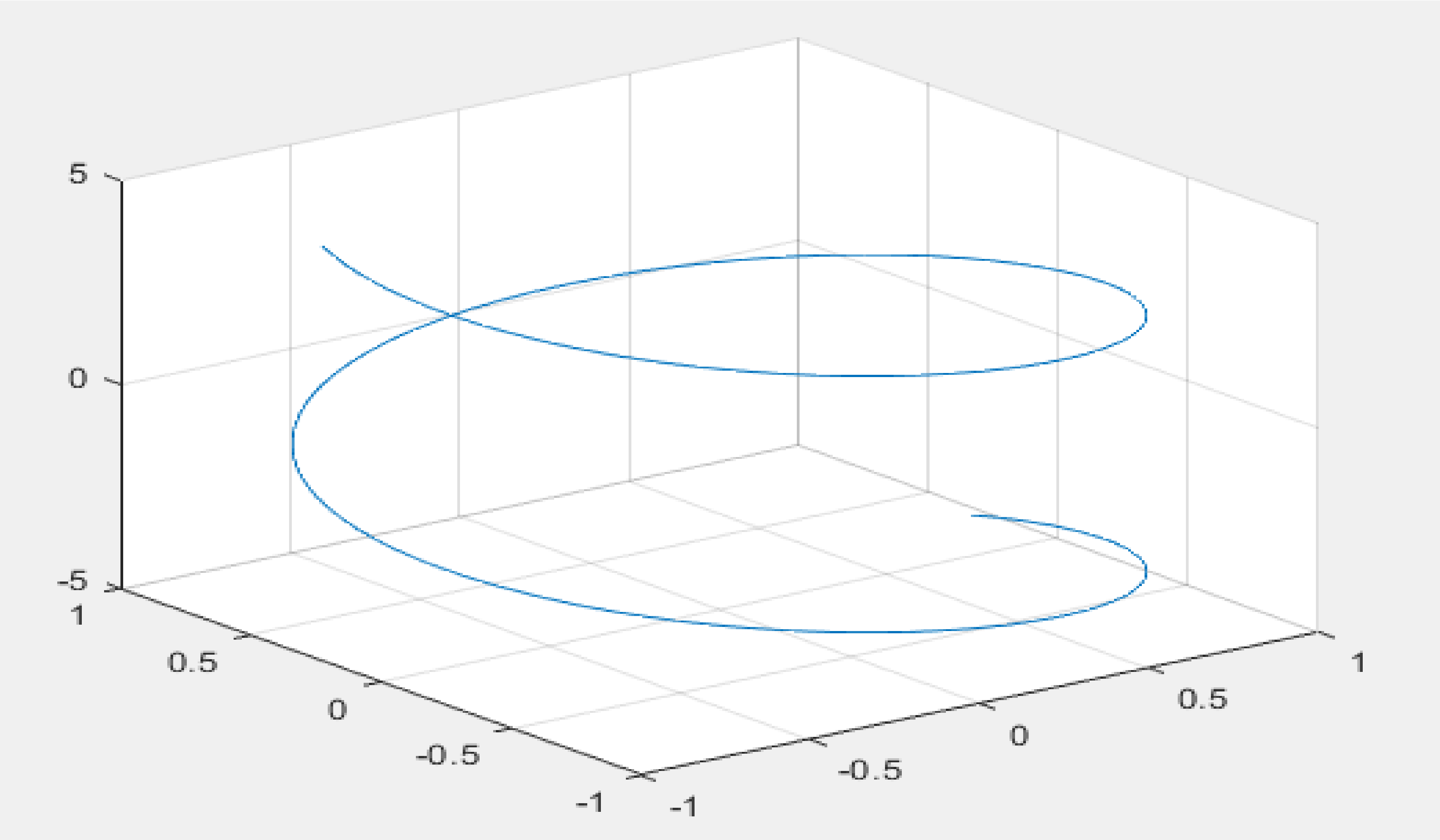
MATLAB – Parametric Plots, Continued…

- The script file as follows:

```
>> syms t
>> xt = sin(t);
>> yt = cos(t);
>> zt = t;
>> fplot3(xt,yt,zt)
```

MATLAB – Parametric Plots, Continued…

- When we run the file, MATLAB displays the following plot:



MATLAB – Polar Plots, Continued…

- Consider another example:

- Plot the parametric curve $x = e^{-\frac{t}{10}}\sin(5t)\,;\, y =$

  $e^{-\frac{t}{10}}\cos(5t); z = t$

  over the parameter range [-10 10]

Note that fplot3(xt,yt,zt, [tmin tmax]) plots xt = x(t), yt = y(t), and zt = z(t) over the interval tmin < t < tmax.

