Experiment 4

Volume of Revolution

I. Aim

To find and visualize the volume of a solid generated by revolving a curve about x = c line.

II. Mathematical Background:

The solid generated by revolving a given curve f(x) about an axis is called solid of revolution.

The volume of solid generated by rotating a curve R(x) about y = c is given by

$$V = \int_a^b \pi[R(x) - c]^2 \, dx.$$

where a and b are lower and upper limits respectively.

Here R(x)-c acts as radius.

III. MATLAB Code:

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revolution.m

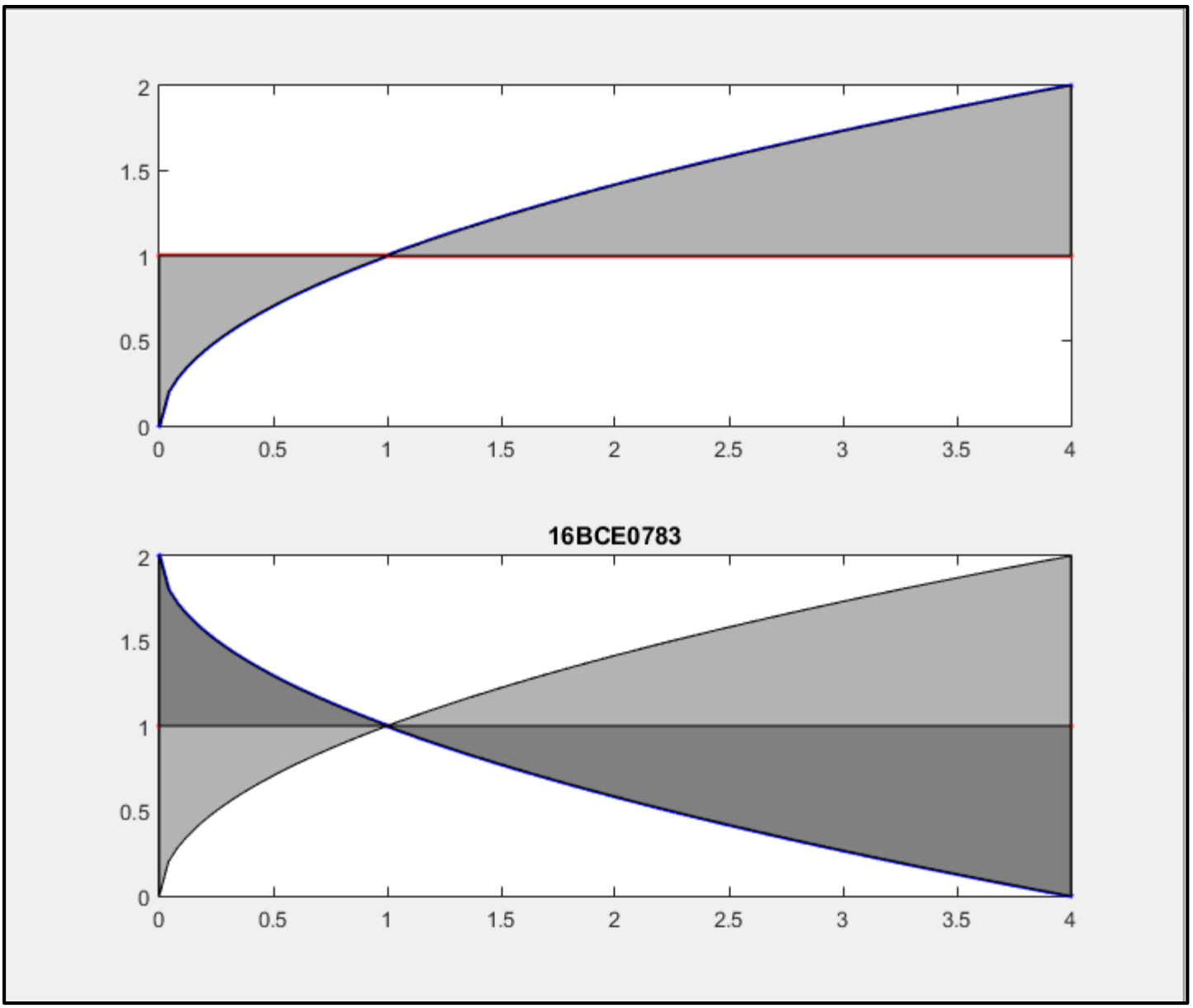
```
clc
clear all
syms x
f = input('Enter the function of x:');
xl = input('Input the limits [x1,x2]:');
il = input('Input the limits of integration [i1 i2]:');
yc = input('Input the axis of rotation:');
vol = pi*int((f-yc)^2,x,il(1),il(2));
disp(['The volume is:',char(vol)])
xvals = linspace(xl(1),xl(2),101);  % Creating Vectors
fvals = double(subs(f,x,xvals));
subplot(2,1,1) % Subplotting
h = plot(xvals,fvals,'-b','LineWidth',2);hold on;
h = plot([xl(1) xl(2)],[yc yc],'-r','LineWidth',2);
%use fill command for shading fill(x,y,[R G B])  x and y vectors of same length
fill([xvals xl(2) xl(1)],[fvals yc yc],[0.7 0.7 0.7])
ivals = linspace(il(1),il(2),101);
fivals = double(subs(f,x,ivals)); % Converting from symbol to double
givals = double(subs(2*yc-f,x,ivals));
subplot(2,1,2)
h = plot([il(1) il(2)],[yc yc],'-r','LineWidth',2);hold on;
h = plot(ivals,givals,'-b','LineWidth',2);
fill([ivals il(2) il(1)],[fivals yc yc],[0.7 0.7 0.7])
fill([ivals il(2) il(1)],[givals yc yc],[0.5 0.5 0.5])
title('16BCE0783')
figure
r = fivals - yc;
[X,Y,Z] = cylinder(r,101);
surf(Z,Y+yc,X,'FaceAlpha',1)
title('16BCE0783')
```

