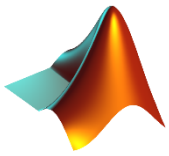
MAT 1011

MATLAB



Digital Assignment – 5

L31+L32

FALL SEMESTER 2019-20

by

SHARADINDU ADHIKARI

19BCE2105

Question 1

Problem:

Find the Gradient of the function $f = x^2 y^3 - 4y$

Code in MATLAB

```
syms x y
f=input('Enter the function f(x,y):');
grad=gradient(f,[x,y]);
f1=diff(f,x);
f2=diff(f,y);
P=inline(vectorize(f1),'x','y');
Q=inline(vectorize(f2),'x','y');
x=linspace(-2,2,10);
y=x;
[X,Y]=meshgrid(x,y);
U=P(X,Y);
V=Q(X,Y);
quiver(X,Y,U,V,1)
axis on
xlabel('x')
ylabel('y')
hold on
ezcontour(f,[-2 2])
fprintf('Gradient of f(x,y) is :\n');
fprintf('%s\n',grad);
```

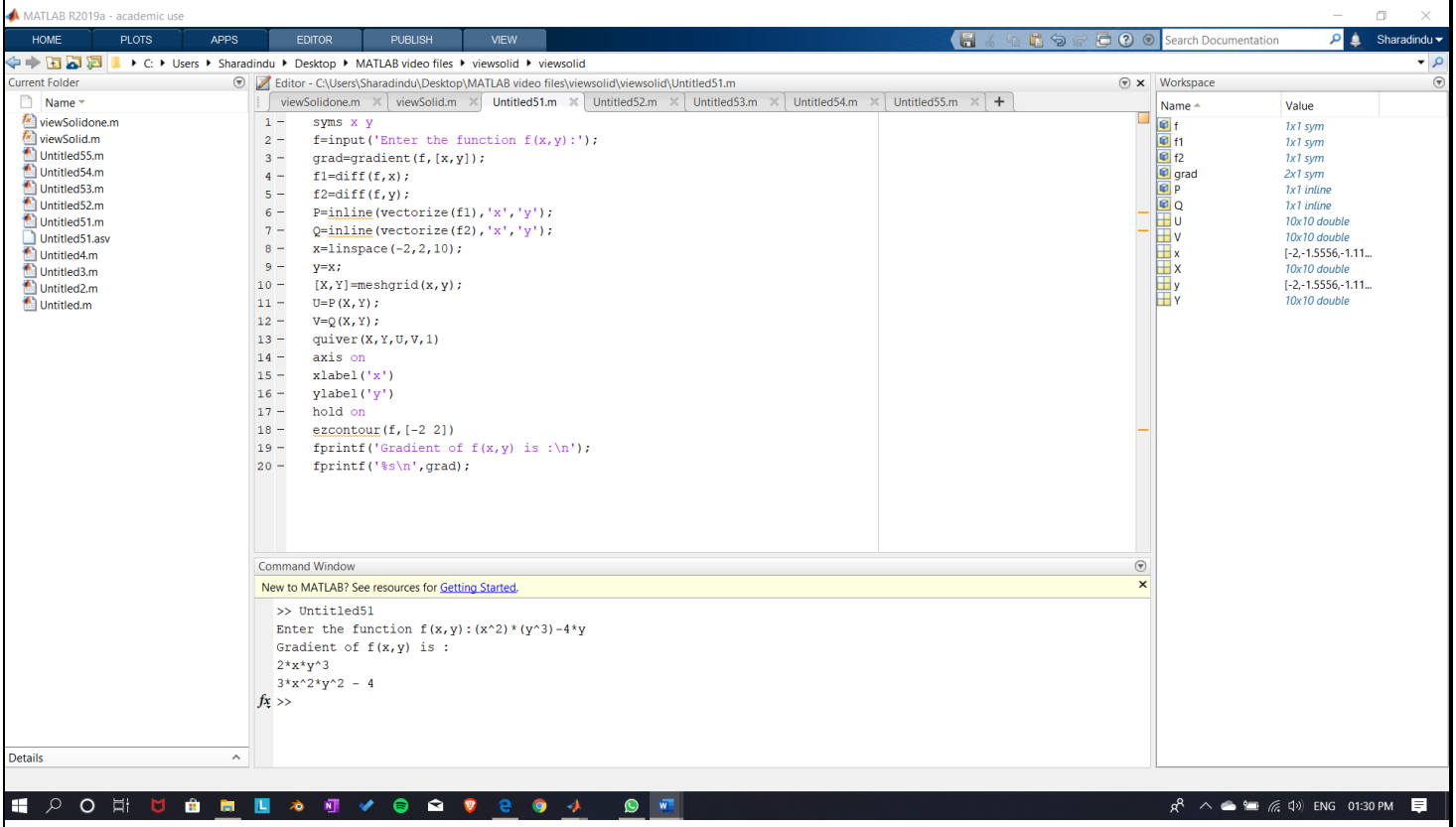
Input:

```
Enter the function f(x,y):(x^2)*(y^3)-4*y
```