MATLAB – Parametric Plots, Continued…

- The script file as follows:

```
>> syms t
>> xt = exp(-t/10).*sin(5*t);
>> yt = exp(-t/10).*cos(5*t);
>> zt = t;
>> fplot3(xt,yt,zt,[-10 10])
```

MATLAB – Parametric Plots, Continued…

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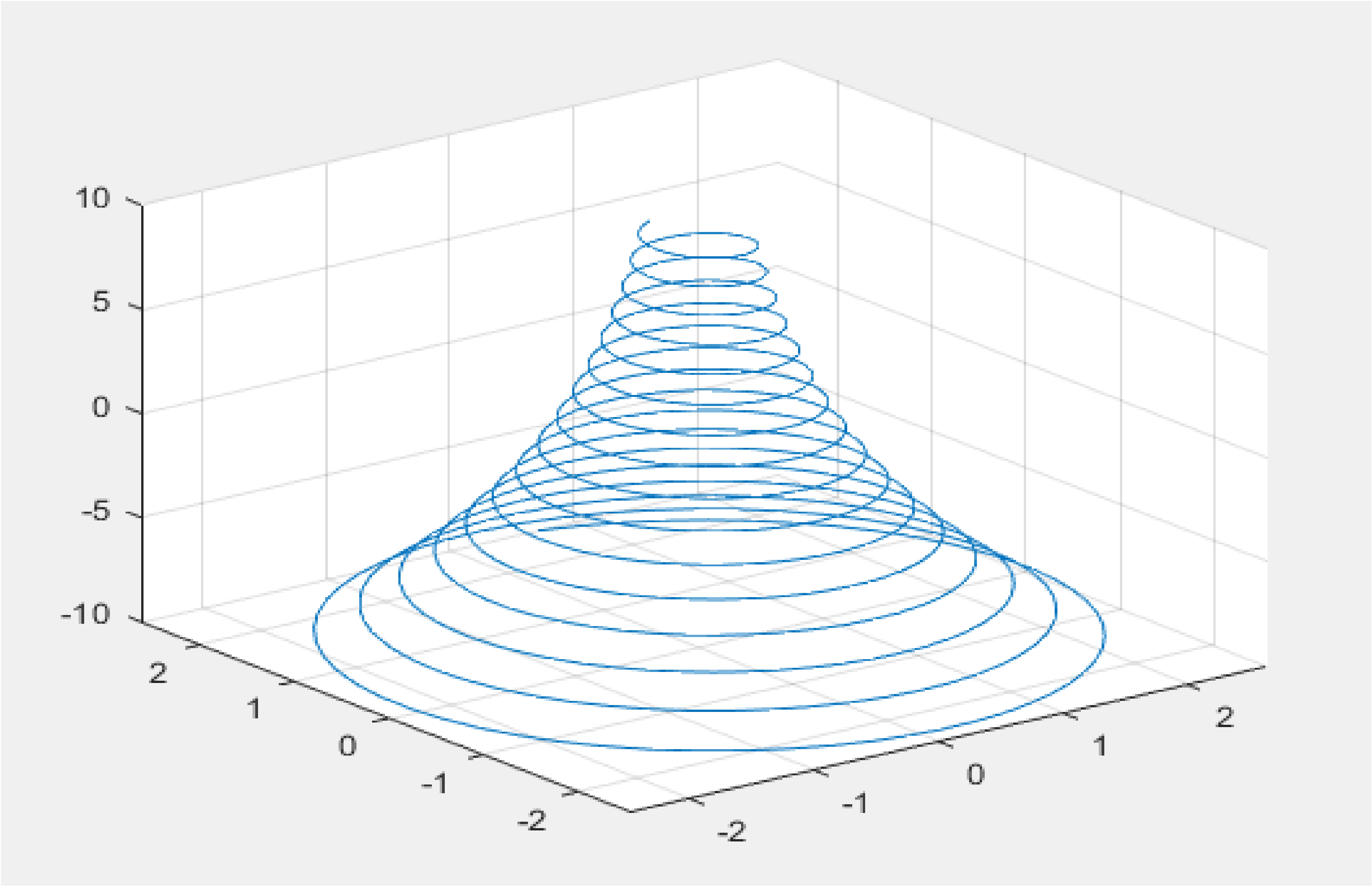
- When we run the file, MATLAB displays the following plot:



THANK YOU