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Name: Bimal parajuli

Reg:20BDS0405

MATLAB FAT

Faculty Name: Dr. M. Prakash

Class Number: VL2020210505039

SLOT: L59 + L60

SET-D

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**ANSWERS IN NEXT PAGE**

# 1. Obtain the maxima and minima value of

$$f(x,y)=2(y^2-x^2)-y^4+x^4$$

## CODES:

```
clc
close all
clc
syms x y
f(x,y)=input('Enter function f(x,y) to calculate the maxima/minima');

p=diff(f,x);           %df/dx
q=diff(f,y);           %df/dy
[ax,ay]=solve(p,q);
ax=double(ax);
ay=double(ay);

r=diff(p,x);           %d2f/dx2
s=diff(p,y);           %d2f/dxdy
t=diff(q,y);           %d2f/dy2
D=r*t-s^2;

figure
fsurf(f);
xlabel('X-axis');
ylabel('Y-axis');
zlabel('Z-axis');
legstr={'Plot of the given function'};
for i=1:size(ax)
    t1=D(ax(i),ay(i));
    t2=r(ax(i),ay(i));
    t3=f(ax(i),ay(i));

    if (double(t1)==0)
        sprintf('At (%f,%f) further investigation needed',ax(i),ay(i))
        legstr=[legstr,{'Case to investigate further'}];
        mkr='ko';
    elseif (double(t1)<0)
        sprintf('The point(%f,%f) is a saddle point',ax(i),ay(i))
        legstr=[legstr,{'Saddle point'}];
        mkr='bv';
    else
        if (double(t2)<0)
            sprintf('The maximum value is %f at the point(%f,%f)',t3,ax(i),ay(i))
            legstr=[legstr,{'maximum value of function'}];
            mkr='g+';
        else
            sprintf('The minimum value is %f at the point(%f,%f)',t3,ax(i),ay(i))
            legstr=[legstr,{'minimum value of the function'}];
        end
    end
end
```

```

        mkr='r+';
    end
end
hold on;
plot3(ax(i),ay(i),t3,mkr,'linewidth',3);
end
legend(legstr,'location','best');
title('Plot of f(x,y) showing maxima/minima')

```

## INPUT:

Enter function f(x,y) to calculate the maxima/minima  
 $2*(y^2-x^2)-y^4+x^4$

## OUTPUT:

ans =

'The point(0.000000,0.000000) is a saddle point'

ans =

'The minimum value is -1.000000 at the point(-1.000000,0.000000)'

ans =

'The minimum value is -1.000000 at the point(1.000000,0.000000)'

ans =

'The maximum value is 1.000000 at the point(0.000000,-1.000000)'

ans =

'The maximum value is 1.000000 at the point(0.000000,1.000000)'