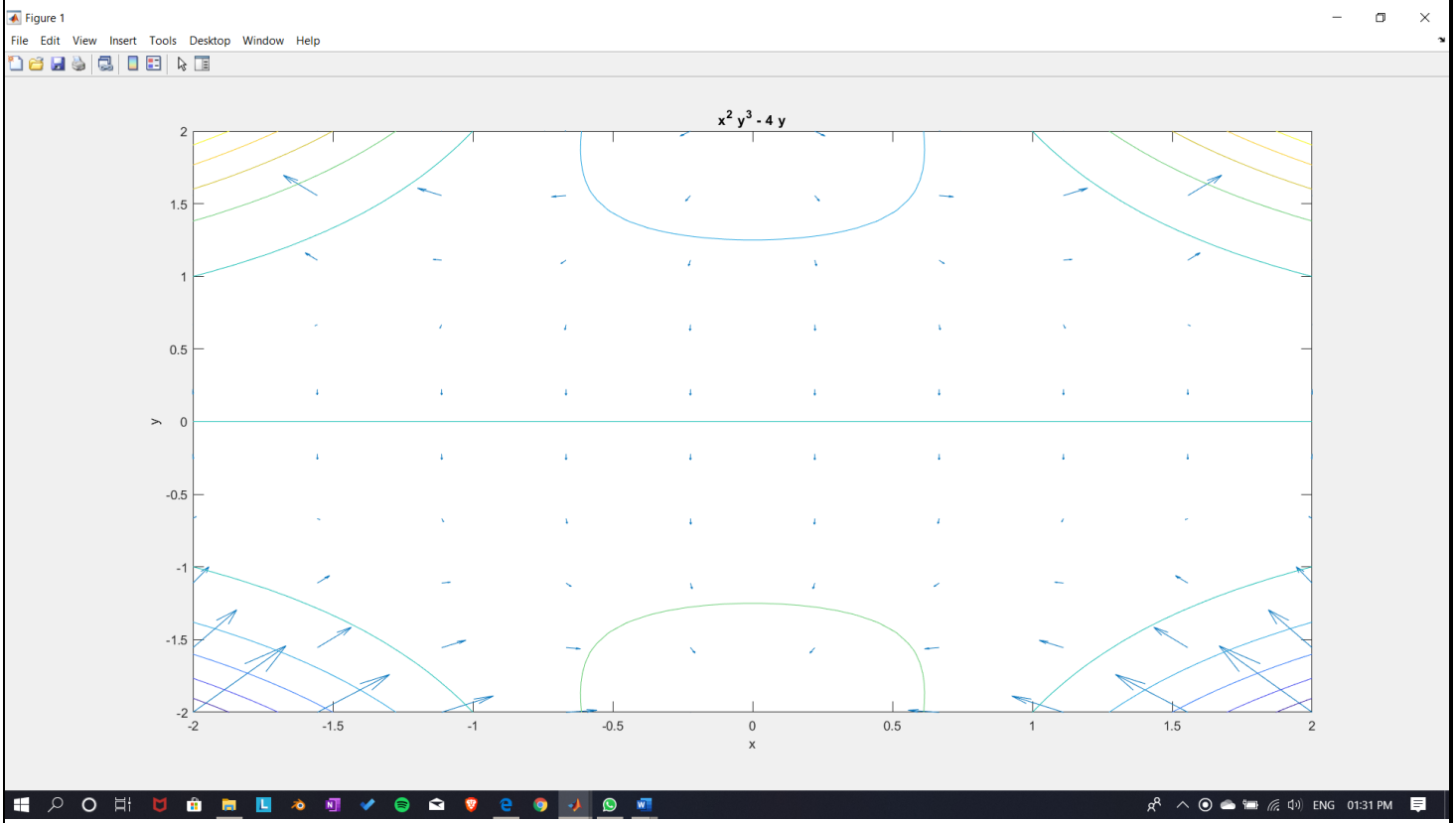
Output:

```
Gradient of f(x,y) is :
2*x*y^3
3*x^2*y^2 - 4
```

Screenshot of Code:



Graph:



Question 2

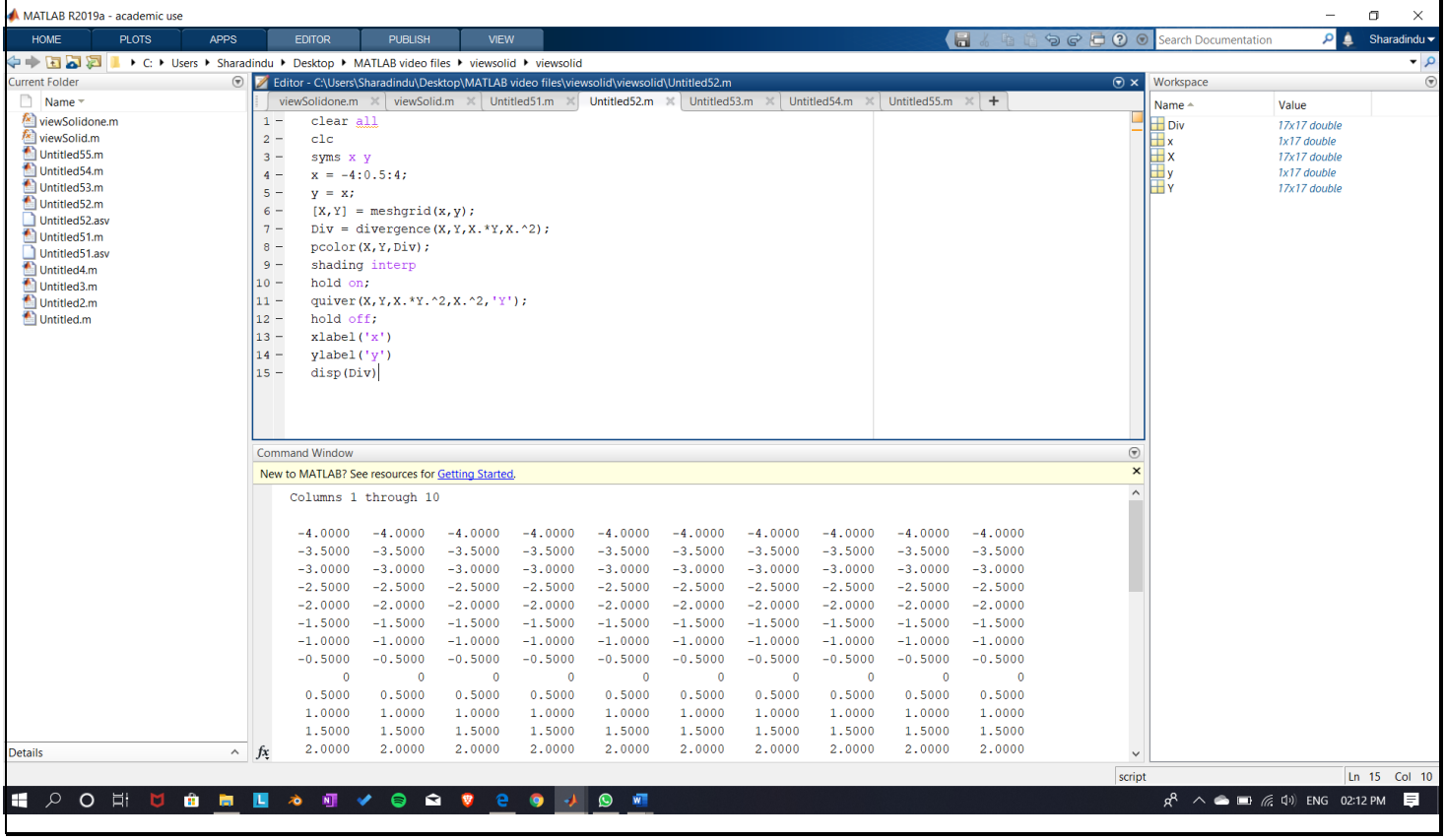
Problem:

Find the divergence of a vector field $f = [\, xy, x^2 \,]$.

Code & Input:

```
clear all
clc
syms x y
x = -4:0.5:4;
y = x;
[X,Y] = meshgrid(x,y);
Div = divergence(X,Y,X.*Y,X.^2);
pcolor(X,Y,Div);
shading interp
hold on;
quiver(X,Y,X.*Y.^2,X.^2,'Y');
hold off;
xlabel('x')
ylabel('y')
disp(Div)
```

Screenshot of Code:



