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Lab Assignment - 5

1. Write a MATLAB code to find the Partial derivative of a given function f(x,y) at a given point (x_1,y_1) and also visualize it.

```
clc
clear all
syms x y
z = input('Enter the two dimensional function f(x,y): ');
x1 = input('enter the x value at which the derivative has to be evaluated: ');
y1 = input('enter the y value at which the derivative has to be evaluated: ');
z1 = subs(subs(z, x, x1), y, y1)
ezsurf(z, [x1-2 x1+2])
f1 = diff(z,x)
slopex = subs (subs (f1,x,x1), y, y1);
[x2,z2]=meshgrid(x1-2:.25:x1+2,0:0.5:10);
y2=y1*ones(size(x2));
hold on
h1=surf(x2,y2,z2) ;
set (h1, 'FaceColor' , [0.7,0.7,0.7], 'EdgeColor', 'none' )
t=linspace(-1,1);
x3=x1+t;
y3=y1*ones(size(t));
z3=z1+slopex*t;
line(x3,y3,z3,'color','blue','linewidth',2)
```

OUTPUT:

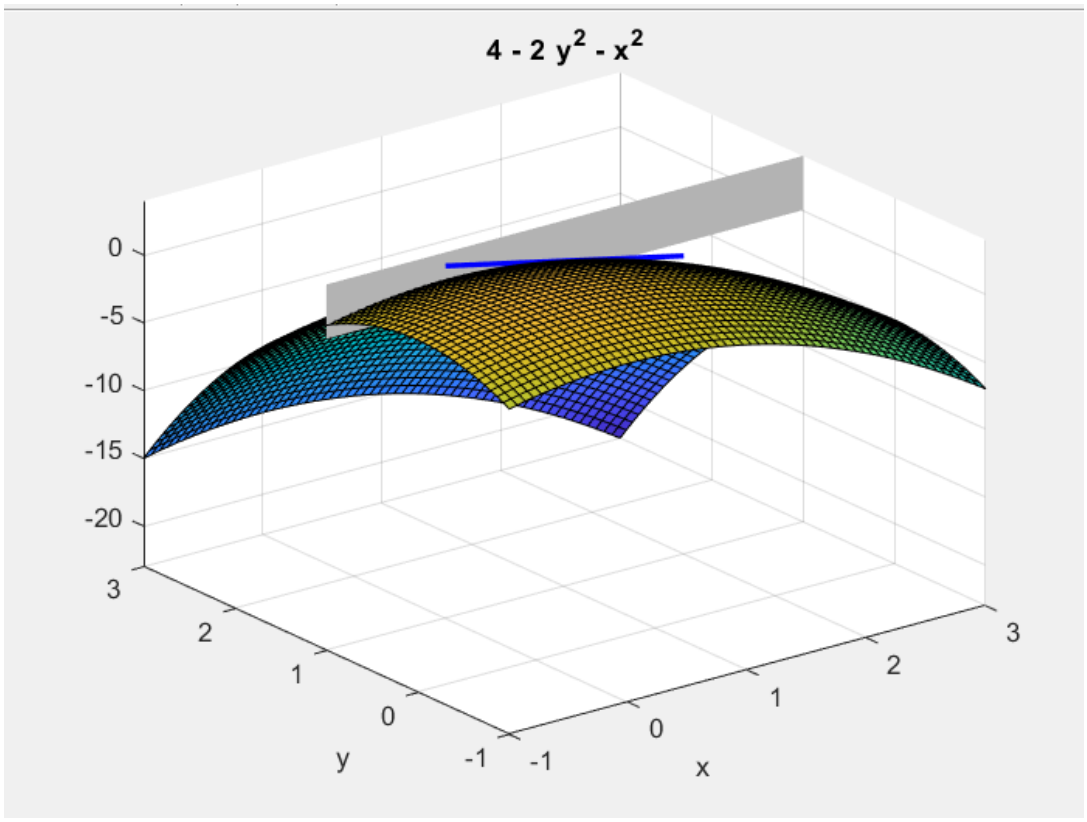
```
Enter the two dimensional function f(x,y): 4-x^2-2*y^2
enter the x value at which the derivative has to be evaluated: 1
enter the y value at which the derivative has to be evaluated: 1

z1 =

1

f1 =

-2*x
```



