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Lab Assignment - 7

Write a MATLAB code to evaluate the volume under surface using double integral and to visualize the same for the given problems below

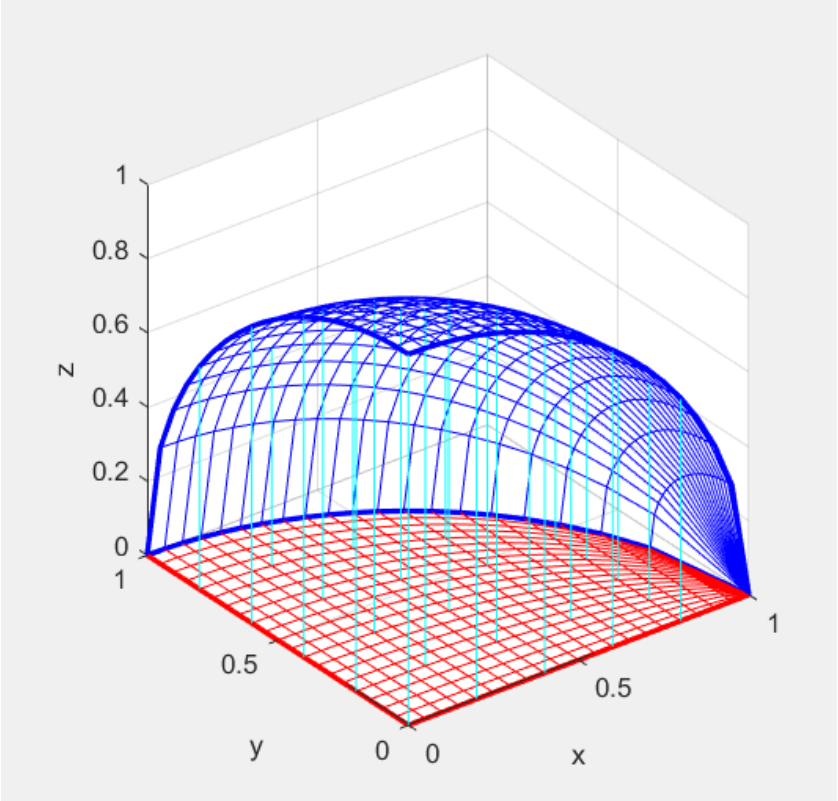
1. Evaluate

