

Q1.

(a) Write a MATLAB code to compute the maximal directional derivative of $f(x, y) = x^3 - 5xy$ at $(1, -1)$. Also draw the vector field along this direction. [10]

(b) Write a MATLAB code to find and visualize the area between the curves $f(x) = 3x^{1/2}$ and $g(x) = x^2$. [10]

a)

```

1 clc
2 clear
3 syms x y
4 F = [];
5 P = inline(vectorize(F(1)), 'x', 'y');
6 Q = inline(vectorize(F(2)), 'x', 'y');
7 x = linspace(-1, 1, 10);
8 y = x;
9 [X,Y] = meshgrid(x,y);
10 U = P(X,Y);
11 V = Q(X,Y);
12 subplot(2,1,1)
13 quiver(X,Y,U,V,1)
14 subplot(2,1,2)
15 quiver(X,Y,U,V,5)
16 axis on
17 xlabel('x')
18 ylabel('y')
19
20 subs(jacobian(x.^3-5*x*y,[x y]),{x,y},{1 -1})

```

Command Window

```
>>
```

b)

```

1 clc
2 clear
3 syms x y
4 x = linspace(1,5,10);
5 y1 = 3*x.^(1/2);
6 y2 = x.^2;
7 if trapz(x,y2)-trapz(x,y1) > 0
8     d = trapz(x,y2)-trapz(x,y1)
9 else
10     d = trapz(x,y1)-trapz(x,y2)
11 end

```

Command Window

```
d =
21.1179
>>
```

Name	Value	Size	Class
d	21.1179	1×1	double
x	[1, 1.4444, 1.8889, 2, ...]	1×10	double
y	1×1 sym	1×1	sym
y1	[3, 3.6056, 4.1231, 4, ...]	1×10	double
y2	[1, 2.0864, 3.5679, 5, ...]	1×10	double

Q2.

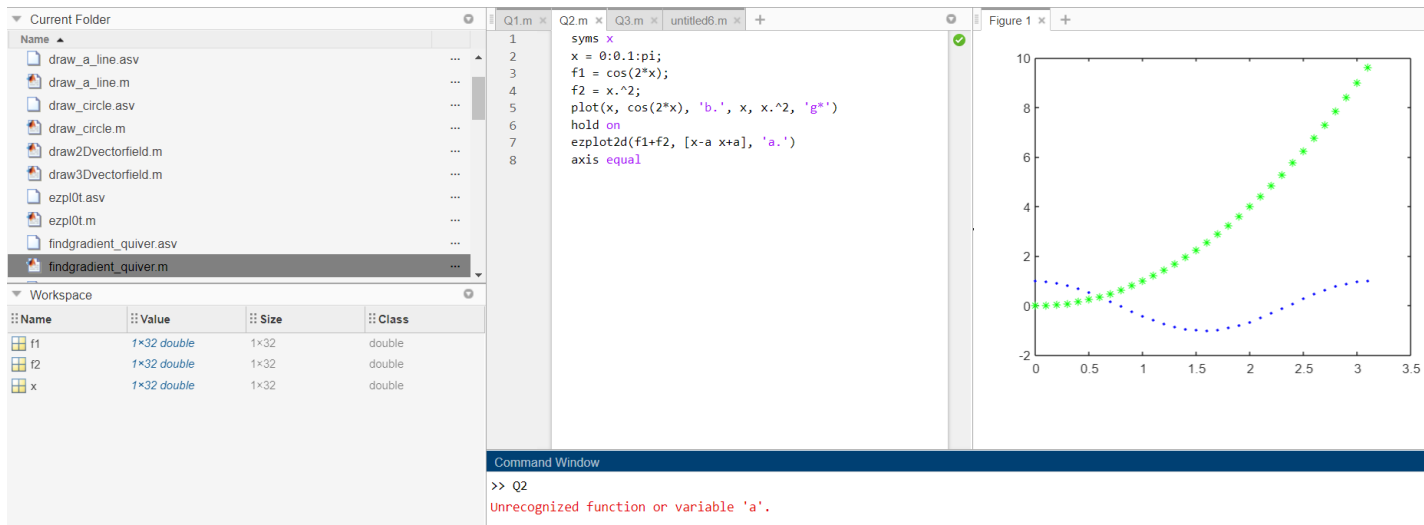
Debug the following codes and find the correct outcomes.

[5]

A student want to plot the function $f(x) = \cos 2x + x^2$ from $0 \leq x \leq \pi$. The following code he wrote have some errors and hence could not get the output. Please rectify the errors and display your output

Code

```
syms x
x = 0:0.1:pi
f1=cos 2x; f2=x^2;
plot(x, cos(2x), 'b.', x, x^2, 'g*');
hold on
ezplot2d(f1+f2, [x-a, x+a], a);
axis equal;
```



Q3.