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s3.m s4.m s5.m s6.m s7.m s8.m s1.m s2.m day1.m ran1.m dayonepic2.m

```
clc
clear all
syms x y
z = input('Enter the two dimensional function f(x,y): ');
x1 = input('enter the x value at which the derivative has to be evaluated: ');
y1 = input('enter the y value at which the derivative has to be evaluated: ');
z1 = subs(subs(z, x, x1), y, y1)
ezsurf(z, [x1-2 x1+2])
f1 = diff(z,x)
slopex = subs (subs (f1,x,x1), y, y1);
[x2,z2]=meshgrid(x1-2:.25:x1+2,0:0.5:10);
y2=y1*ones(size(x2));
hold on
h1=surf(x2,y2,z2) ;
set (h1, 'FaceColor' , [0.7,0.7,0.7], 'EdgeColor', 'none' )
t=linspace(-1,1);
x3=x1+t;
y3=y1*ones(size(t));
z3=z1+slopex*t;
line(x3,y3,z3,'color','blue','linewidth',2)
```

Workspace

Command Window

```
Enter the two dimensional function f(x,y): 4-x^2-2*y^2
enter the x value at which the derivative has to be evaluated: 1
enter the y value at which the derivative has to be evaluated: 1

z1 =

     1


f1 =

    -2*x

fx >>
```

Figure 1

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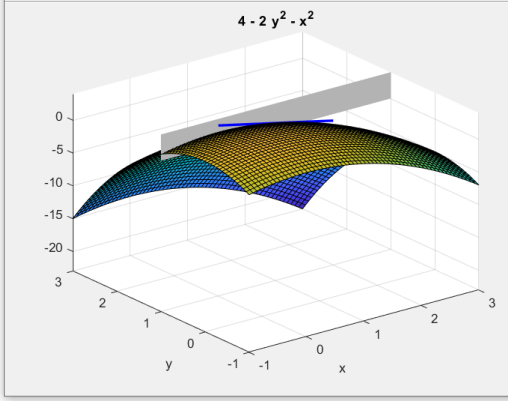


2. Write a MATLAB code to find the Maximum and Minimum values (Extreme values) for the given function f(x,y).

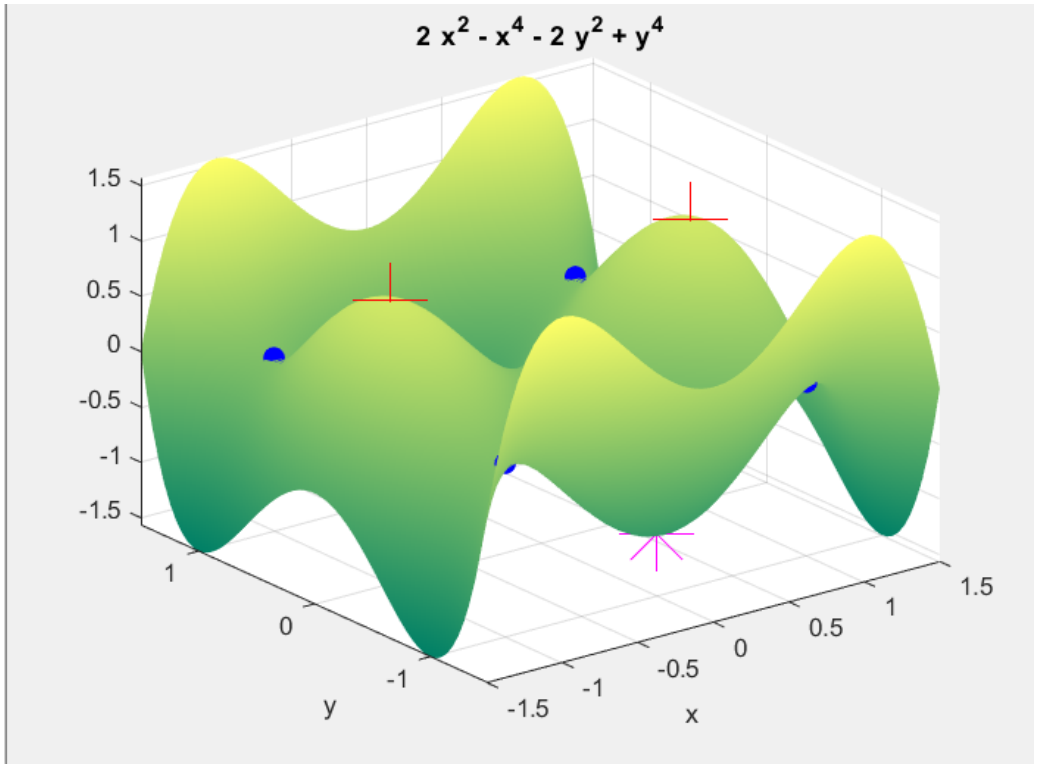
```
clc
clear all
syms x y k T3 real
f = input('Enter the function f(x,y): ');
fx = diff(f,x);
fy = diff(f,y);
[ax ay] = solve(fx,fy);
fxx = diff(fx,x);
D = fxx*diff(fy,y) - diff(fx,y)^2;
r=1;
for k=1:1:size(ax)
if((imag (ax(k))==0)&&(imag(ay(k))==0))
ptx(r)=ax(k);
pty(r)=ay(k);
        r=r+1;
end
end
a1=max(double(ax))
a2=min(double(ax))
b1=max(double(ay))
b2=min(double(ay))
ezsurf(f,[a2-.5,a1+.5,b2-.5,b1+.5])
colormap('summer');
shading interp
hold on
for r1=1:1:(r-1)
 T1=subs(subs(D,x,ptx(r1)),y,pty(r1));
 T2=subs(subs(fxx,x,ptx(r1)),y,pty(r1));
if(double(T1) == 0)
sprintf('The point (x,y) is (%d,%d) and need further investigation',double(ptx(r1)),double(pty(r1)))
elseif(double(T1) < 0)
        T3=subs(subs(f,x,ptx(r1)), y, pty(r1))
sprintf('The point (x,y) is (%d,%d) a saddle point', double(ptx(r1)),double(pty(r1)))
        plot3(double(ptx(r1)),double(pty(r1)),double(T3),'b.','markersize',30);
else
if(double(T2) < 0)
sprintf('The maximum point(x,y) is (%d,%d)',double(ptx(r1)),double(pty(r1)))
T3=subs(subs(f,x,ptx(r1)),y,pty(r1))
sprintf( 'The value of the function is %d',double(T3))
plot3(double(ptx(r1)),double(pty(r1)), double(T3),'r+','markersize', 30);
else
```

```
sprintf('The minimum point(x,y) is (%d,%d)', double(ptx(r1)),double(pty(r1)))
T3=subs(subs(f,x, ptx(r1)), y,pty(r1))
sprintf('The value of the function is %d',double(T3))
plot3(double(ptx(r1)),double(pty(r1)),double(T3),'m*','markersize',30);
end
end
end
```