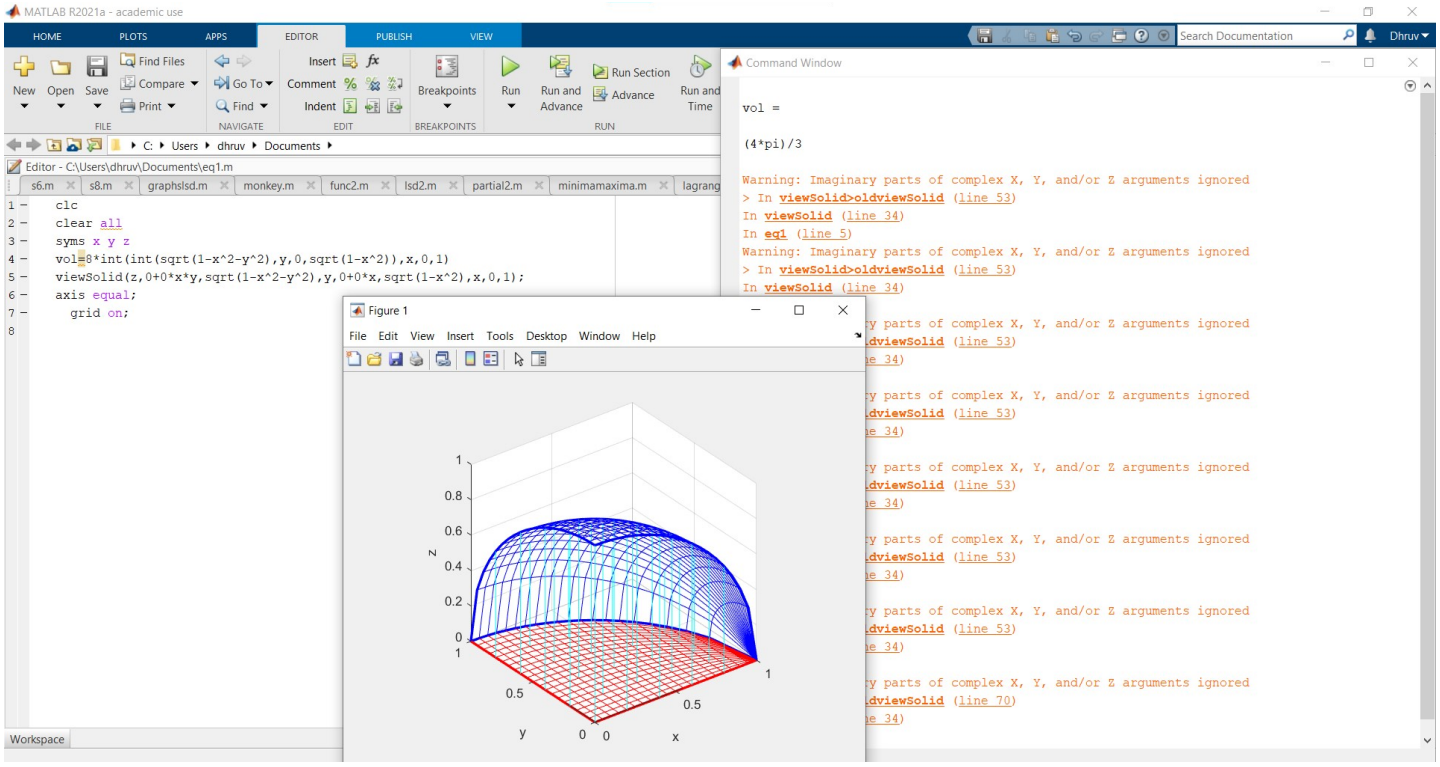
$$i)\ V = 8\int_0^1 \int_0^{\sqrt{1-x^2}} \sqrt{1-x^2-y^2}\, dy\, dx\,.$$

```
clc
clear all
syms x y z
vol=8*int(int(sqrt(1-x^2-y^2),y,0,sqrt(1-x^2)),x,0,1)
viewSolid(z,0+0*x*y,sqrt(1-x^2-y^2),y,0+0*x,sqrt(1-x^2),x,0,1);
axis equal;
  grid on;
```

OUTPUT:

