20BCE1548-TIRTH VISHALBHAI DAVE

EXP-10

Q1-

Find the extreme values of the function $f(x,y)= x^2 +2y^2$ on the circle $x^2+y^2=1$.

CODE: -

```
%% Initialization:
syms x y lam real
f= input('Enter f(x,y) to be extremized : ');
g= input('Enter the constraint function g(x,y) :
');
%% Computing Partial derivatives and finding the
critical points:
F=f-lam*g
Fx=diff(F,x)
Fy=diff(F,y)
[ax,ay,alam]=solve([Fx,Fy,g],x,y,lam)
ax=double(ax)
ay=double(ay)
%% Collecting critical points
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
%% Computing the values at the critical points
ax=ptx
ay=pty
T = subs(f,{x,y},{ax,ay})
T=double(T)
epx=3
```

```
epy=3
figure (1)
for i = 1:length(T)
D=[ax(i)-epx ax(i)+epx ay(i)-epy ay(i)+epy]
fprintf('The critical point (x,y) is
(%1.3f,%1.3f).',ax(i),ay(i))
fprintf('The value of the function is
%1.3f\n',T(i))
ezcontour(f,D)
hold on
h = ezplot(g,D);
set(h,'Color',[1,0.7,0.9])
plot(ax(i),ay(i),'k.','markersize',15+2*i)
end
%% Finding the Maximum and minimum at those
points:
f_min=min(T)
f_max=max(T)
```

OUTPUT: -

Enter f(x,y) to be extremized : x^2+2*y^2

Enter the constraint function g(x,y) : x^2+y^2==1

F =

x^2 + 2*y^2 - lam*(x^2 + y^2) == x^2 + 2*y^2 - lam

Fx =

2*x - 2*lam*x == 2*x

Fy =

4*y - 2*lam*y == 4*y

ax =

-1

1

ay =

0

0

alam =

0

0

ax =

-1

1

ay =

0

0

ax =

-1 1

ay =

0 0

T =

[1, 1]

T =

1 1

epx =

3

epy =

3

D =

-4 2 -3 3

The critical point (x,y) is (-1.000,0.000).The value of the function is 1.000

D =

-2 4 -3 3

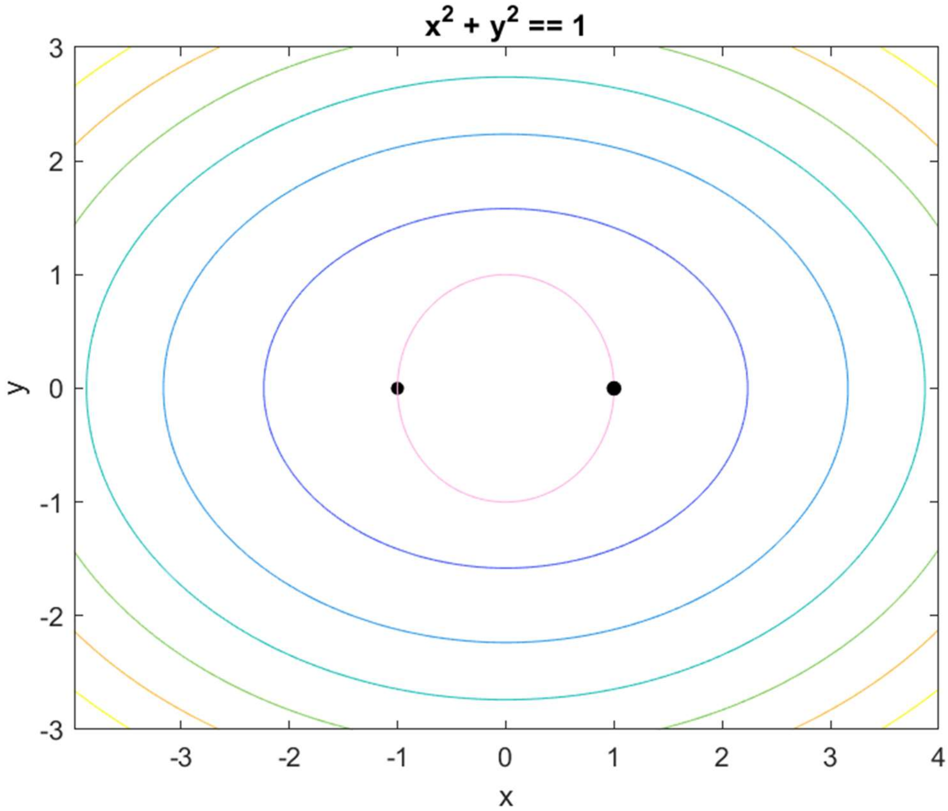
The critical point (x,y) is (1.000,0.000).The value of the function is 1.000

