ENGR 133, Problem Set 06

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Problem 9.6

```
clear
close all
clc

% Problem statement
%{
A certain object moves with the velocity v(t) given in the table
 below.
Determine the object's position x(t) at t = 10 s if x(0) = 3.
time (s)       0   1   2   3   4   5   6   7   8   9   10
velocity (m/s) 0   2   5   7   9   12  15  18  22  20  17
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
t = 0:10;
v = [0,2,5,7,9,12,15,18,22,20,17];

% Perform calculations
d = zeros(1,length(t))+3;
for k = 1:length(t)-1
    d(k+1) = trapz(t(k:k+1),v(k:k+1))+d(k);
end

% Display results
format bank
header = ('          Time      Distance');
disp(header),disp([t',d'])
```

```
          Time      Distance
             0          3.00
          1.00          4.00
          2.00          7.50
```

```
    3.00        13.50
    4.00        21.50
    5.00        32.00
    6.00        45.50
    7.00        62.00
    8.00        82.00
    9.00       103.00
   10.00       121.50
```

Problem 9.9

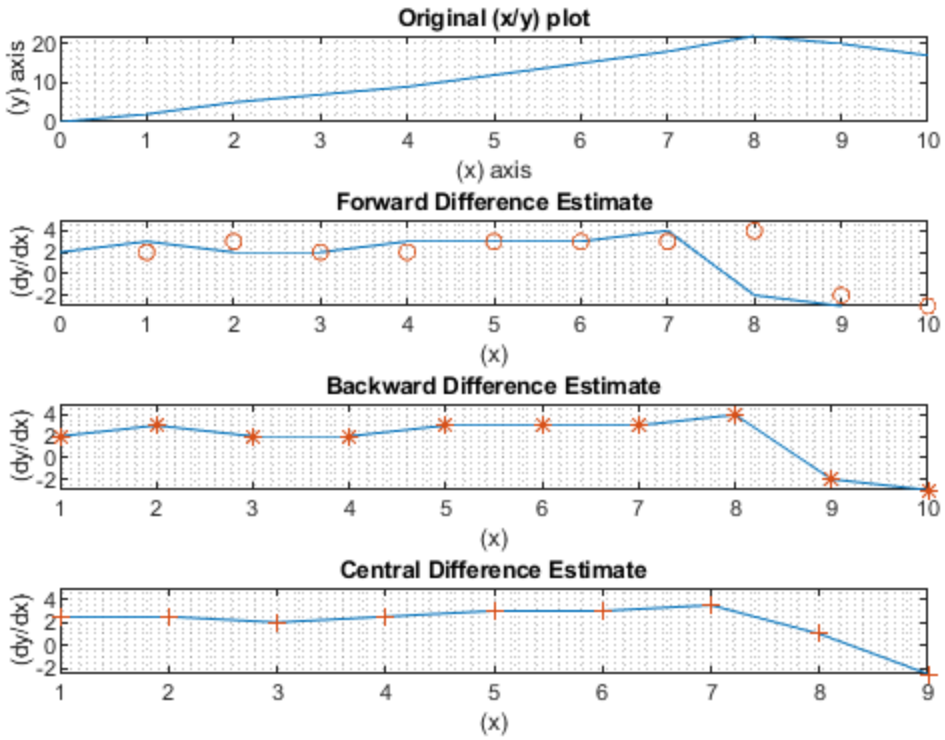
```
clear
close all
clc

% Problem statement
%{
A certain object has a mass of 100 kg and is acted on by a force
f(t) = 500[2-e^(-t)sin(5pi*t)] N. The mass is at rest at t=0.
 Determine the
object's velocity at t=5 s.
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
m = 100; % Mass in kg
v_0 = 0; % Initial velocity (rest)

% Perform calculations
g = @(t)(5*(2-exp(-t).*sin(5*pi*t))); % Force equation
v_5 = integral(g,0,5); % Integral of force equation

% Display results
fprintf('For problem 9.9 the velocity at t = 5 is %4.2f m/s.\n',v_5)

For problem 9.9 the velocity at t = 5 is 49.68 m/s.
```