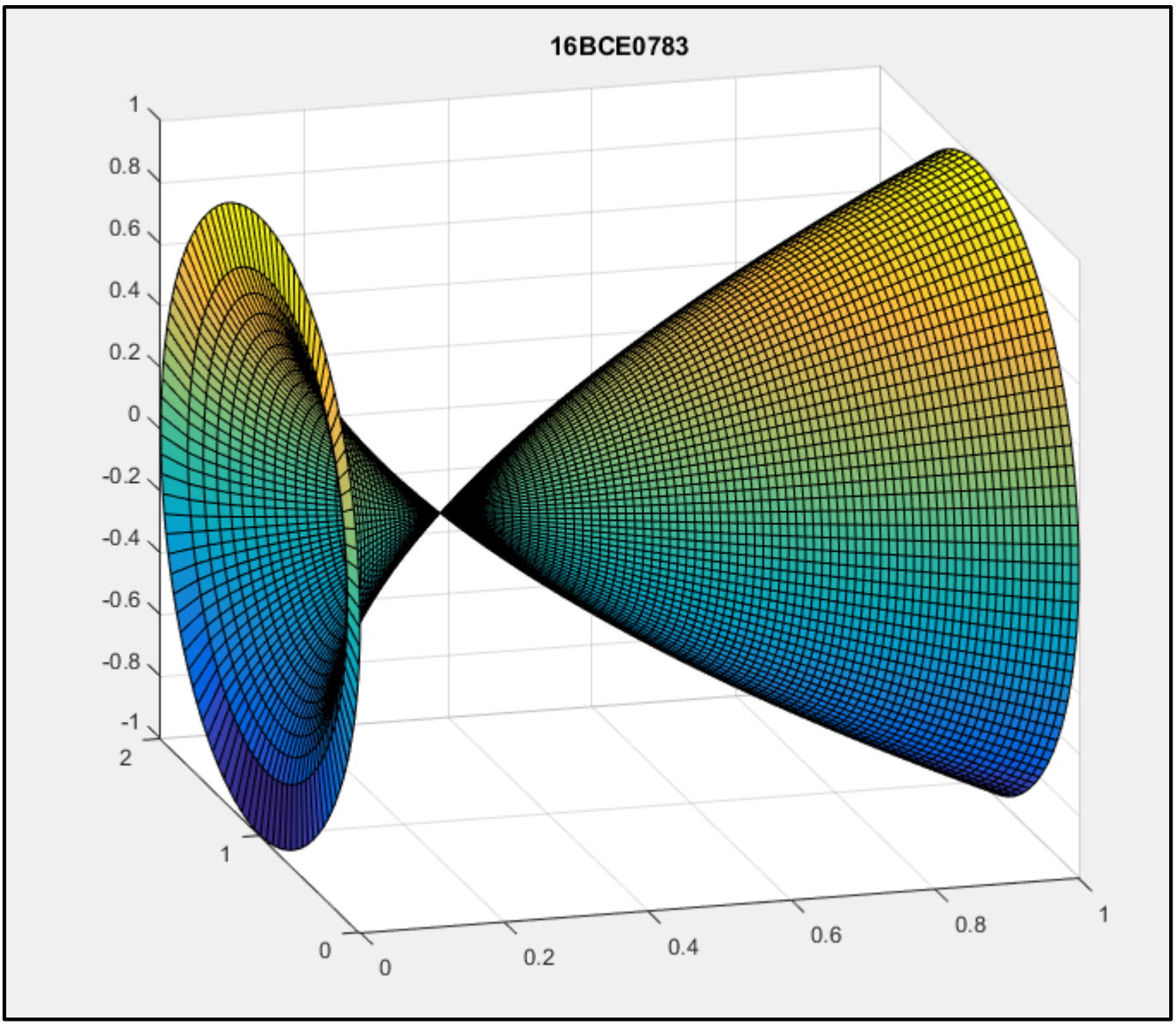
IV. MATLAB I/O:

```
16 -    fill([xvals xl(2) xl(1)],[fvals yc yc],[0.7 0.7 0.7])
17 -    ivals = linspace(il(1),il(2),101);
18 -    fivals = double(subs(f,x,ivals)); % Converting from sy
19 -    givals = double(subs(2*yc-f,x,ivals));
20 -    subplot(2,1,2)
21 -    h = plot([il(1) il(2)],[yc yc],'-r','LineWidth',2);hol
22 -    h = plot(ivals,givals,'-b','LineWidth',2);
```