ans =

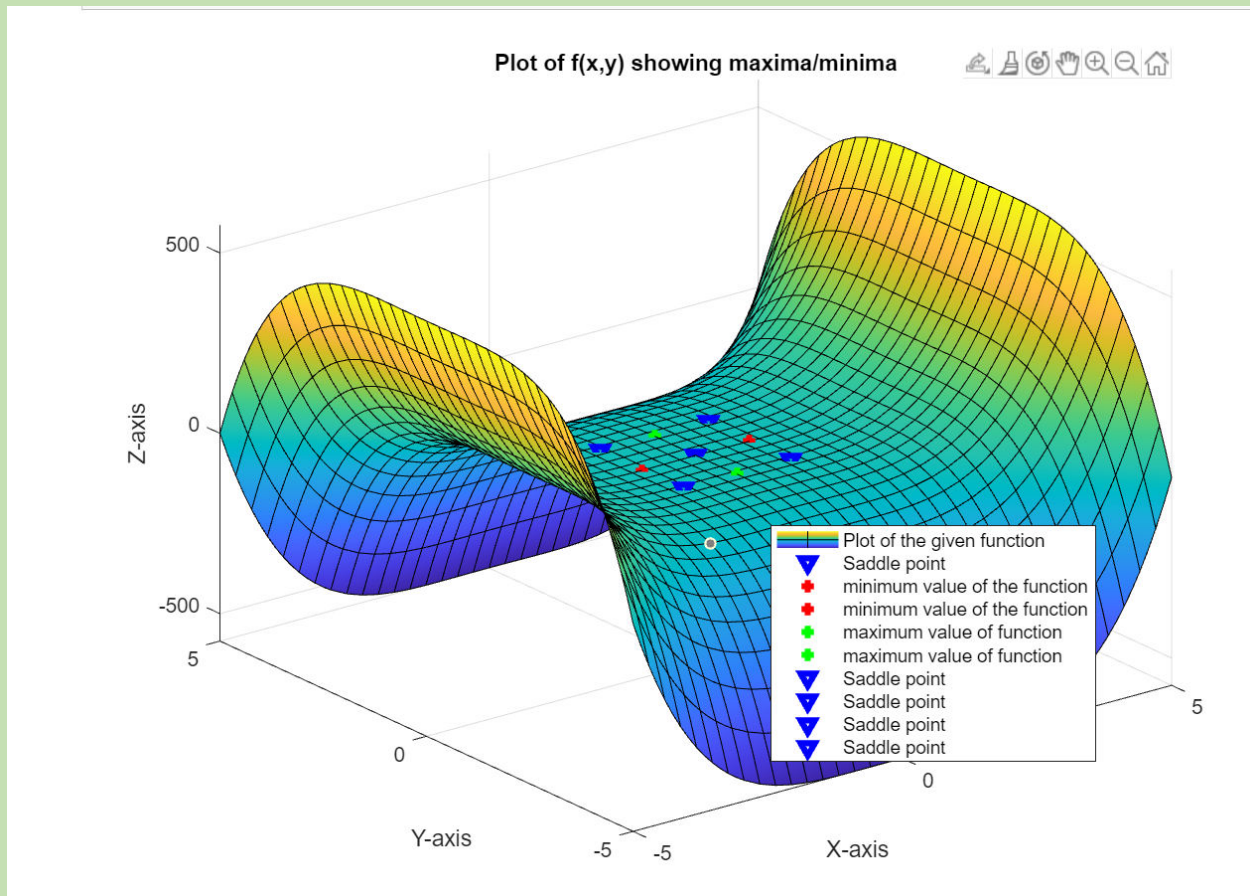
'The point(-1.000000,-1.000000) is a saddle point'

ans =

'The point(1.000000,-1.000000) is a saddle point'

ans =

### RESULTS:



**2. Find the volume of the region enclosed by  $z = x^2 + 3y^2$  and  $z = 6 - x^2 - y^2$ . Use 'input' and add title, legend, axis to the graph.**

**CODE:**

```
clear
close all
clc
syms x y z;
f=input('Enter the function');

%assigning the limit for integration along x,y,z
za=x^2+3*y^2;
zb=6-x^2-y^2;
ya=-sqrt((3-x^2)/2);
yb=sqrt((3-x^2)/2);
xa=-sqrt(3);
xb=sqrt(3);

%calculating and displaying the total volume of
integration
volume=int(int(int(f,z,za,zb),y,ya,yb),x,xa,xb);

disp("the volume enclosed is")
disp(volume)
```

```
%visualizing the 3D plot
viewSolid(z,za,zb,y,ya,yb,x,xa,xb);

grid on;
hold on;

xlabel('x-axis')
ylabel('y-axis')
zlabel('z-axis');

%giving title to the 3D plot
title('Volume enclosed in the solid')
hold off;
```

