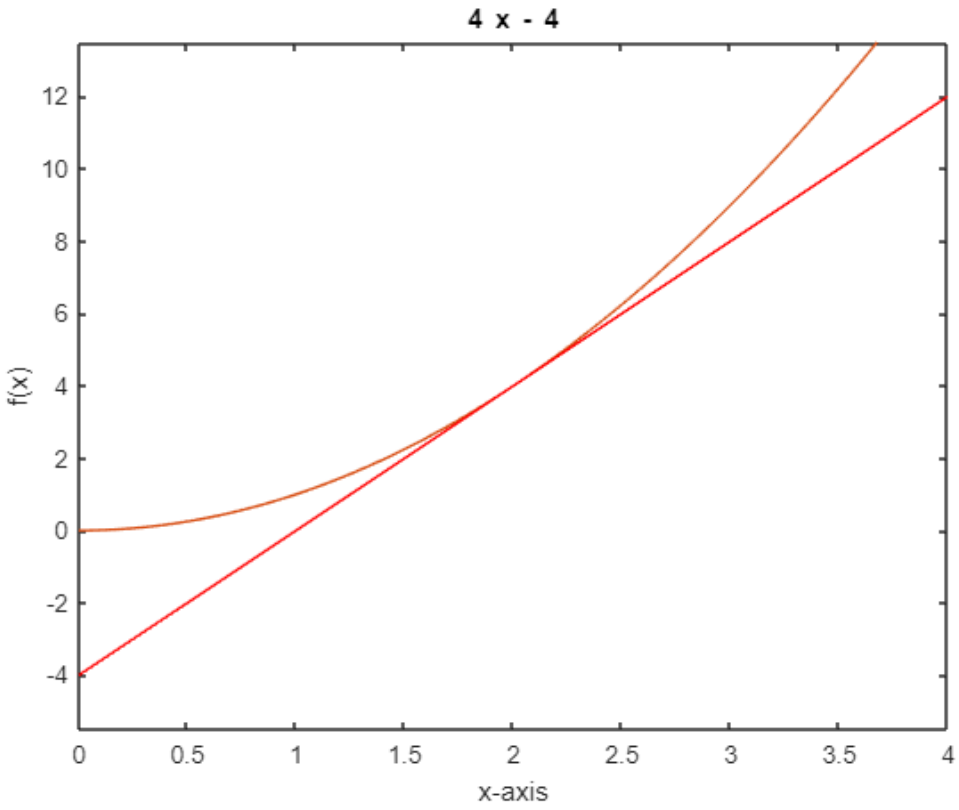
```
% Equation of tangent line passing through (x1, y1)

syms x
y = input('Enter a function in terms of x: ')
x1 = input('Enter the x value at which the tangent has to be found: ')
y1 = subs(y,x,x1) % substitute x by x1 in y
plot(x1, y1,'black')
hold on
ezplot(y, [x1-2, x1+2]) % graph of the curve in domain D
yd = diff(y,x)
slope = subs(yd,x,x1)
Tgn_line = slope*(x-x1) + y1  %Equation of tangent line
h = ezyplot(Tgn_line,[x1-2, x1+2])  %Plotting the tangent line
set(h, 'color','red')
xlabel('x-axis')
ylabel('f(x)')

%Second derivative test for local maxima
sysm x real
f = input('Enter the function: ');
fx = diff(f,x);
fxx = diff(fx,x);
c = solve(fx);
c = double(c);
fprintf('There are %d critical points, and are shown below', length(c))
disp(c)

%Graph of a function, its first and second derivative in domain D
cmin = min(c);
cmax = max(c);
D =   [cmin-0.5, cmax+0.5]
cmin=min(c);
cmax=max(c);
D=[cmin-0.5, cmax+0.5];
hold on
ezplot(f,D)
h=ezplot(fx,D);
set(h,'color','red')