Command Window

```
Enter the function of x:sqrt(x)
Input the limits [x1,x2]:[0 4]
Input the limits of integration [i1 i2]:[0 4]
Input the axis of rotation:1
The volume is:(4*pi)/3
>>
```


2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
3.5
4
16BCE0783
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
3
3.5
4



V. Question - Answers:

Q1 Answer

1. fill Command

fill command is used to shade or fill the area made by a 2-D curve. It's syntax is:

fill(X,Y,[R G B]) where X and Y are vectors(of same length) and [R G B] is color constitution. If necessary, the polygon is closed by connecting the last vertex to the first.

Example

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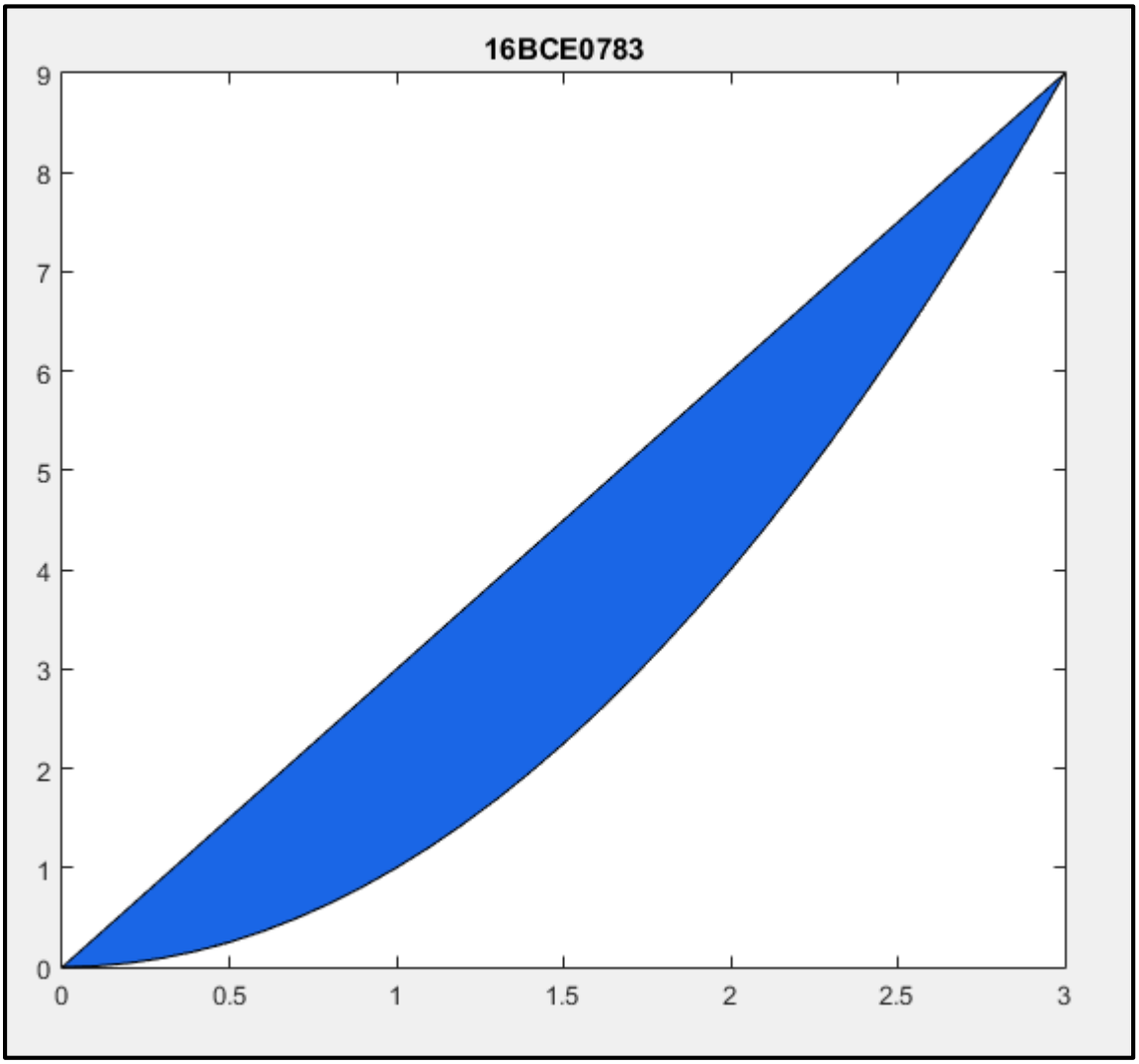
```
1    x = 0:0.1:3; %creating points
2    y1 = x;
3    y2 = x.^2;
4    fill(y1,y2,[0.1 0.4 0.9])
5    title('16BCE0783')
```



2. cylinder command

Cylinder command is used to form a cylinder using the given inputs. Syntax is:

[X Y Z] = cylinder(r,n) where r is a vector and n is number of points on the circumference. Surf command is then used to display the cylinder

