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Lab Assignment - 2

Aim: Write the MATLAB code to find the local maxima and minima for polynomial by using first and second derivative test and plot the function with maximum point, minimum point and point of inflection.

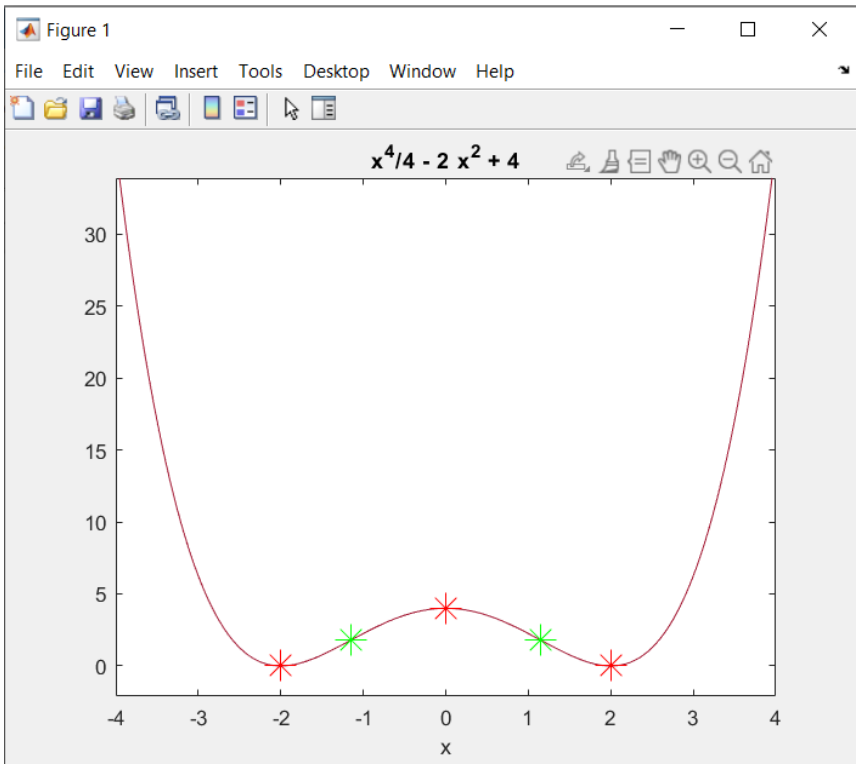
```
% MATLAB code for visualizing local maxima and minima (using first and second
derivative test )
clc
clear all
syms x real
f= input('Enter the function f(x):');
fx= diff(f,x)
c= solve(fx)
cmin = min(double(c));
cmax = max(double(c));
figure(1)
ezplot(f,[cmin-2,cmax+2])
hold on
fxx= diff(fx,x)
for i = 1:1:size(c)
     T1 = subs(fxx,x,c(i));
     T3 = subs(f,x, c(i));
    if(double(T1)==0)
       sprintf('The point x is %d inflection point',double(c(i)))
    else
       if(double(T1)<0)
          sprintf('The maximum point x is %d',double(c(i)))
          sprintf('The value of the function is %d',double(T3))
       else
          sprintf('The minimum point x is %d',double(c(i)))
          sprintf('The value of the function is %d',double(T3))
       end
    end
    plot(double(c(i)),double(T3),'r*','markersize', 15);
end
% plotting inflection points for testing concavity
de=polynomialDegree(fxx);
if(de==0)
```

```
sprintf('the given polynomial is second degree or less')
else
d = solve(fxx)%finding inflection points
for i = 1:1:size(d)
T2 = subs(f,x ,d(i));
plot(double(d(i)), double(T2),'g*','markersize', 15);
end
end
% Identifying maxima and minima through first derivative test
figure(2)
ezplot(fx,[cmin-2,cmax+2])
title('Plotting first derivative of f and critical points')
hold on
for i = 1:1:size(c)
T4 = subs(fx, x ,c(i));
plot(double(c(i)), double(T4), 'r*', 'markersize', 15);
end
figure(3)
ezplot(fxx,[cmin-2,cmax+2])
hold on
if(de==0)
sprintf('the given polynomial is second degree or less, second derivative plot is not
possible')
else
for i = 1:1:size(d)
T4 = subs(fxx, x ,d(i) );
plot(double(d(i)), double(T4), 'r*', 'markersize', 15);
end
title('Plotting second derivative of f and inflection points')
end
```

OUTPUT:

```
Enter the function f(x):x^4/4-2*x^2+4
fx =
x^3 - 4*x
c =
-2
 0
 2
fxx =
```

```
3*x^2 - 4
ans =
        'The minimum point x is -2'
ans =
        'The value of the function is 0'
ans =
        'The maximum point x is 0'
ans =
        'The value of the function is 4'
ans =
        'The minimum point x is 2'
ans =
        'The value of the function is 0'
d =
-(2*3^(1/2))/3
 (2*3^(1/2))/3
```



