

MATLAB EXPERIMENT-4

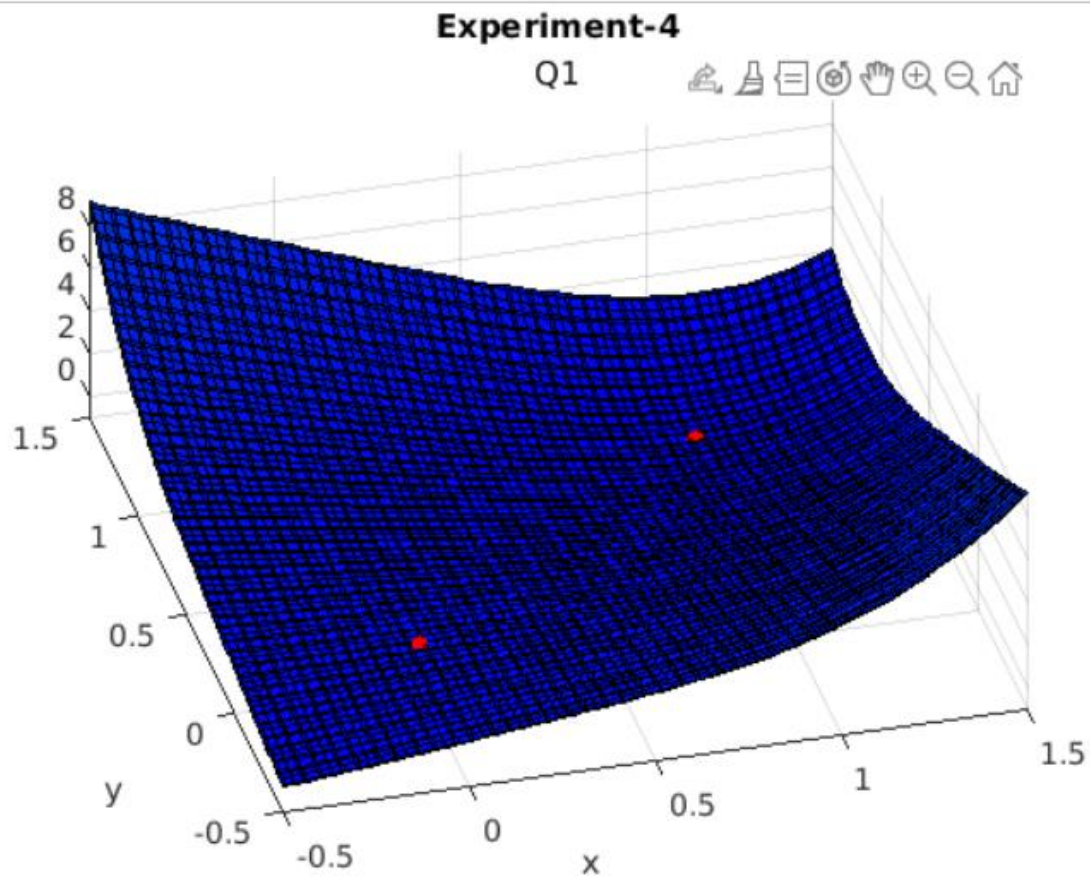
BY-20BCE1209

Q-1) Investigate maximum and minimum for the following function $F(x, y) = x^4 + y^4 - 4xy + 1$

CODE :-

```
clc
clear
syms x y real
f=(x^4)+(y^4)-4*x*y+1;
fx=diff(f,x);
fy=diff(f,y);
fxx=diff(fx,x);
fxy=diff(fx,y);
fyy=diff(fy,y);
[ax,ay]=solve(fx,fy);
ax=double(ax);
ay=double(ay);
D=fxx*fyy-(fxy)^2;
n=length(ax);
d=[ax(1)-0.5,ax(n)+0.5,ay(1)-0.5,ay(n)+0.5];
ezsurf(f,d),colormap("winter");grid on,title Experiment-4 Q1;
hold on
for i=1:length(ax)
    r1=subs(D,[x,y],[ax(i),ay(i)]);
    r2=subs(f,[x y],[ax(i) ay(i)]);
    if r1>0
        t=subs(fxx,[x,y],[ax(i) ay(i)]);
        if t>0
            sprintf("The function has min value at (%f,%f)",ax(i),ay(i))
            sprintf("The min value is %f",r2)
        else
            sprintf("The function has max value at (%f,%f)",ax(i),ay(i))
            sprintf("The min value is %f",r2)
        end
    elseif r1<0
        sprintf("The point (%f,%f) is saddle point",ax(i),ay(i))
    else
        sprintf("The max/min at (%f,%f) cannot be determined",ax(i),ay(i))
    end
    plot3(ax(i),ay(i),r2,'r.','markersize',20)
end
```