Example

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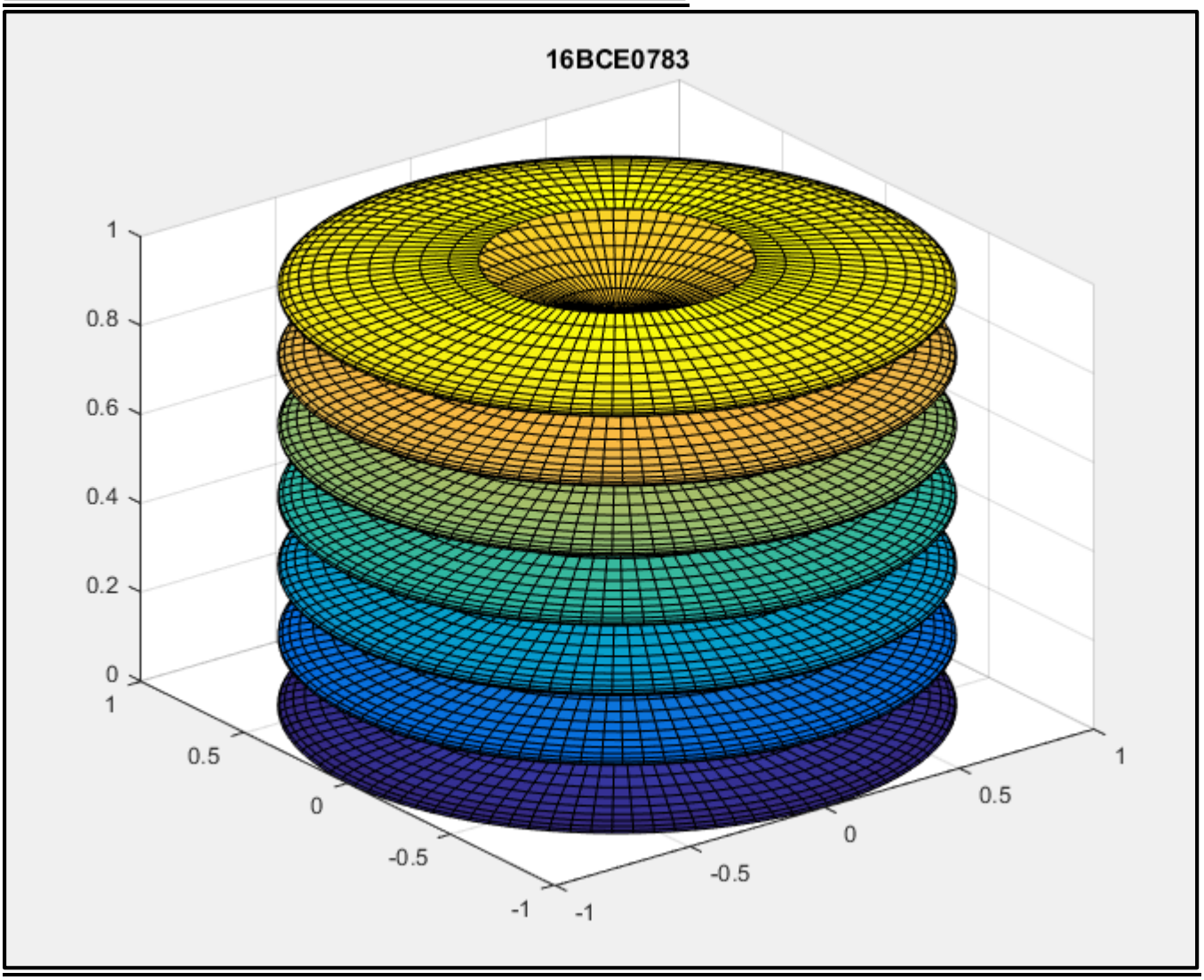
```
1    r = 0:0.1:20;
2    [X Y Z] = cylinder(cos(r),101);
3    surf(X,Y,Z)
4    title('16BCE0783')
```



Q2 Answer

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revolution.m | Untitled5*

```
x = 0:0.1:5;   %Creating points
y1 = (x.^2) .* (cos(x)); %f(x)
y2 = (2*x) - 4; %g(x)
X = [x fliplr(x)];
%fliplr reverses the points in vector in left-right direction
Y = [y1 fliplr(y2)];
fill(X,Y,[0.1 0.4 0.9])
title('16BCE0783, f(x)=x^2cos(x) , g(x)=2x-4')
```