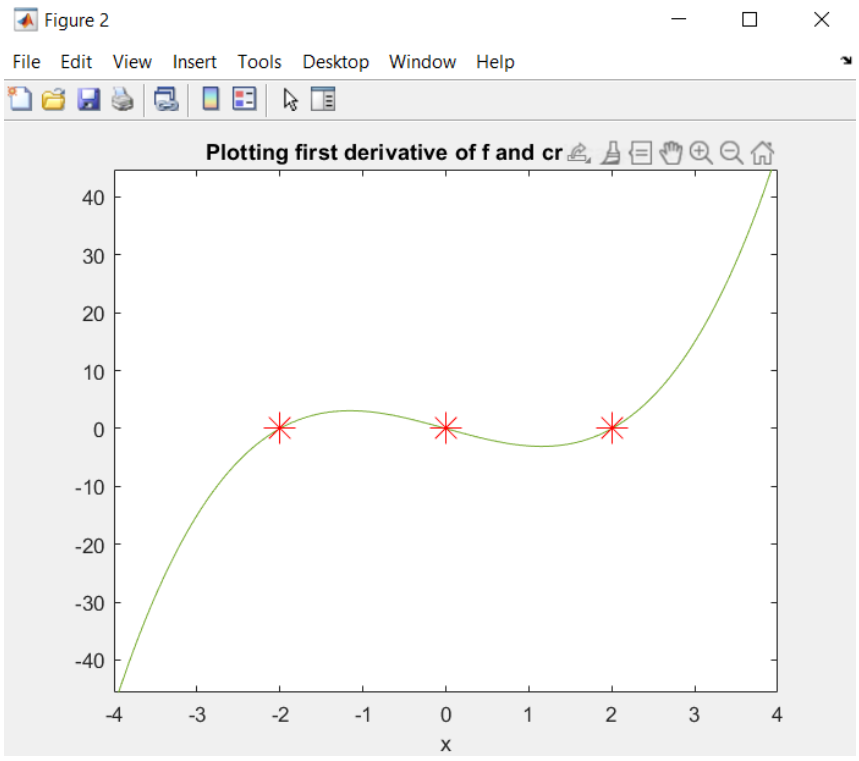


Figure 2
File Edit View Insert Tools Desktop Window Help
Plotting first derivative of f and cr
40
30
20
10
0
-10
-20
-30
-40
-4 -3 -2 -1 0 1 2 3 4
x