OUTPUT: -



COMMAND WINDOW

```
ans =  
    "The point (0.000000,0.000000) is saddle point"  
  
ans =  
    "The function has min value at (-1.000000,-1.000000)"  
  
ans =  
    "The min value is -1.000000"  
  
ans =  
    "The function has min value at (1.000000,1.000000)"  
  
ans =  
    "The min value is -1.000000"
```

Q2 Find the maximum and minimum values of the function $F(x,y) = x^3y + 12x^2 - 8y$

CODE: -

```

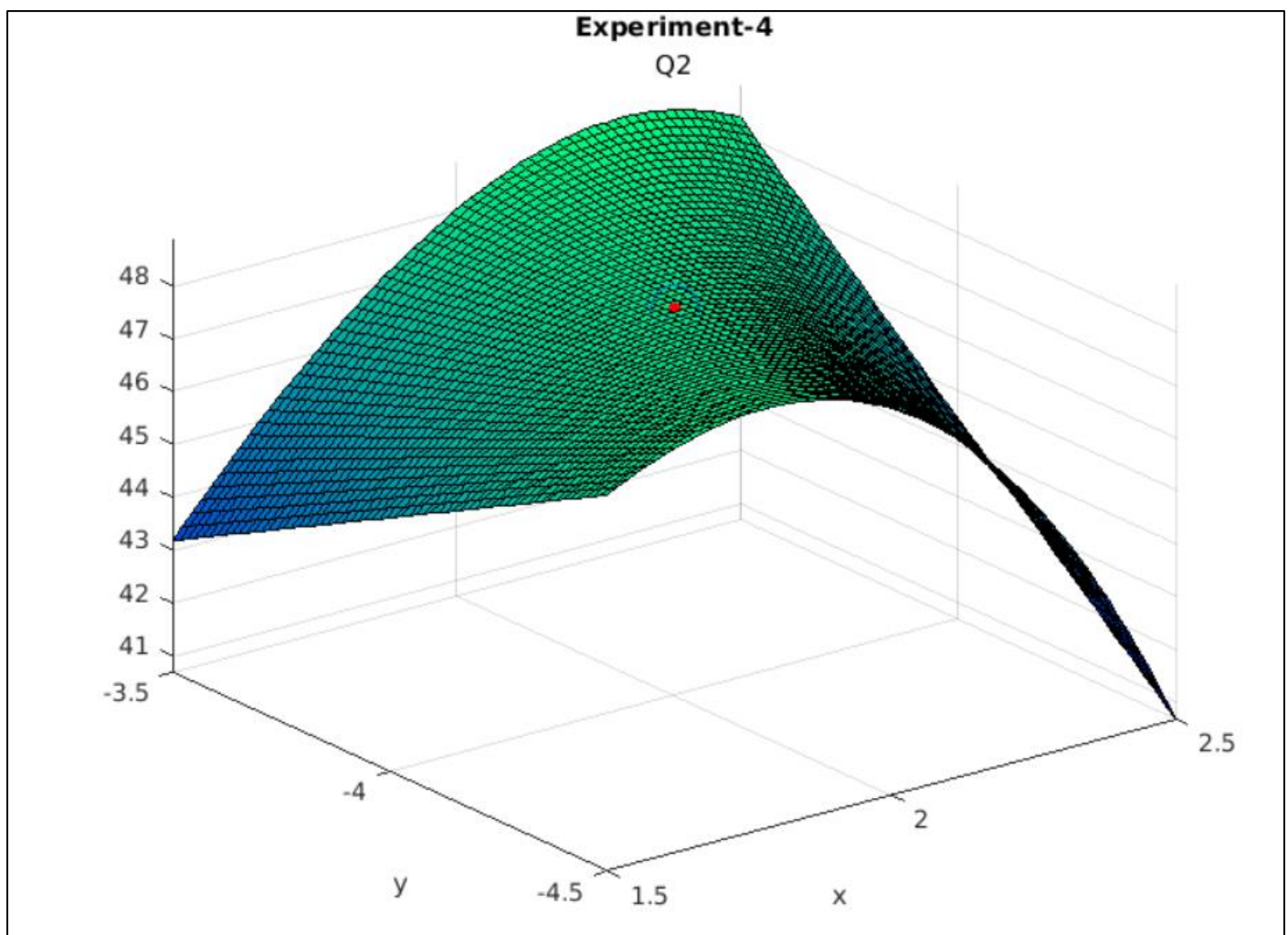
clc
clear
syms x y real
f=(x^3)*y+12*(x^2)+ -8*y;
fx=diff(f,x);
fy=diff(f,y);
fxx=diff(fx,x);
fxy=diff(fx,y);
fyy=diff(fy,y);

[ax,ay]=solve(fx,fy);
ax=double(ax);
ay=double(ay);
D=fxx*fyy-(fxy)^2;
n=length(ax);
d=[ax(1)-0.5,ax(n)+0.5,ay(1)-0.5,ay(n)+0.5];

s=ezsurf(f,d, colormap("winter"));grid on,title Experiment-4 Q2;
hold on
for i=1:length(ax)
    r1=subs(D,[x,y],[ax(i),ay(i)]);
    r2=subs(f,[x y],[ax(i) ay(i)]);
    if r1>0
        t=subs(fxx,[x,y],[ax(i) ay(i)]);
        if t>0
            sprintf("The function has min value at (%f,%f)",ax(i),ay(i))
            sprintf("The min value is %f",r2)
        else
            sprintf("The function has max value at (%f,%f)",ax(i),ay(i))
            sprintf("The min value is %f",r2)
        end
    elseif r1<0
        sprintf("The point (%f,%f) is saddle point",ax(i),ay(i))
    else
        sprintf("The max/min at (%f,%f) cannot be determined",ax(i),ay(i))
    end
    plot3(ax(i),ay(i),r2,'r.','markersize',20)
end

