**MAT1011 – Calculus for Engineers (MATLAB), Fall Semester 2020-2021**

**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');

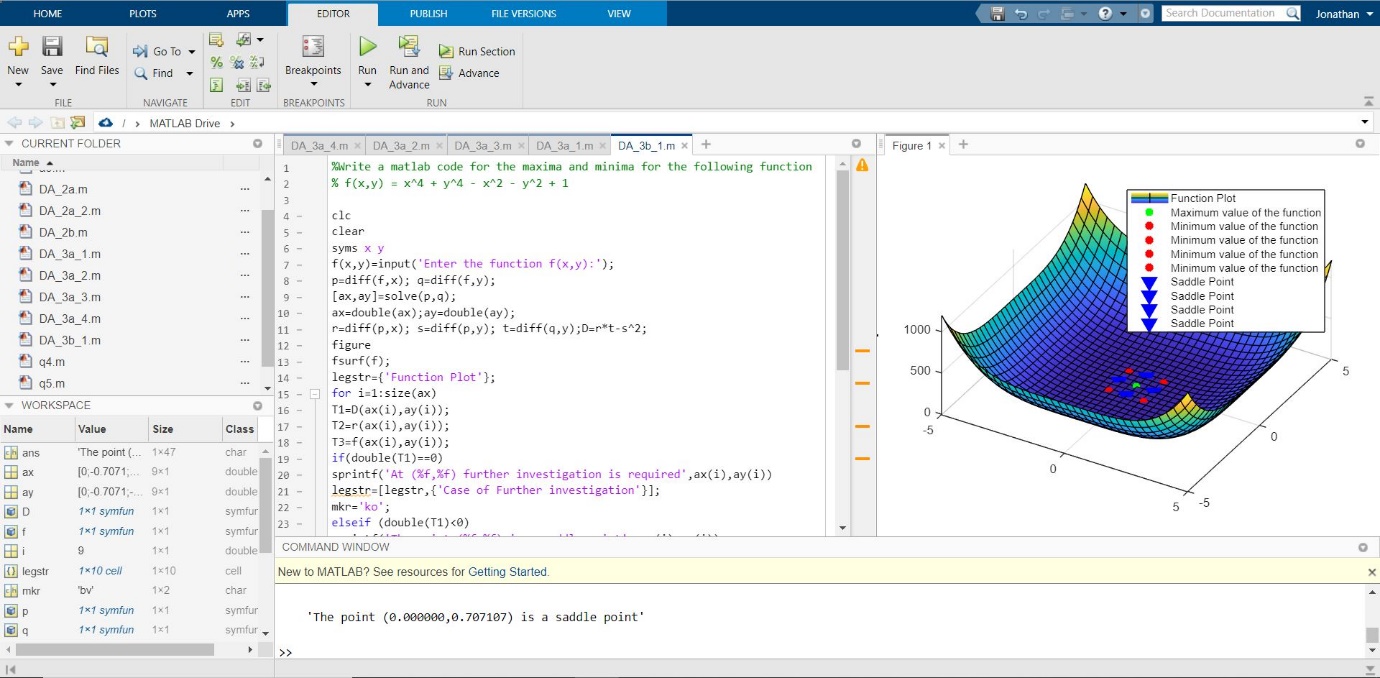
Output (via Command Window):

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'



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