e=ezplot(fxx,D);
set(e,'color','green')
legend(' f ', ' f_x ', ' f_x_x ')
for i = 1:length(c)
T1 = subs( fxx, x ,c(i) );
%T1 = double(T1);
T3 = subs(f, x, c(i));
```

```
%T3 = double(T3);
if (T1==0)
fprintf('\n The test fails at x = %d.', c(i))
elseif (T1 < 0)
fprintf('\n The maximum point occurs at x = %d.', c(i))
fprintf('\n The maximum value of the function is f(%d)=%d.', c(i), T3)
else
fprintf('\n The minimum point occurs at x = %d.', c(i))
fprintf('\n The minimum value of the function is f(%d)=%d.\n', c(i), T3)
end
plot(c(i), T3, 'red*', 'markersize', 15);
end
plot(0, 0, 'red*', 'markersize', 15)
title('Maxima and Minima for a function f(x) of a single variable')
xlabel('x-axis')
ylabel('f(x)')
cmin = min(c);
cmax = max(c);
D = [cmin-0.5, cmax+0.5]
cmin=min(c);
cmax=max(c);
D=[cmin-0.5, cmax+0.5];
hold on
ezplot(f,D)
h=ezplot(fx,D);
set(h,'color','red')
e=ezplot(fxx,D);
set(e,'color','green')
legend(' f ', ' f_x ', ' f_x_x ')
for i = 1:length(c)
T1 = subs( fxx, x ,c(i) );
%T1 = double(T1);
T3 = subs(f, x, c(i));