OUTPUT:

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

a1 =1
a2 =-1
b1 =1
b2 =-1
T3 =0
ans =   'The point (x,y) is (0,0) a saddle point'
ans =   'The maximum point(x,y) is (-1,0)'
T3 =1
ans =   'The value of the function is 1'
ans =   'The maximum point(x,y) is (1,0)'
T3 =1
ans =   'The value of the function is 1'
ans =   'The minimum point(x,y) is (0,-1)'
T3 =-1
ans =   'The value of the function is -1'
ans =   'The minimum point(x,y) is (0,1)'
T3 =-1
ans =   'The value of the function is -1'
T3 =0
ans =   'The point (x,y) is (-1,-1) a saddle point'
T3 =0
ans =   'The point (x,y) is (1,-1) a saddle point'
T3 =0
ans =   'The point (x,y) is (-1,1) a saddle point'
T3 =0
ans =   'The point (x,y) is (1,1) a saddle point'
```



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```
a2=min(double(ax))
b1=max(double(ay))
b2=min(double(ay))
ezsurf(f,[a2-.5,a1+.5,b2-.5,b1+.5])
colormap('summer');
shading interp
hold on
for r1=1:1:(r-1)
 T1=subs(subs(D,x,ptx(r1)),y,pty(r1));
 T2=subs(subs(fxx,x,ptx(r1)),y,pty(r1));
if(double(T1) == 0)
sprintf('The point (x,y) is (%d,%d) and need further investigation',double(ptx(r1)),doub
elseif(double(T1) < 0)
    T3=subs(subs(f,x,ptx(r1)), y, pty(r1))
sprintf('The point (x,y) is (%d,%d) a saddle point', double(ptx(r1)),double(pty(r1)))
    plot3(double(ptx(r1)),double(pty(r1)),double(T3),'b.','markersize',30);
else
if(double(T2) < 0)
sprintf('The maximum point(x,y) is (%d,%d)',double(ptx(r1)),double(pty(r1)))
T3=subs(subs(f,x,ptx(r1)),y,pty(r1))
sprintf( 'The value of the function is %d',double(T3))
plot3(double(ptx(r1)),double(pty(r1)), double(T3),'r+','markersize', 30);
else
sprintf('The minimum point(x,y) is (%d,%d)', double(ptx(r1)),double(pty(r1)))
T3=subs(subs(f,x, ptx(r1)), y,pty(r1))
sprintf('The value of the function is %d',double(T3))
plot3(double(ptx(r1)),double(pty(r1)),double(T3),'m*','markersize',30);
end
end
end
```

Command Window

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

a1 =

     1

a2 =

    -1

b1 =

     1

b2 =

    -1

T3 =

     0

ans =

    'The point (x,y) is (0,0) a saddle point'

ans =

    'The maximum point(x,y) is (-1,0)'
```