## INPUT:

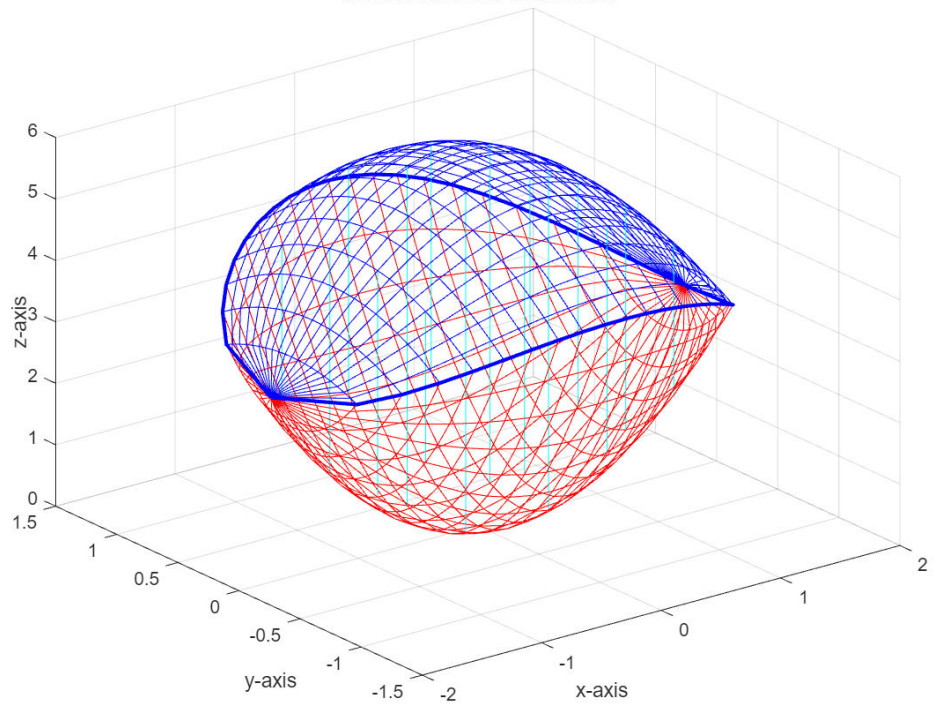
Enter the function

$1+0*x$

## OUTPUT:

the volume enclosed is  
 $(9*\pi*2^{(1/2)})/2$

Volume enclosed in the solid



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Q.1.

SET-D :

```
clear  
close all  
clc  
syms x y  
f(x,y) = input('Enter function f(x,y) to calculate maxima/minima');  
p = diff(f,x);  
q = diff(f,y);  
[ax,ay] = solve(p,q);  
ax = double(ax);  
ay = double(ay);
```

```
r = diff(p,x);  
s = diff(q,y);  
t = diff(q,x);  
D = r*t - s^2;
```

```
figure  
fsurf(f); xlabel('x-axis'); ylabel('y-axis'); zlabel('z-axis');  
legend = {'Plot of given function'}.
```



for i = 1: size(ax)

$T_1 = D(ax(i), ay(i));$

$T_2 = \delta(ax(i), ay(i));$

$T_3 = f(ax(i), ay(i));$

if (double( $T_1$ ) == 0)

fprintf('At (%f,%f) further investigation needed', ax(i), ay(i))

legstr = [legstr, {'case to investigate further'}];

mkr = 'ko';

elseif (double( $T_1$ ) < 0)

fprintf('At point (%f,%f), it is saddle point', ax(i), ay(i))

legstr = [legstr, {'Saddle point'}];

mkr = 'bv'

else

if (double( $T_2$ ) < 0)

fprintf('The max value of function is %f at (%f,%f)',  $T_3$ , ax(i), ay(i))

legstr = [legstr, {'Max value of function'}];

mkr = 'g+';

else

fprintf('The min value of function is %f at (%f,%f)',  $T_3$ , ax(i), ay(i))

legstr = [legstr, {'Min value of function'}];

mkr = 'rt';

end

end

hold on

plot3(ax(i), ay(i),  $T_3$ , mkr, 'linewidth', 3);

end

legend(legstr, 'location', 'Best');

title('Plot of  $f(x,y)$  showing maxima/minima')

Give input:-

Enter function  $f(x,y)$  to calculate maxima/minima.

~~$2x^2 - x^2 - y^4$~~   $2*(y^2 - x^2) - y^4 + x^4.$

20BDS0405

Q2) Find the volume of region enclosed by

$$z = x^2 + 3y^2$$

$$z = 6 - x^2 - y^2.$$

Use 'input' and add title, axis, to the graph.

```
clear
close all
clc
syms x y z;
f = input("Enter the function");
zza = x^2 + 3*y^2;
zb = 6 - x^2 - y^2;
ya = -sqrt((3 - x^2)/2);
yb = sqrt((3 - x^2)/2);
xa = -sqrt(3);
xb = sqrt(3);
Volume = int(int(int(func, z, za, zb), y, ya, yb), x, xa, xb);
disp("The total volume enclosed is");
disp(Volume)
ViewSolid(z, zza, zb, y, ya, yb, x, xa, xb);
grid on;
hold on;
xlabel('x-axis'); ylabel('y-axis'); zlabel('z-axis');
title("Volume enclosed by the two functions (region D)")
hold off;
```