vol = (4*pi)/3



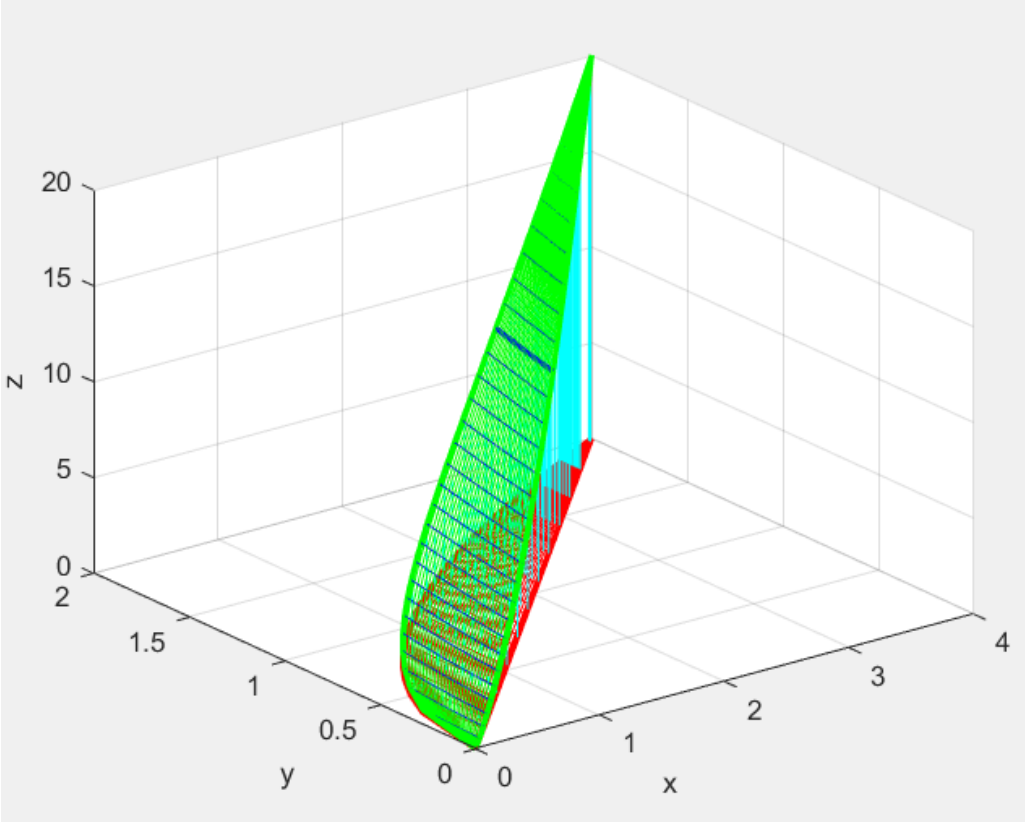


$$ii)\ \int_{0}^{4}\int_{\frac{y}{2}}^{\sqrt{y}} (x^2+y^2)\,dx\,dy$$

```
clc
clear all
syms x y z
vol = int(int(x^2+y^2, x,y/2,sqrt(y)), y, 0, 4)
viewSolidone(z,0+0*x*y,x^2+y^2,x,y/2,sqrt(y),y,0,4);
grid on;
```

OUTPUT:

vol = 216/35



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```
1 -  clc
2 -  clear all
3 -  syms x y z
4 -  vol = int(int(x^2+y^2, x,y/2,sqrt(y)), y, 0, 4)
5 -  viewSolidone(z,0+0*x*y,x^2+y^2,x,y/2,sqrt(y),y,0,4);
6 -  grid on;
7
```

Command Window

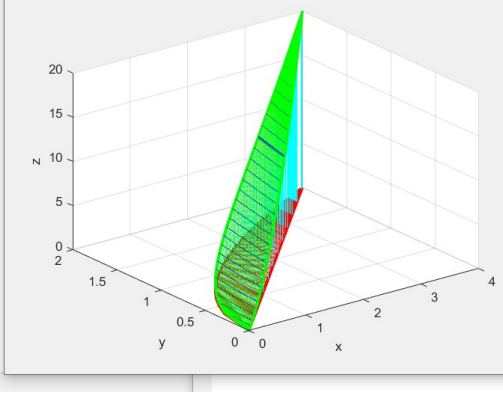
```
vol =