```

OUTPUT: -



COMMAND WINDOW

ans =

"The point (2.000000,-4.000000) is saddle point"

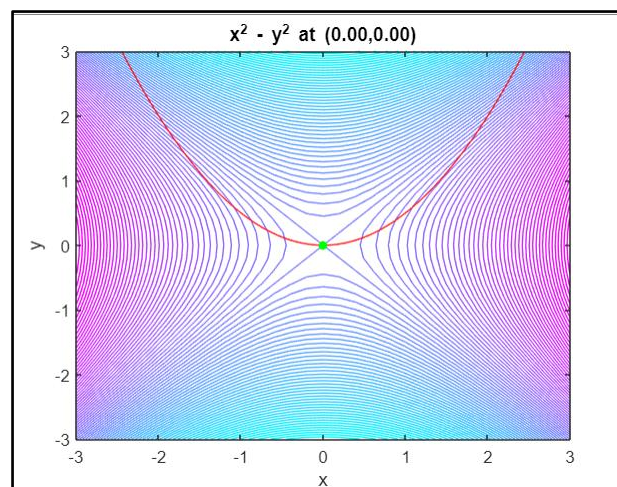
Q3 Find the extreme values of the function $f(x,y)=x^2-y^2$ subject to the constraints $2y-x^2=0$