%T3 = double(T3);
if (T1==0)
fprintf('\n The test fails at x = %d.', c(i))
elseif (T1 < 0)
fprintf('\n The maximum point occurs at x = %d.', c(i))
fprintf('\n The maximum value of the function is f(%d)=%d.', c(i), T3)
else
fprintf('\n The minimum point occurs at x = %d.', c(i))
fprintf('\n The minimum value of the function is f(%d)=%d.\n', c(i), T3)
end
plot(c(i), T3, 'red*', 'markersize', 15);
end
```

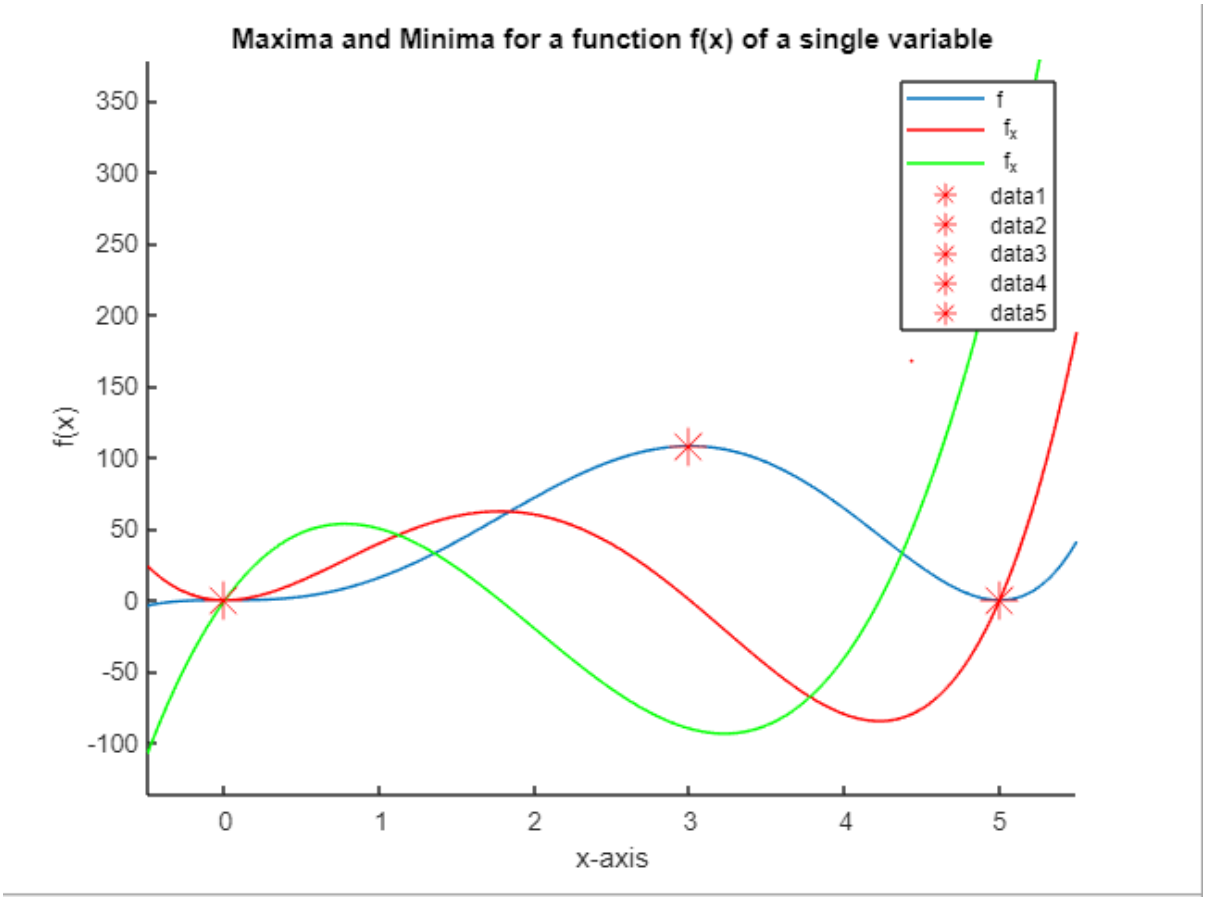
```
plot(0, 0, 'red*', 'markersize', 15)
title('Maxima and Minima for a function f(x) of a single variable')
xlabel('x-axis')
ylabel('f(x)')
```

OUTPUT WINDOW:

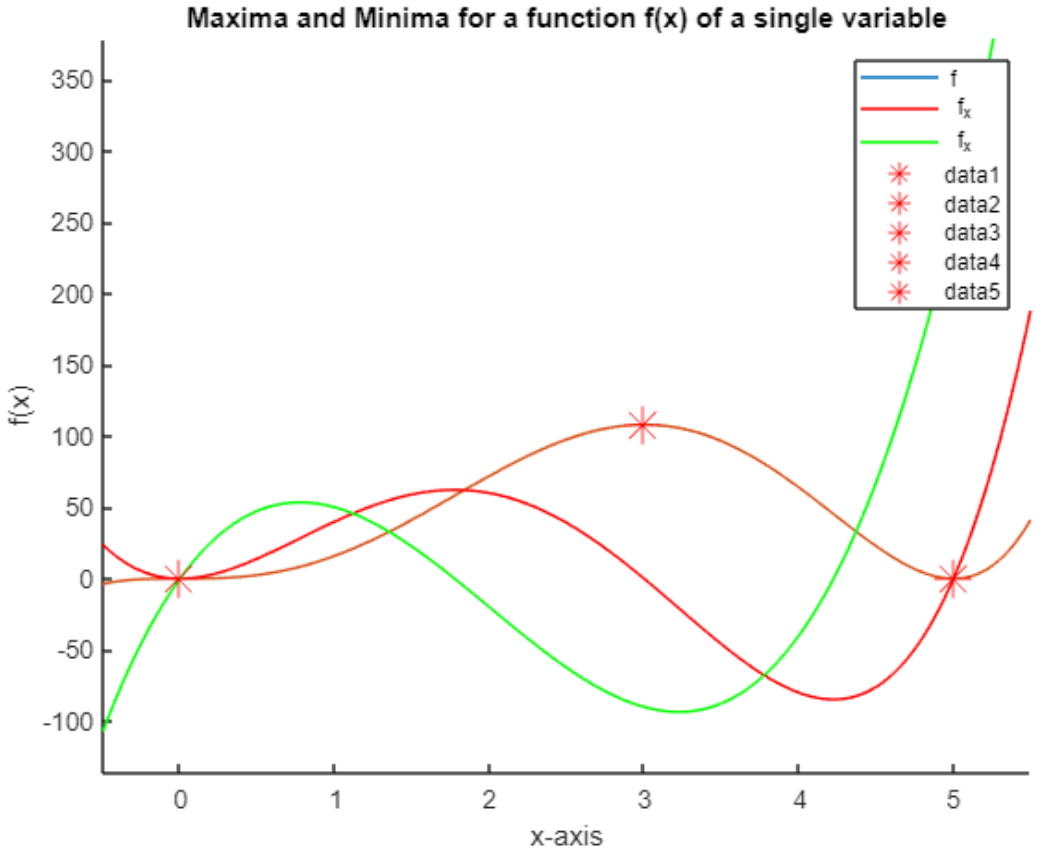
```
Enter a function in terms of x:
x^2

y =

x^2

Enter the x value at which the tangent has to be found:
2

x1 =

     2


y1 =

4


yd =

2*x


slope =

4

Tgn_line =

4*x - 4
```



```
>>   h =


     c =

     0
     0
     3
     5
     >> There are 4 critical points, and are shown below
```




```
>>>
     D =

        -0.5000    5.5000


     The test fails at x = 0.