  216/35

fx >>
```

Figure 1

File Edit View Insert Tools Desktop Window Help



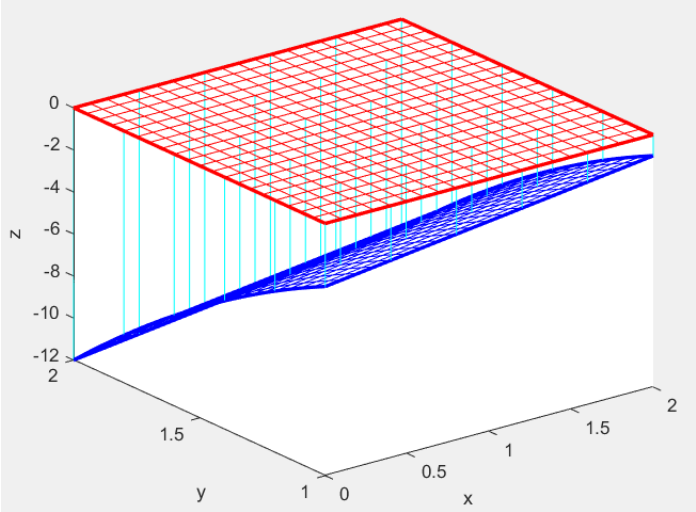
Workspace

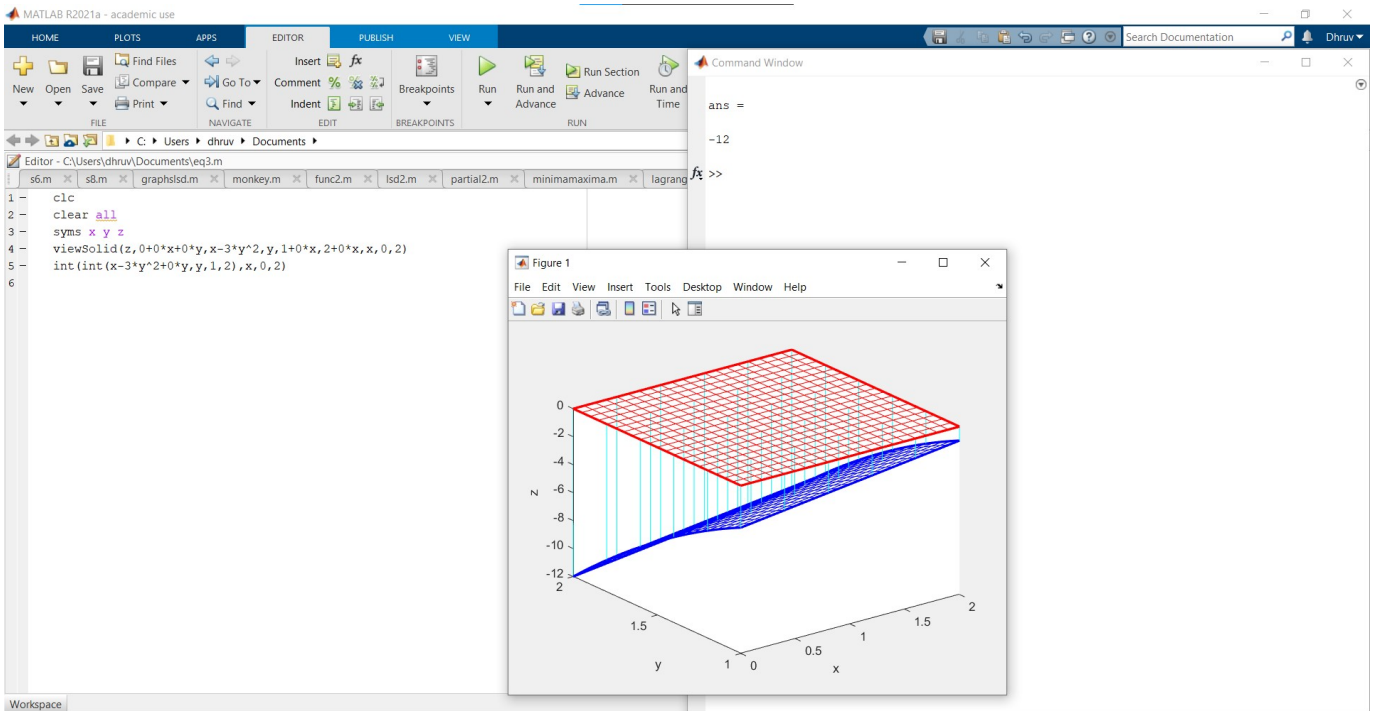
iii) Evaluate $\iint_R (x-3y^2)dA$ where $R=\{(x,y)\mid 0\le x\le 2, 1\le y\le 2\}$