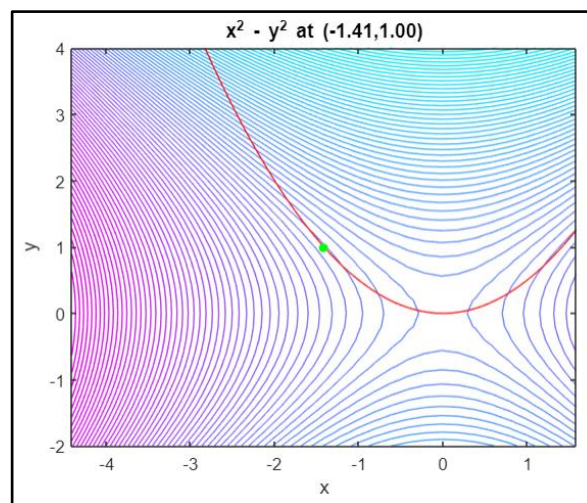
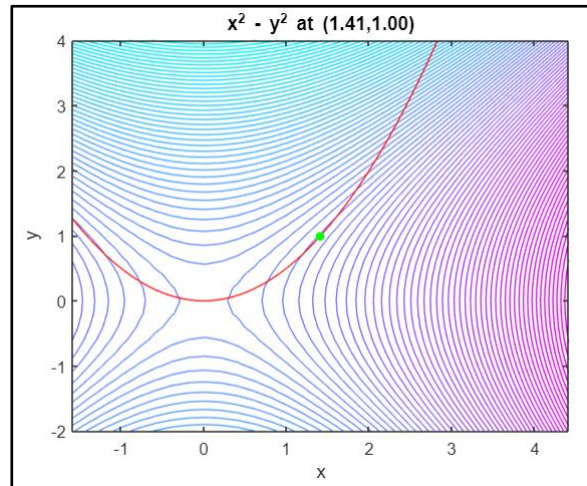
CODE :-

```
clc
clear
syms x y l real
f=x^2-y^2;
g=2*y-x^2;
[lam,x1,y1]=solve(jacobian(f-l*g,[x,y,l]));
x1=double(x1);y1=double(y1);
t=double(subs(f,{x,y},{x1,y1}));
x2=0;y2=0;k=t(1);
for i=1:size(t)
    figure
    sprintf("The critical points are (%.2f,%.2f)",x1(i),y1(i))
    sprintf("The extreme value of func is %.3f",t(i))

    [X1,Y1]=meshgrid(x1(i)-3:0.2:x1(i)+3,y1(i)-3:0.2:y1(i)+3);
    Z2=@(x,y)eval(vectorize(f));
    Z1=Z2(X1,Y1);
    contour(X1,Y1,Z1,85),colormap("cool");
    hold on
    s=ezplot(g,[x1(i)-3 x1(i)+3 y1(i)-3 y1(i)+3]);
    set(s,'Color',[1,0.1,0.1]);
    str=sprintf("%s at (%.2f,%.2f)",f,x1(i),y1(i));
    title(str)
    plot(x1(i),y1(i),'g.','markersize',15);
end
```

OUTPUT :-





```

COMMAND WINDOW

ans =

    "The critical points are (0.00,0.00)"

ans =

    "The extreme value of func is 0.000"

ans =

    "The critical points are (1.41,1.00)"

ans =

    "The extreme value of func is 1.000"

ans =

    "The critical points are (-1.41,1.00)"

ans =

    "The extreme value of func is 1.000"

>>

```


Q4 Find the extreme values of the function $f(x,y)=2x+2xy+y$ subject to constraints $2x+y=100$

CODE: -

```
clc
clear
close all
syms x y l real
f=2*x +y+2*x*y;
g=2*x+y-100;
[lam,x1,y1]=solve(jacobian(f-l*g,[x,y,l]));
x1=double(x1);y1=double(y1);
t=double(subs(f,{x,y},{x1,y1}));
x2=0;y2=0;k=t(1);
for i=1:size(t)
    figure
    sprintf("The critical points are (%.2f,%.2f)",x1(i),y1(i))
    sprintf("The extreme value of func is %.3f",t(i))

    [X1,Y1]=meshgrid(x1(i)-3:0.2:x1(i)+3,y1(i)-3:0.2:y1(i)+3);
    Z2=@(x,y)eval(vectorize(f));
    Z1=Z2(X1,Y1);
    contour(X1,Y1,Z1,85),colormap("cool");
    hold on
    s=ezplot(g,[x1(i)-3 x1(i)+3 y1(i)-3 y1(i)+3]);
    set(s,'Color',[1,0.1,0.1]);
    str=sprintf("%s at (%.2f,%.2f)",f,x1(i),y1(i));
    title(str)

    plot(x1(i),y1(i),'g.','markersize',15);
end
```

OUTPUT: -

COMMAND WINDOW

ans =

"The critical points are (25.00,50.00)"

ans =

"The extreme value of func is 2600.000"