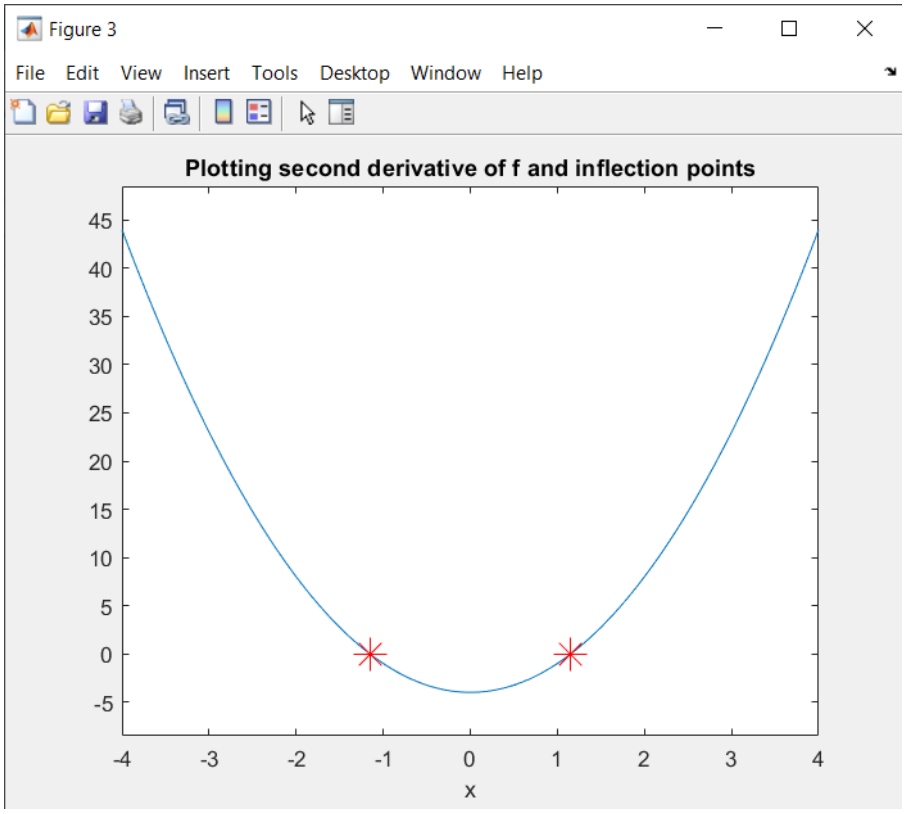
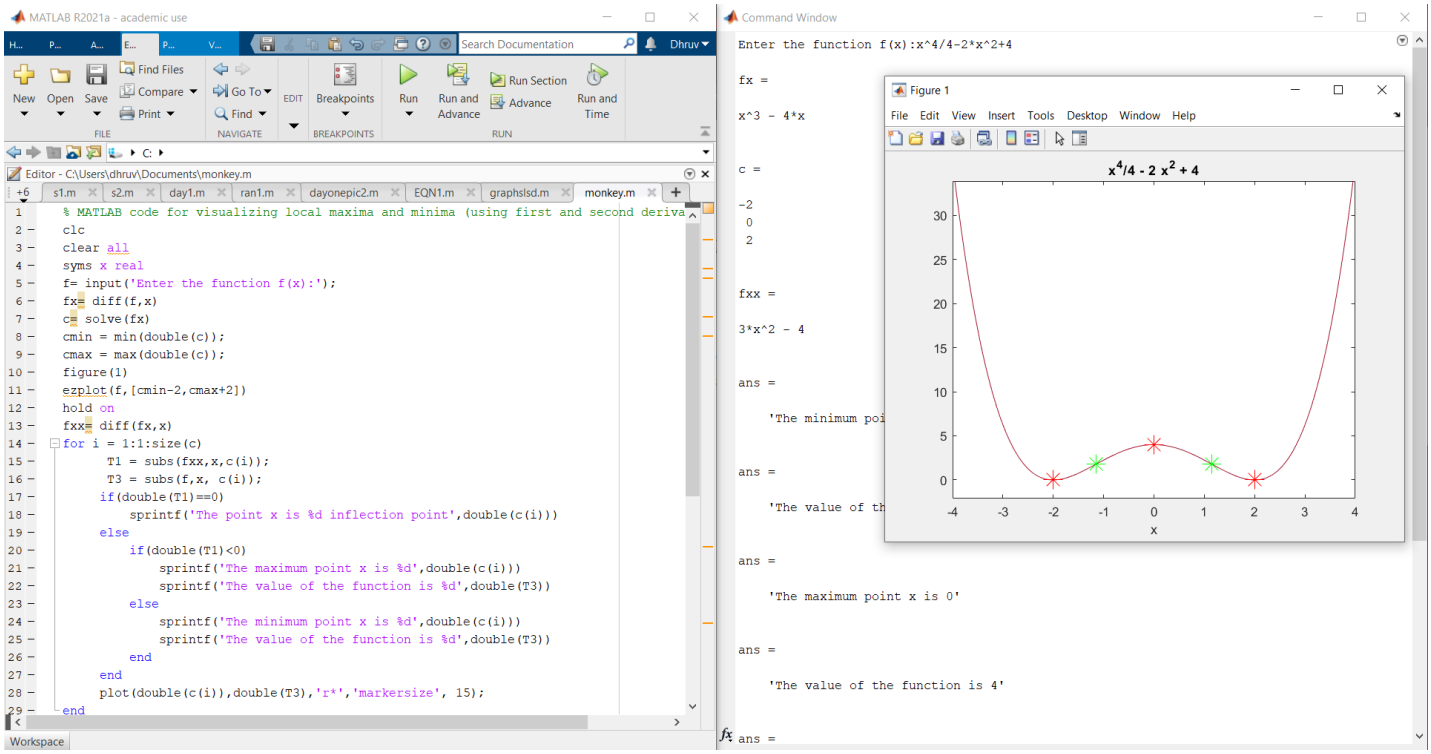


Figure 3
File Edit View Insert Tools Desktop Window Help
Plotting second derivative of f and inflection points
45
40
35
30
25
20
15
10
5
0
-5
-4 -3 -2 -1 0 1 2 3 4
x



Aim: Write the MATLAB code to find the local maxima and minima for any function by using first and second derivative test and plot the function with maximum point, minimum point and point of inflection.