```
clc
clear all
syms x y z
viewSolid(z,0+0*x+0*y,x-3*y^2,y,1+0*x,2+0*x,x,0,2)
int(int(x-3*y^2+0*y,y,1,2),x,0,2)
```

OUTPUT:

ans = -12



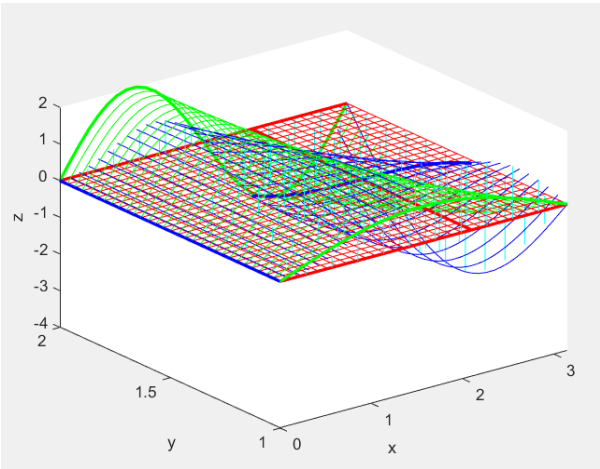


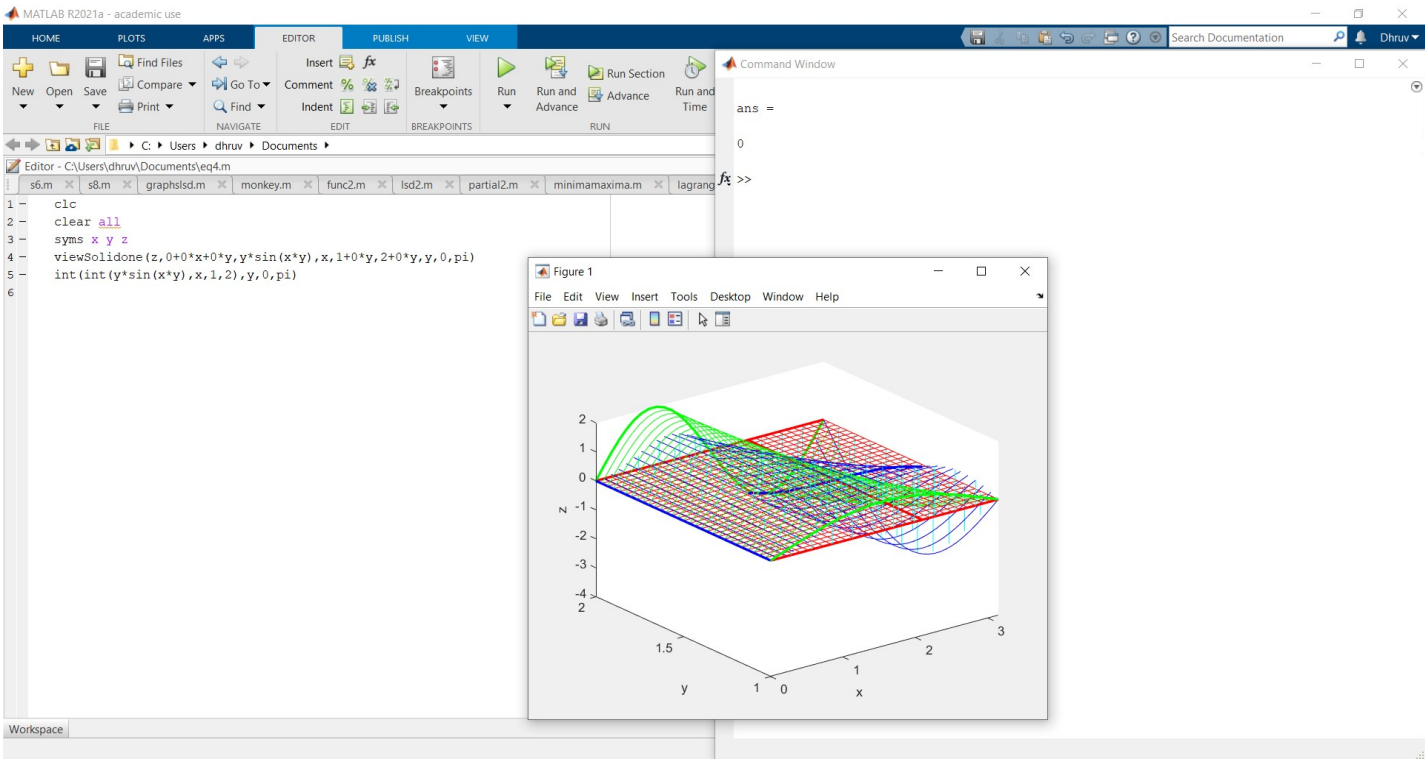
iv) Evaluate $\iint_R y\sin(xy)\,dA$ where $R=[1,2]\times[0,\pi]$

