```
% Define the rate expression function
k1 =input('Input the value of k1 '); % rate constant 1
K2 =input('Input the value of K2 '); % rate constant 2
f = @(Ca) (k1 * Ca) / (1 + K2 * Ca.^2 + Ca); % form of rate equation
g = @(Ca) (k1 * (1 - K2 * Ca.^2)) / (1 + K2*Ca.^2 + Ca)^2;

% Calculate the derivative at a specific point
syms Ca;
deriv = (k1*(1-K2*Ca.^2))/(1+K2*Ca.^2 + Ca)^2;
point=input('Input the point at which Ca is to be calculated ');
e = subs(deriv,Ca,point);
disp('Derivative of f at chosen required ca is');
disp(e);


% Calculate the area under the curve by trapezoidal rule
Ca_max=input('Define the max value for the Ca ');
Ca_min=input('Define the min value for our Ca ');
h = 0.1;
n = (Ca_max-Ca_min)/0.1;
area = 0.5*(f(Ca_max)+f(Ca_min));
for i=1:n
    Ca = Ca_min+i*h;
    area = area + f(Ca);
end
area  = area*h;
disp('area under the curve is :');
disp(area);

% finding minimum and maximum functional value over the given domain
Ca_maxfn = 0.0; % let functional maximum over the domain is at zero
maxfn = -Inf;
for Ca = Ca_min:h:Ca_max
    fn = f(Ca);
    if fn> maxfn
       maxfn = fn;
       Ca_maxfn = Ca;
    end
end
disp(['Maximum functional value is ', num2str(maxfn), ' occurs at Ca = ', num2str↙
(Ca_maxfn)]);

Ca_minfn = 0.0; % let functional minimum over the domain is at zero
minfn = Inf;
for Ca = Ca_min:h:Ca_max
    fn = f(Ca);
    if fn< minfn
       minfn = fn;
       Ca_minfn = Ca;
```

```
    end
end
disp(['Minimum functional value is ', num2str(minfn), ' occurs at Ca = ', num2str↙
(Ca_minfn)]);

% drawing a straight line between two points on the function
Ca1 =input('Enter the first point for making the line '); %first point to have a line
Ca2 =input('Enter the Second point for making the line '); %second point to have a↙
line
m = (f(Ca2)-f(Ca1))/(Ca2-Ca1); %slope of the required line
c = f(Ca1)-m*Ca1; % intercept of the required line
disp(['tzhe required line having points Ca1 and Ca2 is y =  ', num2str(m), '*x + ',↙
num2str(c)]);
%Finding the value of Ca at which the slope of the curve is equal to the%
%line obtained%
disp('Ca at which the slope on the curve is equal to the slope on the line is');
Cao=fzero(@(Ca) g(Ca)-m, 1);
disp(Cao);
%Plotting the graph of the given function we have%
ca=Ca_min:0.01:Ca_max;
%Given the equation of y = f(ca)we have%
y=(k1*ca)./(1+K2*ca.^2);
plot(ca, y)
title('Plot of the given function')
xlabel('ca')
ylabel('f(ca)')
grid on
```

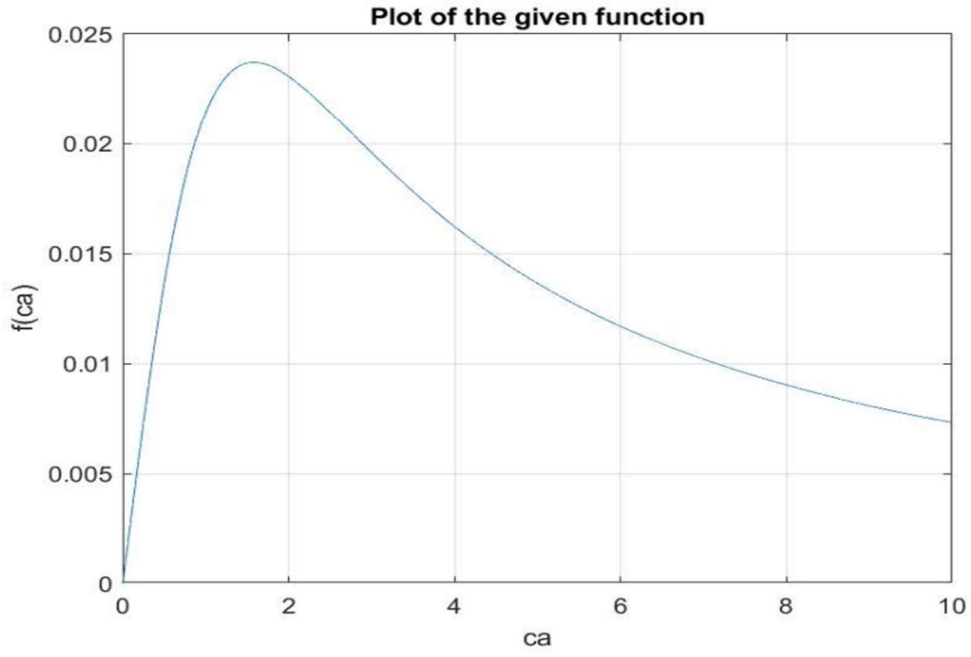
Given below are the 2 examples displaying the functioning of our MATLAB code

(1)

```
CodingAssignment
Input the value of k1 0.03
Input the value of K2 0.4
Input the point at which Ca is to be calculated 4.5
Derivative of f at chosen required ca is
-213/184960

Define the max value for the Ca 10
Define the min value for our Ca 0
area under the curve is :
    0.0925

Maximum functional value is 0.013245 occurs at Ca = 1.6
Minimum functional value is 0 occurs at Ca = 0
Enter the first point for making the line 2
Enter the Second point for making the line 7
tzhe required line having points Ca1 and Ca2 is y =  -0.001087*x +
0.015217
Ca at which the slope on the curve is equal to the slope on the line is
    2.2270
```



(2)

```
>> CodingAssignment
Input the value of k1 0.5
Input the value of K2 0.02
Input the point at which Ca is to be calculated 3
Derivative of f at chosen required ca is
1025/43681

Define the max value for the Ca 10
Define the min value for our Ca 0
area under the curve is :
    3.5156

Maximum functional value is 0.38976 occurs at Ca = 7.1
Minimum functional value is 0 occurs at Ca = 0
Enter the first point for making the line 1
Enter the Second point for making the line 6.5
tzhe required line having points Ca1 and Ca2 is y =  0.025805*x + 0.22172
Ca at which the slope on the curve is equal to the slope on the line is
    2.8615
```