Problem 9.19

```
clear
close all
clc

% Problem statement
%{
Plot the estimate of the derivative dy/dx from the following data. Do
 this
```

```
by using forward, backward, and central difference. Compare the
 results.
x   0   1   2   3   4   5   6   7   8   9   10
y   0   2   5   7   9  12  15  18  22  20   17
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
x = 0:10;
y = [0,2,5,7,9,12,15,18,22,20,17];
n = length(x);
d1 = diff(y)./diff(x);
d2 = (y(3:n)-y(1:n-2))./(x(3:n)-x(1:n-2));

% Perform calculations

subplot(4,1,1)
plot(x,y), grid minor, xlabel('(x) axis'), ylabel('(y) axis')
title('Original (x/y) plot')

% Forward difference
subplot(4,1,2)
plot(x(1:n-1),d1,x(2:n),d1,'o'),grid minor, xlabel('(x)'),ylabel('(dy/
dx)')
title('Forward Difference Estimate')

% Backward Difference
subplot(4,1,3)
plot(x(2:n),d1,x(2:n),d1,'*'),grid minor, xlabel('(x)'),ylabel('(dy/
dx)')
title('Backward Difference Estimate')

% Central Difference
subplot(4,1,4)
plot(x(2:n-1),d2,x(2:n-1),d2,'+'),grid minor,
 xlabel('(x)'),ylabel('(dy/dx)')
title('Central Difference Estimate')

% Display results
fprintf('For problem 9.19 the most accurate estimate is the central
 difference\n')
```

```
For problem 9.19 the most accurate estimate is the central difference
```

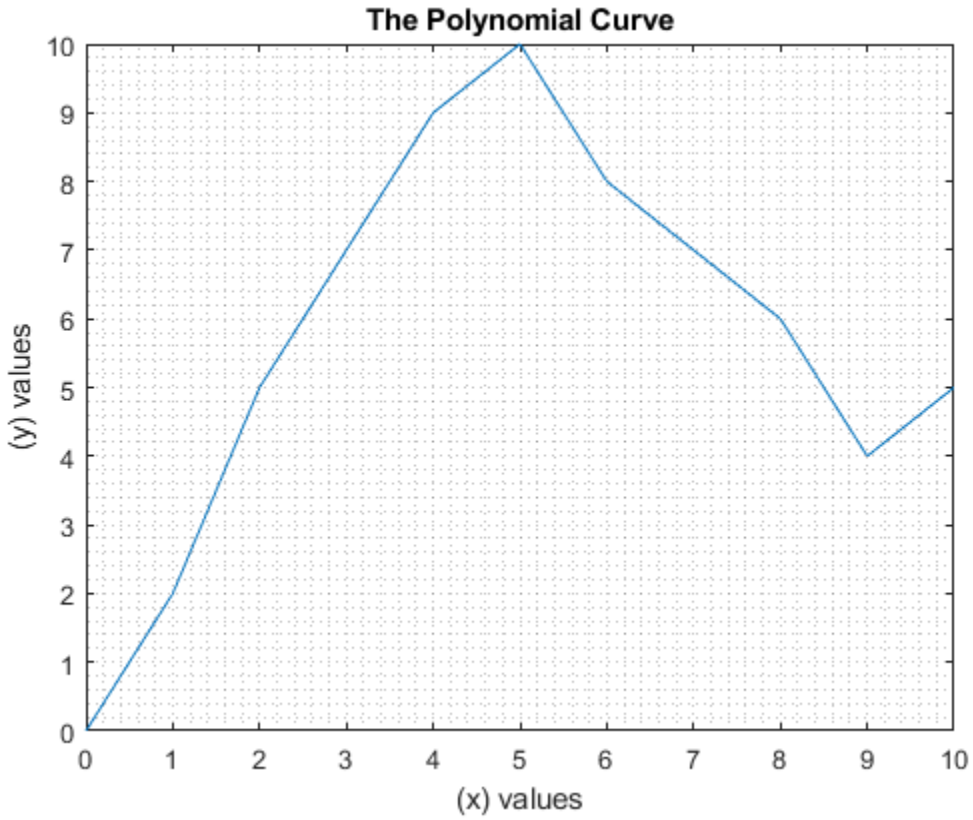


Problem 9.20

```
clear
close all
clc

% Problem presentation
%{
At a relative maximum of a curve y(x), the slope dy/dx is zero. Use
 the
following data to estimate the values of x and y that correspond to a
maximum point.
x   0   1   2   3   4   5   6   7   8   9   10
y   0   2   5   7   9  10   8   7   6   4   5
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
x = 0:10;
y = [0,2,5,7,9,10,8,7,6,4,5];
```

```
% Perform calculations
P = polyfit(x,y,4);
Y = polyval(P,x);
Y_2 = polyder(P);
roots = roots(Y_2);

% Display results
plot(x,y),grid minor, xlabel('(x) values'), ylabel('(y) values')
title('The Polynomial Curve')
fprintf('The points of the graph where the slope is zero are: \n')
disp(roots)
```

```
The points of the graph where the slope is zero are:
    9.23
    4.89
   -0.66
```



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