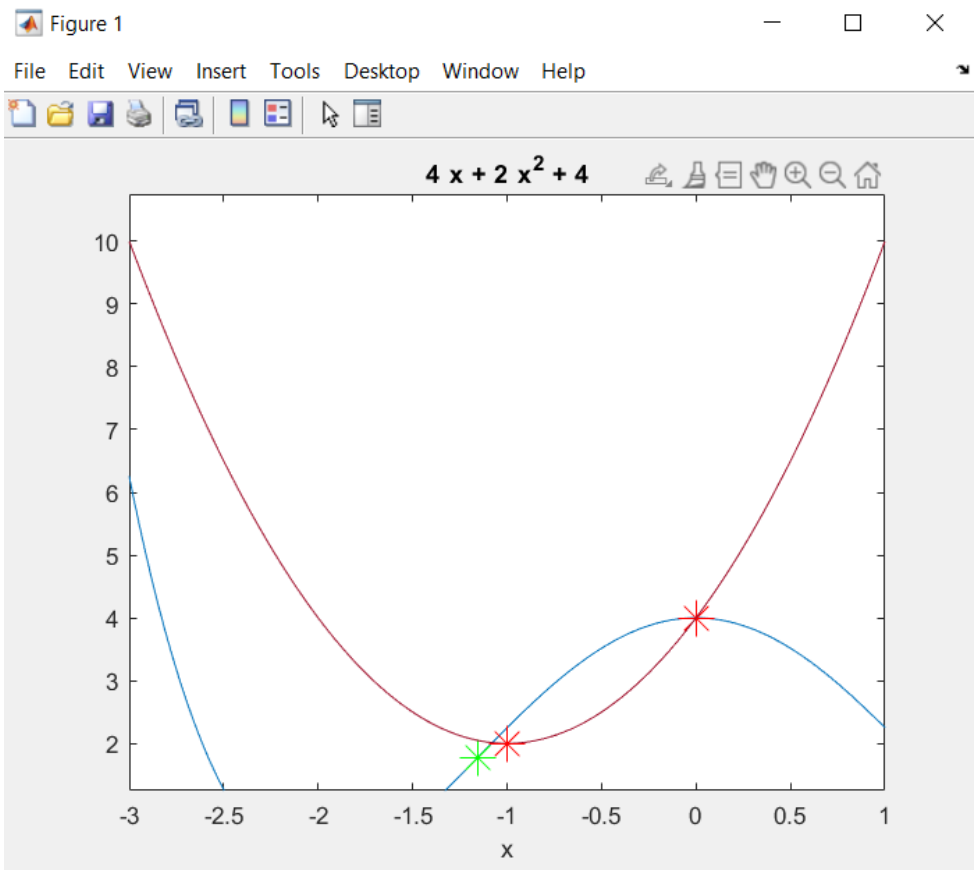
```
clc
syms x real
syms trigo
f=input('enter the function')
fx =diff(f)
c=solve(fx)
cmin=min(double(c))
cmax=max(double(c))
figure(1)
ezplot(f,[cmin-2,cmax+2])
hold on
fxx=diff(fx,x)
for i=1:1:size(c)
        t1=subs(fxx,x,c(i))
        t3=subs(f,x,c(i))
        if (double(t1)==0)
```

```
        sprintf('the pointx is %d inflection point',double(c(i)))
        else

        if(double(t1)<0)
        sprintf('the maximum point x is %d',double(c(i)))
        sprintf('the value of the function is %d',doubke(t3))
        else
        sprintf('The minimum point X is %d',double(c(i)))
        sprintf('The value of the function is %d',double(t3))
        end
        end
        plot(double(c(i)),double(t3),'r*','markersize',15);
end
```

OUTPUT:

```
enter the function
2*x^2+4*x+4
f =
2*x^2 + 4*x + 4
fx =
4*x + 4
c =
-1
cmin =
        -1
cmax =
        -1
fxx =
4
t1 =
4
t3 =
2
ans =
        'The minimum point X is -1'
ans =
        'The value of the function is 2'
```



MATLAB R2021a - academic use

```
clc
syms x real
syms trigo
f=input('enter the function')
fx =diff(f)
c=solve(fx)
cmin=min(double(c))
cmax=max(double(c))
figure(1)
ezplot(f,[cmin-2,cmax+2])
hold on
fxx=diff(fx,x)
for i=1:1:size(c)
    t1=subs(fxx,x,c(i))
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    if (double(t1)==0)
        sprintf('the pointx is %d inflection point',double(c(i)))
    else

        if(double(t1)<0)
            sprintf('the maximum point x is %d',double(c(i)))
            sprintf('the value of the function is %d',doubke(t3))
        else
            sprintf('The minimum point X is %d',double(c(i)))
            sprintf('The value of the function is %d',double(t3))
        end
    end
    plot(double(c(i)),double(t3),'r*','markersize',15);
end
```

Command Window

```
c =

    -1


cmin =

    -1


cmax =

    -1


fxx =

     4


t1 =

     4


t3 =

     2


ans =

    'The minimum point X is -1'


ans =

    'The value of the function is 2'

>>
```