```
clc
clear all
syms x y z
viewSolidone(z,0+0*x+0*y,y*sin(x*y),x,1+0*y,2+0*y,y,0,pi)
int(int(y*sin(x*y),x,1,2),y,0,pi)
```

OUTPUT:

ans = 0





Converting Cartesian to polar coordinates

2. Find the volume of the solid bounded by the plane z=0 and the paraboloid $z = 1 - x^2 - y^2$

Sol:

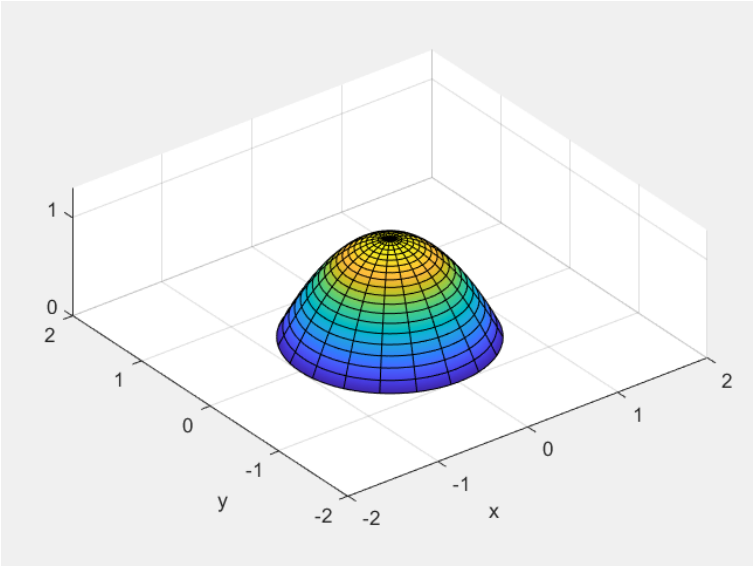
By changing the coordinates from Cartesian to Polar we get

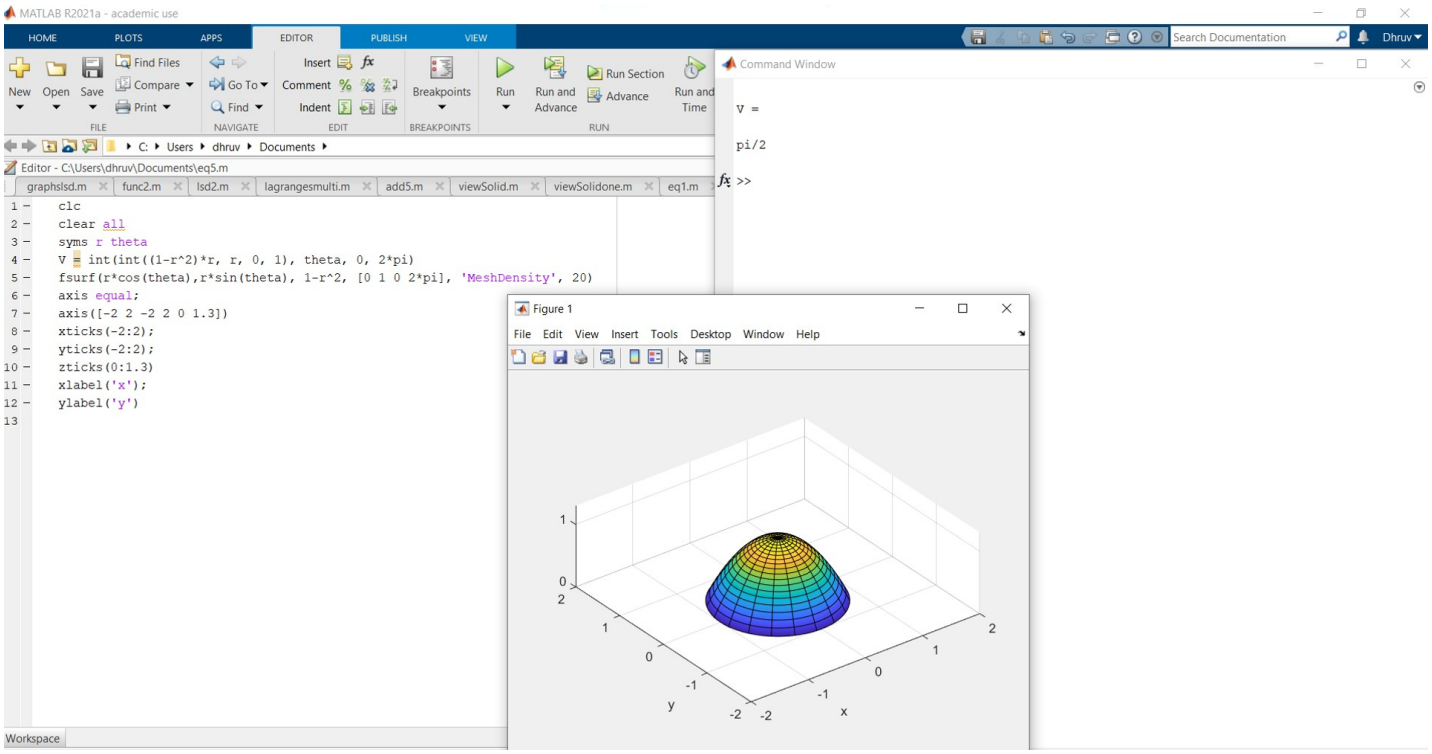
$$V = \iint_D (1 - x^2 - y^2)dA = \int_0^{2\pi} \int_0^1 (1 - r^2)r\,dr\,d\theta$$