     The test fails at x = 0.
     The maximum point occurs at x = 3.
     The maximum value of the function is f(3)=108.
     The minimum point occurs at x = 5.
     The minimum value of the function is f(5)=0.
```



There are 4 critical points, and are shown below

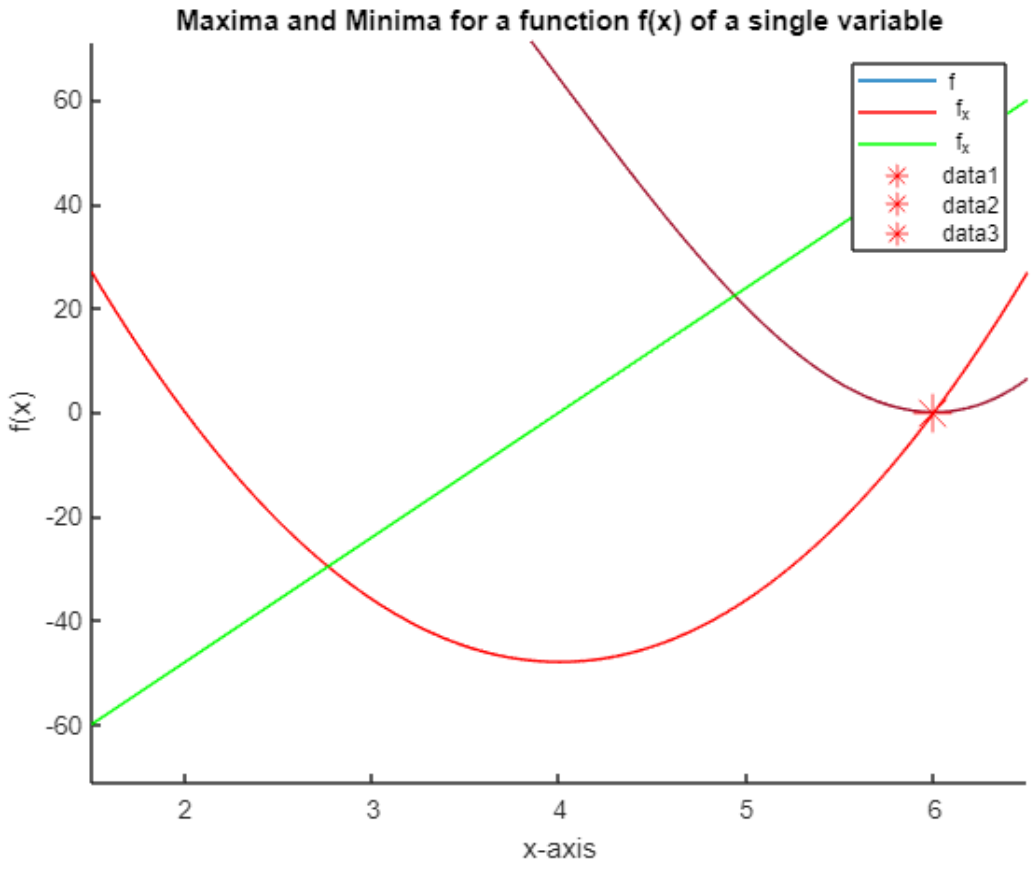
```
     0
     0
     3
     5
```

```
D =

   -0.5000    5.5000
```

```
 The test fails at x = 0.
 The test fails at x = 0.
 The maximum point occurs at x = 3.
 The maximum value of the function is f(3)=108.
 The minimum point occurs at x = 5.
 The minimum value of the function is f(5)=0.