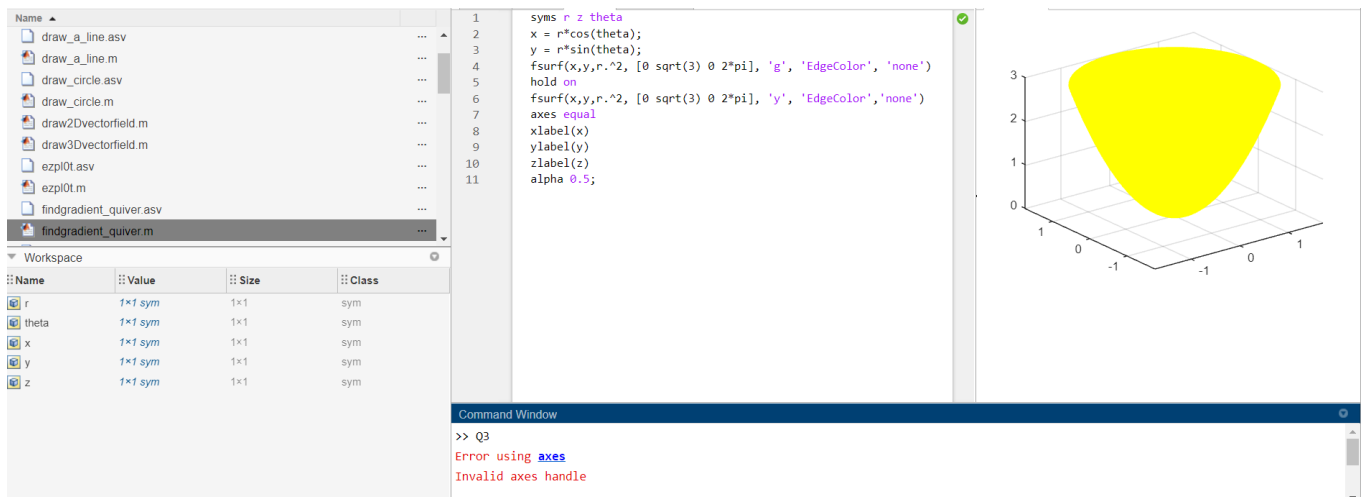
Debug the following codes and find the correct outcomes.

[5]

A student tried to visualize the solid enclosed between the paraboloids $z = x^2 + y^2$ and $z = 3 - x^2 - y^2$. Help him to rectify his code to get the desired output.

Code

```
syms r, z, theta
x = r * cos theta; y = r * sin theta
fsurf(x, y, 5-r^2, [0 sqrt(3) 0 2*pi], 'g', 'EdgeColor', 'none');
hold on
fsurf(x,y,r^2, [0 sqrt(3) 0 2*pi], 'y', 'EdgeColor', 'none');
axes equal; xlabel(x); ylabel(y); zlabel(z);
alpha 0.5
```



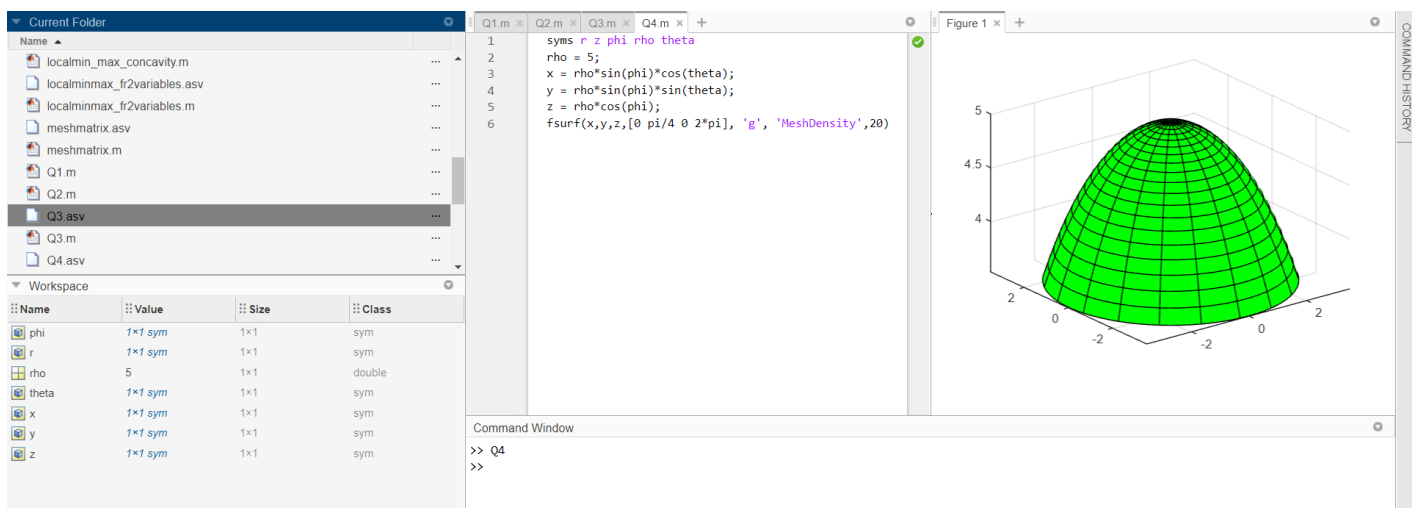
Q4.

Debug the following codes and find the correct outcomes.

A student tried to draw a hemisphere of radius 5 with centre at origin. He encountered errors in his code. Debug his code to visualize the hemisphere.

Code

```
syms r, z,  $\phi$ ,  $\rho$ ,  $\theta$ 
 $\rho=5$ 
 $x = \rho * \sin \phi * \cos \theta$ ,
 $y = \rho * \sin \phi * \sin \theta$ ,  $z = \rho * \cos \phi$ ;
fsurf(x,y,z, [0  $\pi/4$  0  $2*\pi$ ], 'g', 'MeshDensity', 20);
```



Q5.

Debug the following codes and find the correct outcomes.

[5]

A student wrote the following code to visualize the graph of the functions. But there are errors. Identify and correct the errors and then execute the code. Give your output.

Code

```
Syms x,y
x=0:,1;2π;
sub-plot1(2,2,1);
plot(x,sinx);
sub-splot2(2,2,2);
plots(x,cosx);
sub-plot3(2,2,3)
plots(x,exp(-x));
sub-plot4(2,2,4); plots(x,sin3x);
```