Output:

```
  Columns 1 through 10

   -4.0000   -4.0000   -4.0000   -4.0000   -4.0000   -4.0000   -4.0000
-4.0000   -4.0000   -4.0000
   -3.5000   -3.5000   -3.5000   -3.5000   -3.5000   -3.5000   -3.5000
-3.5000   -3.5000   -3.5000
   -3.0000   -3.0000   -3.0000   -3.0000   -3.0000   -3.0000   -3.0000
-3.0000   -3.0000   -3.0000
   -2.5000   -2.5000   -2.5000   -2.5000   -2.5000   -2.5000   -2.5000
-2.5000   -2.5000   -2.5000
   -2.0000   -2.0000   -2.0000   -2.0000   -2.0000   -2.0000   -2.0000
-2.0000   -2.0000   -2.0000
   -1.5000   -1.5000   -1.5000   -1.5000   -1.5000   -1.5000   -1.5000
-1.5000   -1.5000   -1.5000
   -1.0000   -1.0000   -1.0000   -1.0000   -1.0000   -1.0000   -1.0000
-1.0000   -1.0000   -1.0000
   -0.5000   -0.5000   -0.5000   -0.5000   -0.5000   -0.5000   -0.5000
-0.5000   -0.5000   -0.5000
         0         0         0         0         0         0         0
0         0         0
    0.5000    0.5000    0.5000    0.5000    0.5000    0.5000    0.5000
0.5000    0.5000    0.5000
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
1.0000    1.0000    1.0000
    1.5000    1.5000    1.5000    1.5000    1.5000    1.5000    1.5000
1.5000    1.5000    1.5000
    2.0000    2.0000    2.0000    2.0000    2.0000    2.0000    2.0000
2.0000    2.0000    2.0000
    2.5000    2.5000    2.5000    2.5000    2.5000    2.5000    2.5000
2.5000    2.5000    2.5000
    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000
3.0000    3.0000    3.0000
    3.5000    3.5000    3.5000    3.5000    3.5000    3.5000    3.5000
3.5000    3.5000    3.5000
    4.0000    4.0000    4.0000    4.0000    4.0000    4.0000    4.0000
4.0000    4.0000    4.0000

  Columns 11 through 17

   -4.0000   -4.0000   -4.0000   -4.0000   -4.0000   -4.0000   -4.0000
   -3.5000   -3.5000   -3.5000   -3.5000   -3.5000   -3.5000   -3.5000
   -3.0000   -3.0000   -3.0000   -3.0000   -3.0000   -3.0000   -3.0000
   -2.5000   -2.5000   -2.5000   -2.5000   -2.5000   -2.5000   -2.5000
   -2.0000   -2.0000   -2.0000   -2.0000   -2.0000   -2.0000   -2.0000
   -1.5000   -1.5000   -1.5000   -1.5000   -1.5000   -1.5000   -1.5000
   -1.0000   -1.0000   -1.0000   -1.0000   -1.0000   -1.0000   -1.0000
   -0.5000   -0.5000   -0.5000   -0.5000   -0.5000   -0.5000   -0.5000
         0         0         0         0         0         0         0
    0.5000    0.5000    0.5000    0.5000    0.5000    0.5000    0.5000
    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
    1.5000    1.5000    1.5000    1.5000    1.5000    1.5000    1.5000
    2.0000    2.0000    2.0000    2.0000    2.0000    2.0000    2.0000
    2.5000    2.5000    2.5000    2.5000    2.5000    2.5000    2.5000
    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000
    3.5000    3.5000    3.5000    3.5000    3.5000    3.5000    3.5000
    4.0000    4.0000    4.0000    4.0000    4.0000    4.0000    4.0000
```

Graph:

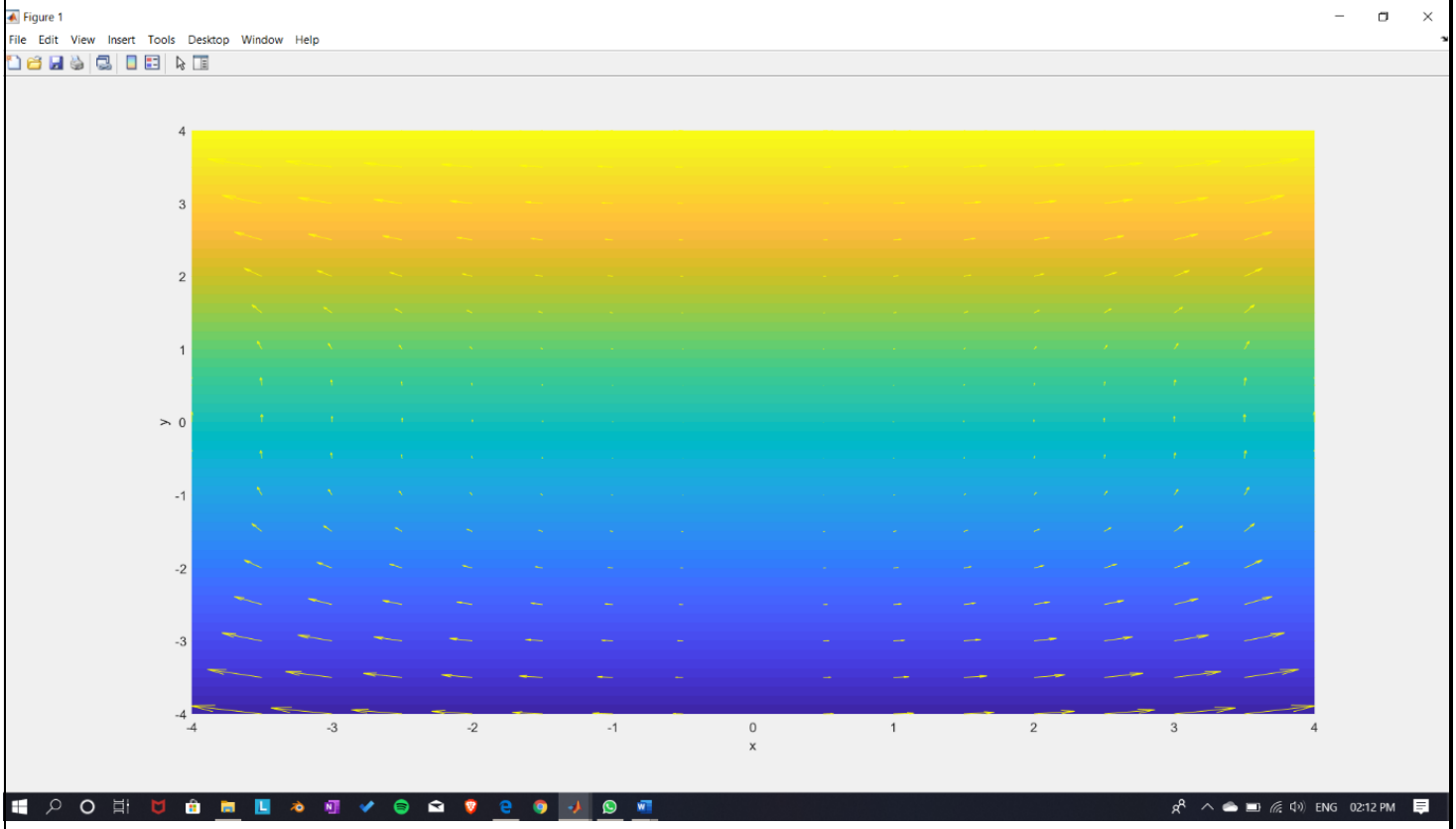


Figure 1
File Edit View Insert Tools Desktop Window Help
4
3
2
1
y 0
-1
-2
-3
-4
-4 -3 -2 -1 0 1 2 3 4
x
ENG 02:12 PM

Question 3

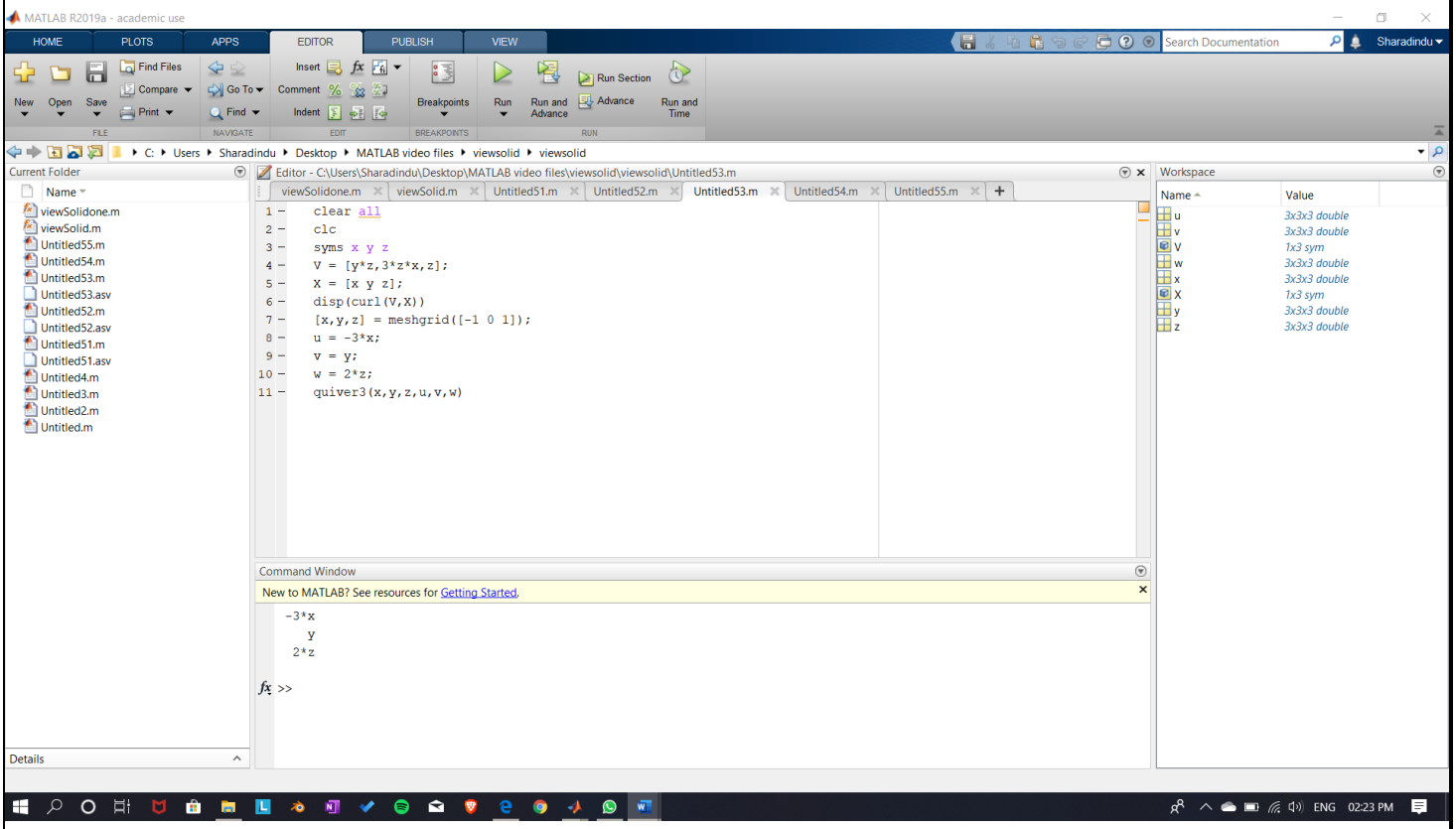
Problem:

Visualize the curl of a vector function $f = [yz,\ 3\,zx,\ z]$.

Code & Input:

```
clear all
clc
syms x y z
V = [y*z,3*z*x,z];
X = [x y z];
disp(curl(V,X))
[x,y,z] = meshgrid([-1 0 1]);
u = -3*x;
v = y;
w = 2*z;
quiver3(x,y,z,u,v,w)
```

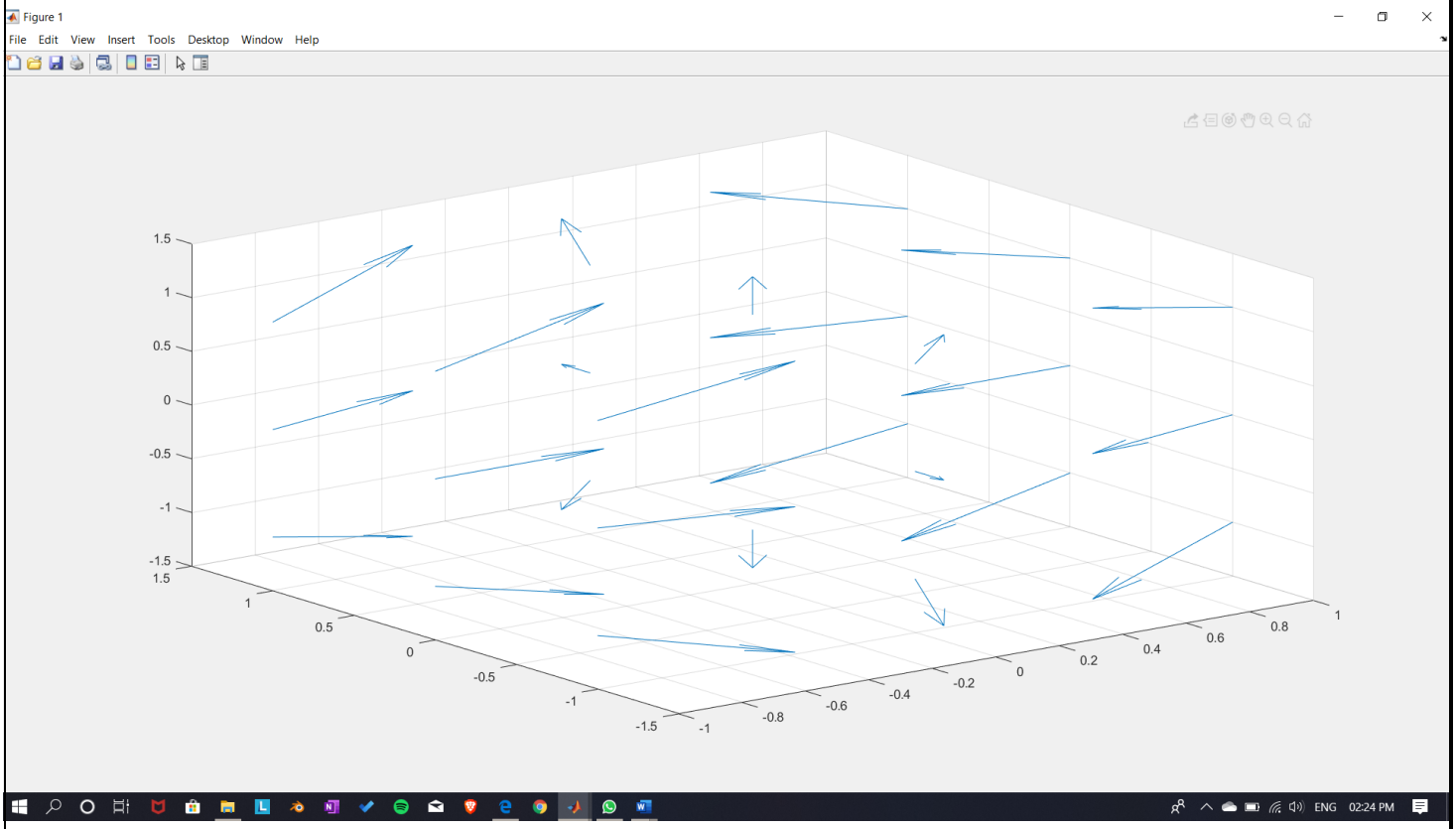
Screenshot of Code:



Output:

```
-3*x
    y
 2*z
```

Graph:



Question 4

Problem:

Find the work done for the force $\vec{F}(x,y,z) = yz\vec{i} + xz\vec{j} + (xy + 2z)\vec{k}$ along the line segment from (1, 0, –2) to (4, 6, 3).

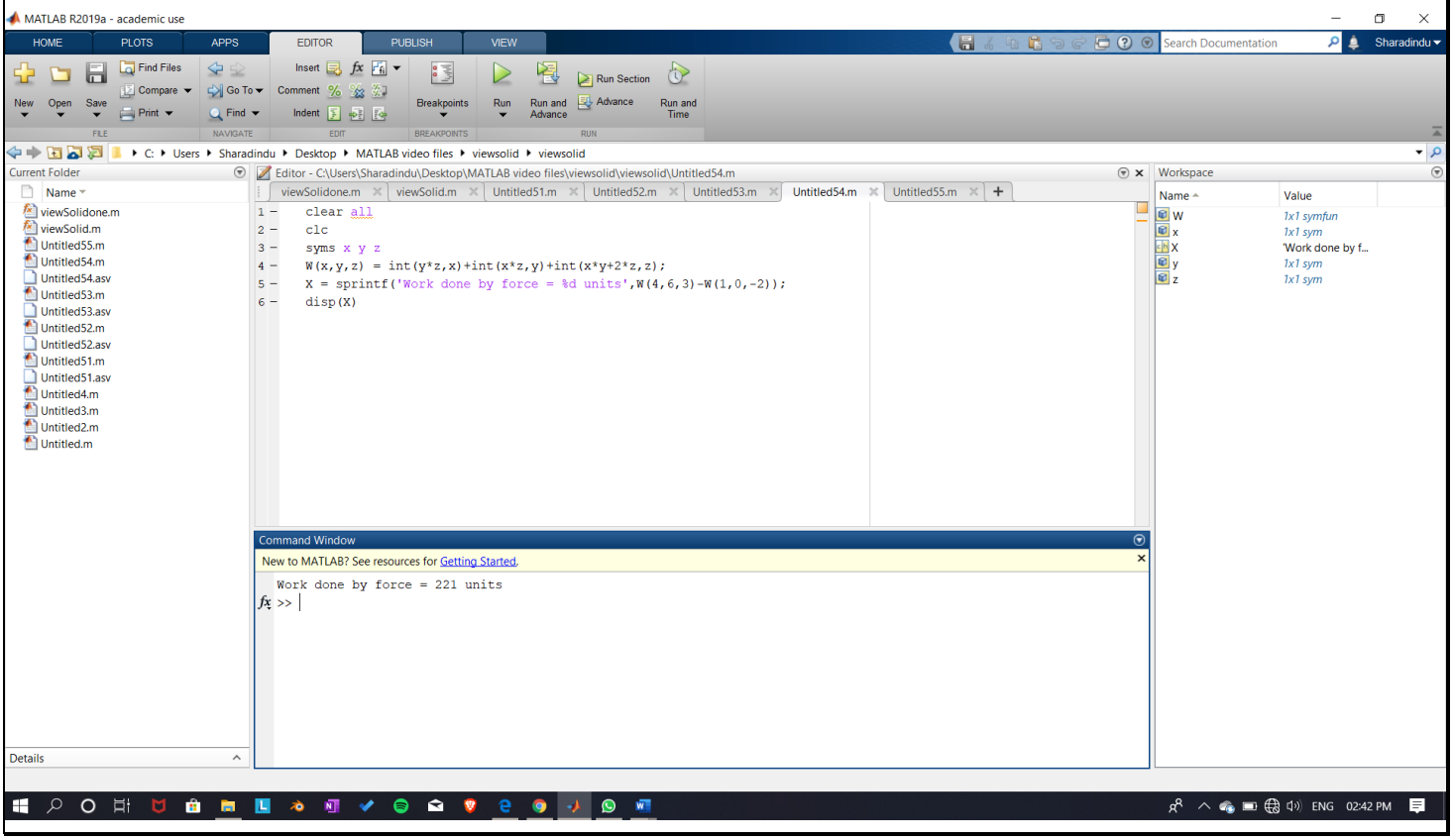
Code & Input:

```
clear all
clc
syms x y z
W(x,y,z) = int(y*z,x)+int(x*z,y)+int(x*y+2*z,z);
X = sprintf('Work done by force = %d units',W(4,6,3)-W(1,0,-2));
disp(X)
```

Output:

```
Work done by force = 221 units
```

Screenshot of Code:



Question 5

Problem:

Find the work done for the force $\vec{F}(x, y) = x^2\vec{i} + y^2\vec{j}$ along the arc of the parabola $y = 2x^2$ from $(-1, 2)$ to $(2, 8)$.