```

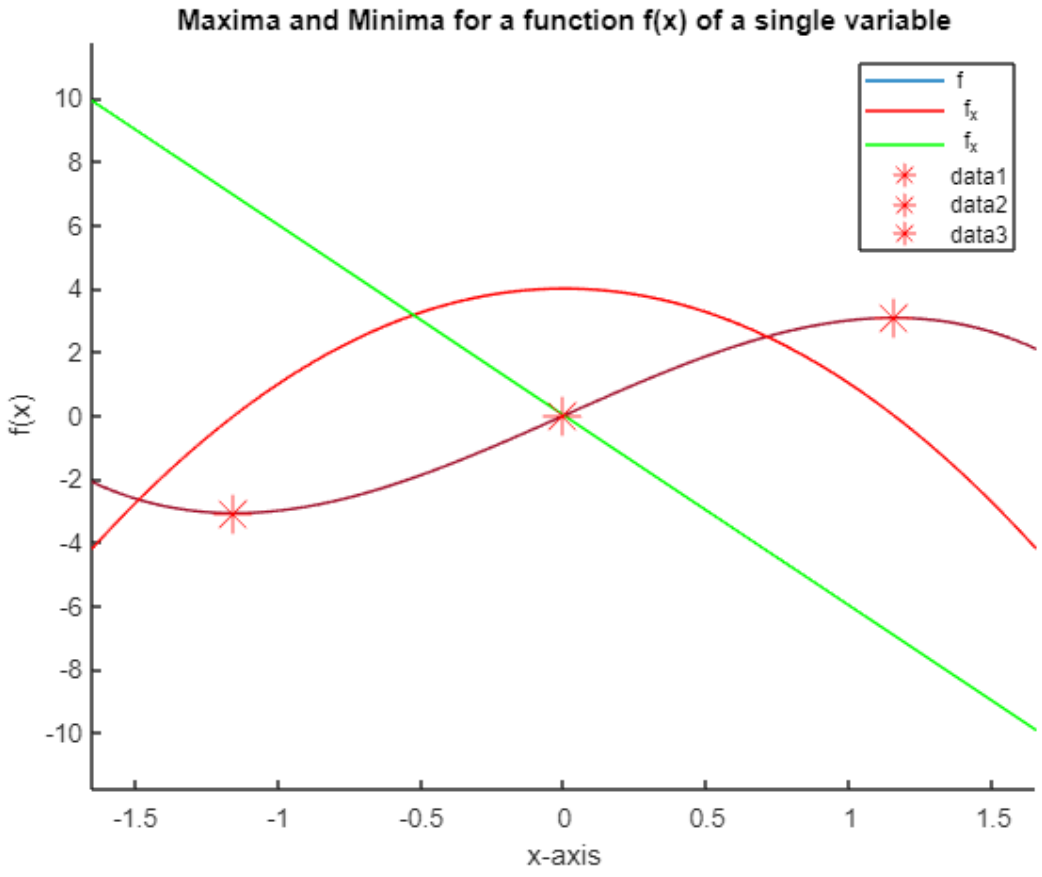
```
D =

   -0.5000    5.5000
```

```
 The test fails at x = 0.
 The test fails at x = 0.
 The maximum point occurs at x = 3.
 The maximum value of the function is f(3)=108.
 The minimum point occurs at x = 5.
 The minimum value of the function is f(5)=0.
```




```
There are 2 critical points, and are shown below     2
     6


D =

    1.5000    6.5000


 The maximum point occurs at x = 2.
 The maximum value of the function is f(2)=128.
 The minimum point occurs at x = 6.
 The minimum value of the function is f(6)=0.

D =

    1.5000    6.5000
```

```
 The maximum point occurs at x = 2.
 The maximum value of the function is f(2)=128.
 The minimum point occurs at x = 6.
 The minimum value of the function is f(6)=0.
```




```
There are 2 critical points, and are shown below   -1.1547
    1.1547


D =

   -1.6547    1.6547


 The minimum point occurs at x = -1.154701e+00.
 The minimum value of the function is f(-1.154701e+00)=-3.

 The maximum point occurs at x = 1.154701e+00.
 The maximum value of the function is f(1.154701e+00)=3.

D =
```

```
  -1.6547    1.6547


The minimum point occurs at x = -1.154701e+00.
The minimum value of the function is f(-1.154701e+00)=-3.

The maximum point occurs at x = 1.154701e+00.
The maximum value of the function is f(1.154701e+00)=3.
```