```
clc
clear all
syms r theta
V = int(int((1-r^2)*r, r, 0, 1), theta, 0, 2*pi)
fsurf(r*cos(theta),r*sin(theta), 1-r^2, [0 1 0 2*pi], 'MeshDensity', 20)
axis equal;
axis([-2 2 -2 2 0 1.3])
xticks(-2:2);
yticks(-2:2);
zticks(0:1.3)
xlabel('x');
ylabel('y')
```

OUTPUT:

V = pi/2





3. Find the volume of the solid that lies under the cone $z = x^2 + y^2$ and above the xy- plane, and inside the cylinder $x^2 + y^2 = 2x$

Sol:

By changing the coordinates from Cartesian to Polar we get

$$V = \iint_D (x^2 + y^2)dA = \int_{-\pi/2}^{\pi/2} \int_0^{2\cos\theta} (r^2)rdrd\theta$$

```
clc
clear all
syms r theta z r1
v=int(int((r^2)*r,r,0,2*cos(theta)),theta,-pi/2,pi/2)
r=2*cos(theta), x = r*cos(theta), y = r*sin(theta)
fsurf(x,y,z, [0 2*pi 0 1], "MeshDensity", 16)
axis equal;
xlabel('x');
ylabel('y');
zlabel('z')
zticks(0:1.5)
hold on
fsurf(r1*cos(theta),r1*sin(theta),r1^2, [0 1 0 2*pi], "MeshDensity", 20)
```

OUTPUT:

v = (3*pi)/2

r = 2*cos(theta)

x = 2*cos(theta)^2

y = 2*cos(theta)*sin(theta)