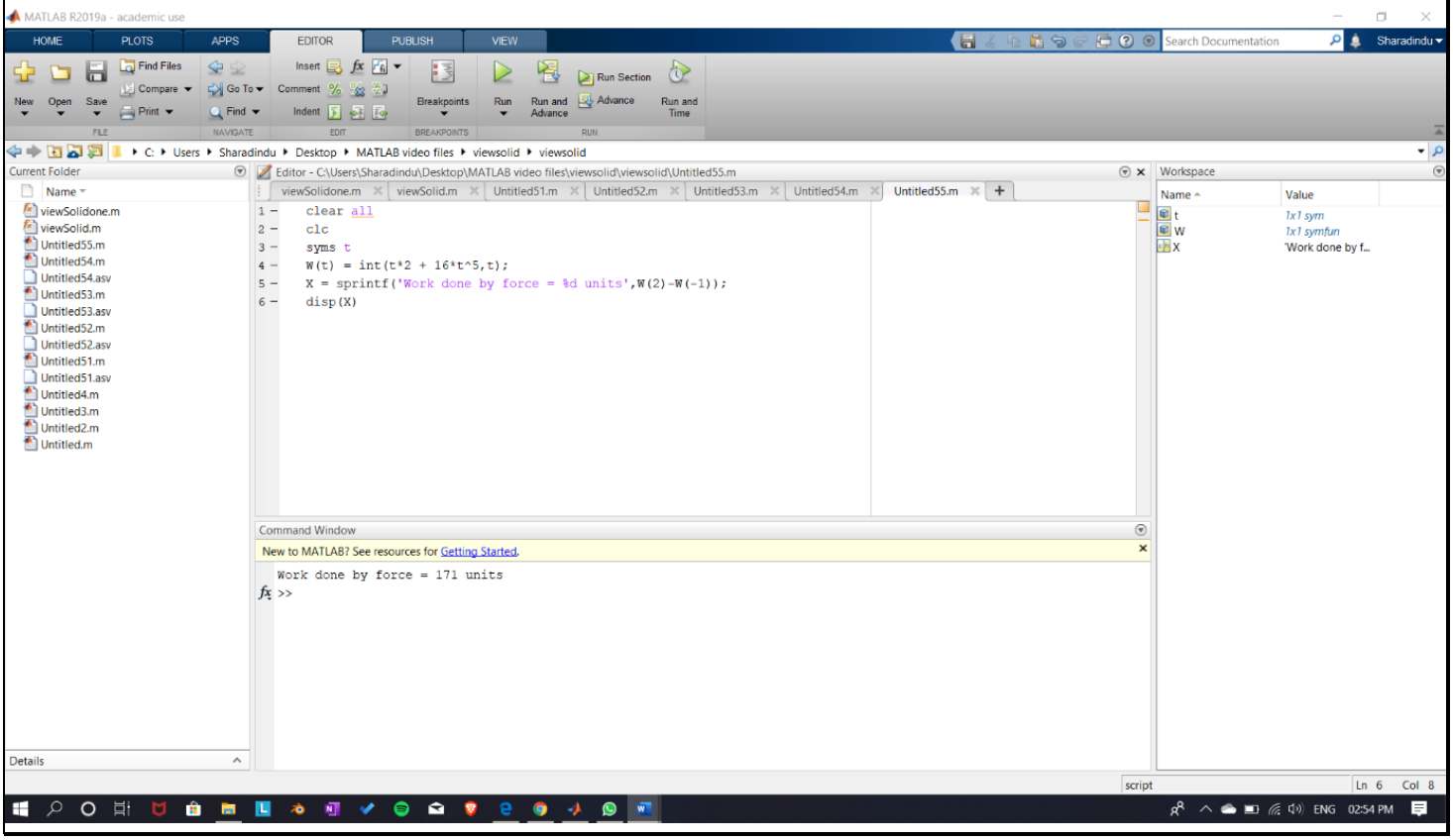
Code & Input:

```
clear all
clc
syms t
W(t) = int(t*2 + 16*t^5,t);
X = sprintf('Work done by force = %d units',W(2)-W(-1));
disp(X)
```

Output:

```
Work done by force = 171 units
```

Screenshot of Code:



End