

Digital Assignment SL. 6, Experiment – 3B: Maxima and Minima for a function of two variables

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Q1) Write a matlab code for the maxima and minima for the following function: $f(x,y) = x^4 + y^4 - x^2 - y^2 + 1$

A: Code is as follows:

```
%Write a matlab code for the maxima and minima for the following function
% f(x,y) = x^4 + y^4 - x^2 - y^2 + 1

clc
clear
syms x y
f(x,y)=input('Enter the function f(x,y):');
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(p,y); t=diff(q,y);D=r*t-s^2;
figure
fsurf(f);
legstr={'Function Plot'};
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 is required',ax(i),ay(i))
legstr=[legstr,{'Case of Further investigation'}}];
mkr='ko';
elseif (double(T1)<0)
sprintf('The point (%f,%f) is a saddle point', ax(i),ay(i))
legstr=[legstr,{'Saddle Point'}}]; % updating Legend marker
mkr='bv';
else
if (double(T2) < 0)
sprintf('The maximum value of the function is f(%f,%f)=%f', ax(i),ay(i), T3)
legstr=[legstr,{'Maximum value of the function'}}];% updating Legend marker
mkr='g+';
else
sprintf('The minimum value of the function is f(%f,%f)=%f', ax(i),ay(i), T3)
legstr=[legstr,{'Minimum value of the function'}}];% updating Legend marker
mkr='r*';
end
end
hold on
plot3(ax(i),ay(i),T3,mkr,'Linewidth',4);
end
legend(legstr,'Location','Best');
```

Output (via Command Window):

Enter the function $f(x,y)$:

$x^4 + y^4 - x^2 - y^2 + 1$

ans =

'The maximum value of the function is $f(0.000000,0.000000)=1.000000$ '

ans =

'The minimum value of the function is $f(-0.707107,-0.707107)=0.500000$ '

ans =

'The minimum value of the function is $f(0.707107,-0.707107)=0.500000$ '

ans =

'The minimum value of the function is $f(-0.707107,0.707107)=0.500000$ '

ans =

'The minimum value of the function is $f(0.707107,0.707107)=0.500000$ '

ans =

'The point $(-0.707107,0.000000)$ is a saddle point'

ans =

'The point $(0.707107,0.000000)$ is a saddle point'

ans =

'The point $(0.000000,-0.707107)$ is a saddle point'

ans =

'The point (0.000000,0.707107) is a saddle point'

