ENGR 133, Lab 07

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Problem 1

```
clear
close all
clc

% Problem Presentation
%{
Given two equations with three unknowns and are asked to solve for "x"
 and
"y" in terms of "a".
%}

% Intialize variables
syms a x y
eqn1 = x+6*y == a;
eqn2 = 2*x-3*y == 9;

% Perform calculations and display results
[X,Y] = solve(eqn1,eqn2,{x,y});
pretty([X,Y])
```

```
/ a    18   2 a    3 \
| - + --,  --- - - |
\ 5     5   15    5 /
```

Problem 2

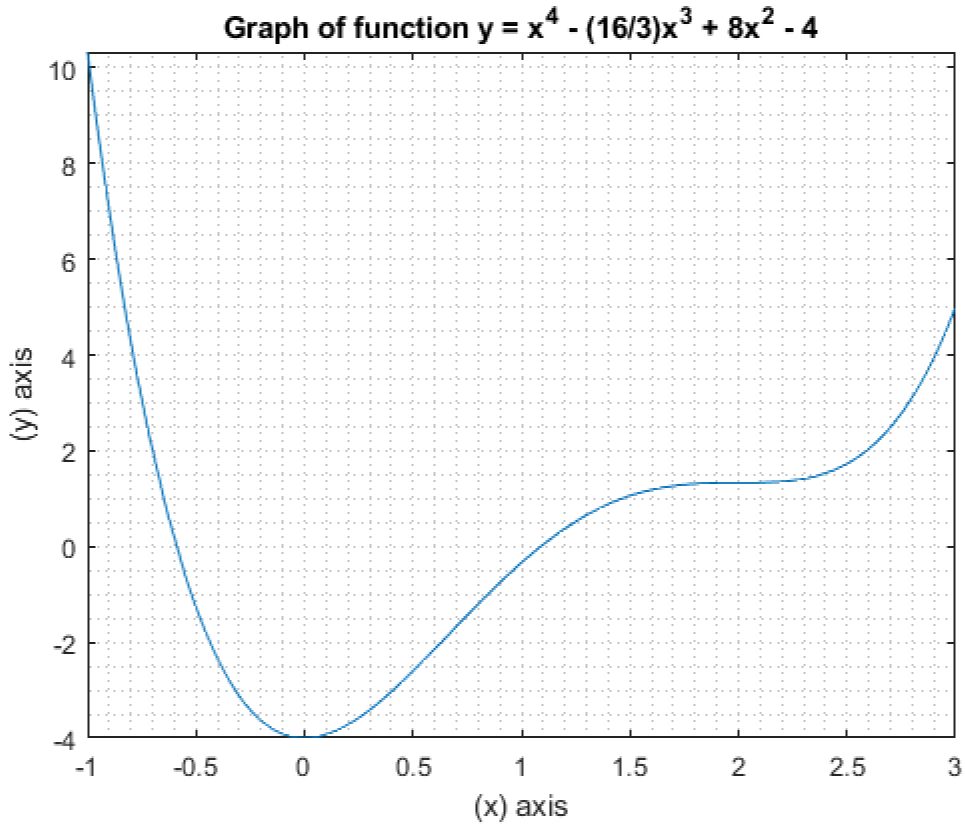
```
clear
close all
clc

% Problem Presentation
%{
Determine all the local minima and local maxima and all the inflection
points where dy/dx = 0 of the following function: y = x^4 -
16/3x^3+8x^2-4.
%}
```

```
% Initialize variables
syms x
y = x^4-(16/3)*x^3+8*x^2-4;
dydx = diff(y);
d2ydx2 = diff(dydx);

% Peform calculations
% Find the x and y values of interest
x_points = solve(dydx);
y_points = subs(y,x,x_points);


% Loop to evaluate nature of zero points
for k = 1:length(x_points)
    eval(k) = subs(d2ydx2,x,x_points(k));
    if double(eval(k)) > 0
        outcomes(k) = "local minima";
    elseif double(eval(k)) == 0
        outcomes(k) = "inflection points";
    else
        outcomes(k) = "local maximum";
    end
end

% Display results
for k = 1:length(x_points)
     fprintf('\nA %s exists at x = %4.2f, y = %4.2f.\n
\n',outcomes{1,k}, double(x_points(k)),double(y_points(k)))
end
fplot(y,[double(x_points(1))-1 double(x_points(length(x_points)))+1])
title("Graph of function y = x^4 - (16/3)x^3 + 8x^2 - 4")
ylabel('(y) axis')
xlabel('(x) axis')
grid minor
```

A local minima exists at x = 0.00, y = -4.00.

A inflection points exists at x = 2.00, y = 1.33.

A inflection points exists at x = 2.00, y = 1.33.



Problem 3

```
clear
close all
clc

% Problem presentation
%{
Here we have the case of a rocket launch where the fuel burns for a
specific length of time and we are interested in knowing the velocity
 at
the end of the fuel burn. We are given the function that best
 describes the
acceleration (dv/dt) and mass as a function of time fuel burns.
%}

% Intialize variables
syms t T mo r b g to tf

% Perform calculations
v_t = int((T/(mo*(1-r*t/b)))-g,to,tf);
v_b = double(subs(v_t,{T mo r b g to tf},{48000 2200 0.8 40 9.81 0
 40}));

% Display results
```

```
fprintf('\nThe rocket velocity at fuel burnout is v = %6.2f m/s.\n
\n',v_b)
```

```
The rocket velocity at fuel burnout is v = 1363.35 m/s.
```

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