f_min =

1

f_max =

1



Q2-

Find the extreme values of the function $f(x,y)=3x+4y$ on the circle x^2+y^2=1

CODE: -

```
%% Initialization:
syms x y lam real
f= input('Enter f(x,y) to be extremized : ');
g= input('Enter the constraint function g(x,y) :
');
%% Computing Partial derivatives and finding the
critical points:
F=f-lam*g
Fx=diff(F,x)
Fy=diff(F,y)
[ax,ay,alam]=solve([Fx,Fy,g],x,y,lam)
ax=double(ax)
ay=double(ay)
%% Collecting critical points
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
%% Computing the values at the critical points
ax=ptx
ay=pty
T = subs(f,{x,y},{ax,ay})
T=double(T)
epx=3
epy=3
figure (1)
for i = 1:length(T)
D=[ax(i)-epx ax(i)+epx ay(i)-epy ay(i)+epy]
fprintf('The critical point (x,y) is
(%1.3f,%1.3f).',ax(i),ay(i))
```

```
fprintf('The value of the function is
%1.3f\n',T(i))
ezcontour(f,D)
hold on
h = ezplot(g,D);
set(h,'Color',[1,0.7,0.9])
plot(ax(i),ay(i),'k.','markersize',15+2*i)
end
%% Finding the Maximum and minimum at those
points:
f_min=min(T)
f_max=max(T)
```

OUTPUT: -

Enter f(x,y) to be extremized : 3*x+4*y

Enter the constraint function g(x,y) : x^2+y^2==1

F =

3*x + 4*y - lam*(x^2 + y^2) == 3*x - lam + 4*y

Fx =

3 - 2*lam*x == 3

Fy =

4 - 2*lam*y == 4

ax =

-1

1

ay =

0

0

```
alam =
0
0
ax =
   -1
    1
ay =
    0
    0
ax =
   -1     1
ay =
    0     0
T =
[-3, 3]
T =
   -3     3
epx =
    3
epy =
    3
D =
   -4     2    -3     3
```

The critical point (x,y) is (-1.000,0.000).The value of the function is -3.000

D =

-2 4 -3 3

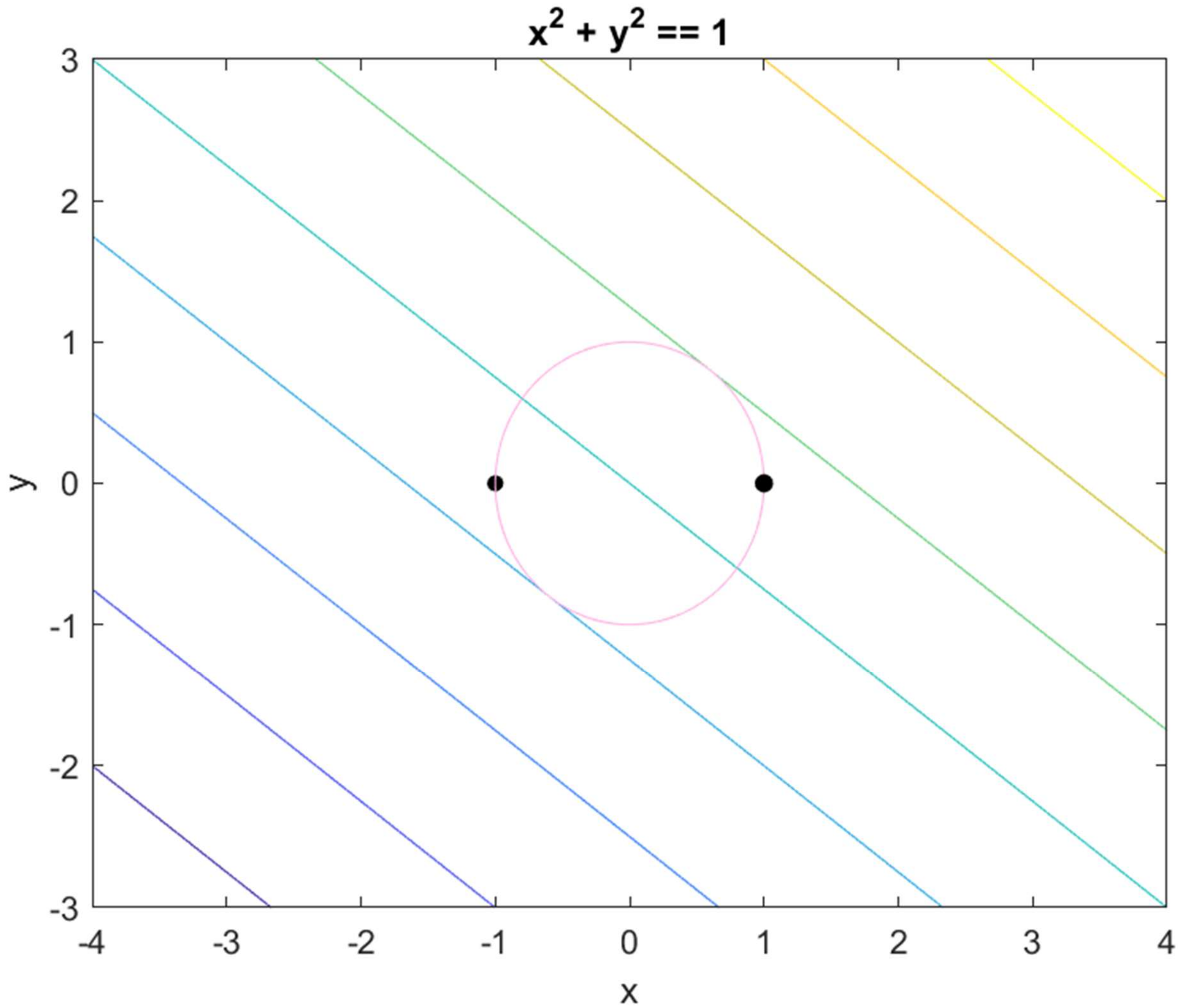
The critical point (x,y) is (1.000,0.000).The value of the function is 3.000

f_min =

-3

f_max =

3



Q3-

Find the extreme values of the function $f(x,y)$=xy on the ellipse $\frac{x^2}{8}+\frac{y^2}{2}=1$

CODE: -

```
%% Initialization:
syms x y lam real
f= input('Enter f(x,y) to be extremized : ');
g= input('Enter the constraint function g(x,y) :
');
%% Computing Partial derivatives and finding the
critical points:
F=f-lam*g
Fx=diff(F,x)
Fy=diff(F,y)
[ax,ay,alam]=solve([Fx,Fy,g],x,y,lam)
ax=double(ax)
ay=double(ay)
%% Collecting critical points
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
%% Computing the values at the critical points
ax=ptx
ay=pty
T = subs(f,{x,y},{ax,ay})
T=double(T)
epx=3
epy=3
figure (1)
for i = 1:length(T)
D=[ax(i)-epx ax(i)+epx ay(i)-epy ay(i)+epy]
```

```
fprintf('The critical point (x,y) is
(%1.3f,%1.3f).',ax(i),ay(i))
fprintf('The value of the function is
%1.3f\n',T(i))
ezcontour(f,D)
hold on
h = ezplot(g,D);
set(h,'Color',[1,0.7,0.9])
plot(ax(i),ay(i),'k.','markersize',15+2*i)
end
%% Finding the Maximum and minimum at those
points:
f_min=min(T)
f_max=max(T)
```

OUTPUT: -

Enter f(x,y) to be extremized : x*y

Enter the constraint function g(x,y) : ((x^2)/8)+((y^2)/2)==1

F =

x*y - lam*(x^2/8 + y^2/2) == x*y - lam

Fx =

y - (lam*x)/4 == y

Fy =

x - lam*y == x

ax =

-2*2^(1/2)

2*2^(1/2)

ay =

0

0

alam =

0

0

ax =

-2.8284

2.8284

ay =

0

0

ax =

-2.8284   2.8284

ay =

0   0

T =

[0, 0]

T =

0   0

epx =

3

epy =

3

D =

-5.8284   0.1716   -3.0000   3.0000

The critical point (x,y) is (-2.828,0.000).The value of the function is 0.000

D =

-0.1716   5.8284   -3.0000   3.0000

The critical point (x,y) is (2.828,0.000).The value of the function is 0.000

f_min =

0

f_max =

0