ENGR 113, Problem Set 07

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Authored by: Andres Choque Authored on: 11/21/2020

Problem 11.6

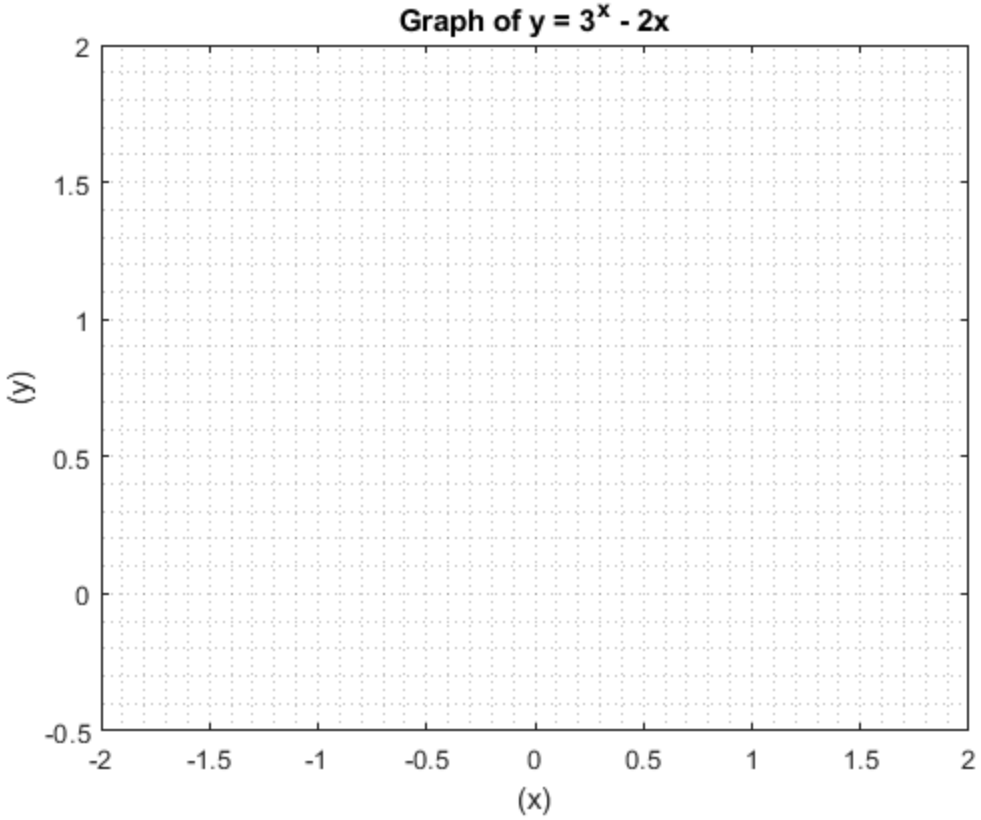
```
clear,clc,close all

% Problem Presentation
%{
The law of cosines for a triangle states that a^2 = b^2+c^2-2bc Cos A,
where a is the length of the side opposite the angle A, and b and c
 are the
lengths of the other sides.
a) use MATLAB to solve for b
b) suppose that A = 60, a = 5 m, and c = 2m. Determine b.
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
% Part a:
syms a b c A
eq1 = (b^2)+(c^2)-(2*b*c)*cos(A)==a^2;

% part b:
A_1 = (60*pi/180);
a_1 = 5;
c_1 = 2;

% Perform calculations
% Part a:
eq2 = solve(eq1,b);

% Part b:
eq3 = subs(eq2,A,A_1);
eq4 = subs(eq3,a,a_1);
eq5 = subs(eq4,c,c_1);
solu = double(eq5);
```

```
% Display results
fprintf('The equation in terms of b is: \n')
disp(eq2)
fprintf('The solution for b is %4.3f \n',solu)
```

```
The equation in terms of b is:
c*cos(A) + (a^2 + c^2*cos(A)^2 - c^2)^(1/2)
c*cos(A) - (a^2 + c^2*cos(A)^2 - c^2)^(1/2)

The solution for b is 5.690
The solution for b is -3.690
```

Problem 11.11

```
close all
clear
clc

% Problem statement
%{
Use MATLAB to find all the values of x where the graph of y = 3^x-2x
 has a
horizontal tangent line.
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
syms x
eq1 = 3^x-2*x;
y = 3^x-2*x;
xpts = linspace(-2,2,500);

% Perform calculations
dydx = diff(eq1);
solu = solve(dydx,x);

% Display results
plot(xpts,solu), grid minor, xlabel('(x)'), ylabel('(y)')
title('Graph of y = 3^x - 2x')
```



Problem 11.13

```
clear
close all
clc

% Problem set
%{
The surface area of a sphere of radius r is S = 4pir^2. Its volume is
 V =
4pir/3.
a) use MATLAB to find the expression for dS/dV.
b) a spherical ballon expands as air is pumped into it. What is the
 rate of
increase in the balloon's surface area with volume when its volume is
 30
cubic inches?
%}

% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
```

```
% part a:
syms r S V
eq1 = 4*pi*r^2;
eq2 = (4*pi*r^3)/3;
eq1_1 = (45/(2*pi))^(1/3);
% part b:
V_1 = 30;

% Perform calculations
% part a:
eq_r = diff(eq1);
eq_r2 = diff(eq2);
dSdV = (eq_r)/(eq_r2);

% part b:
f = subs(dSdV,r,eq1_1);
solu = double(f);
% Display results
fprintf('for part a the expression is: ')
disp(dSdV)
fprintf('for part b the rate of increase is: %4.4f ',solu)
```

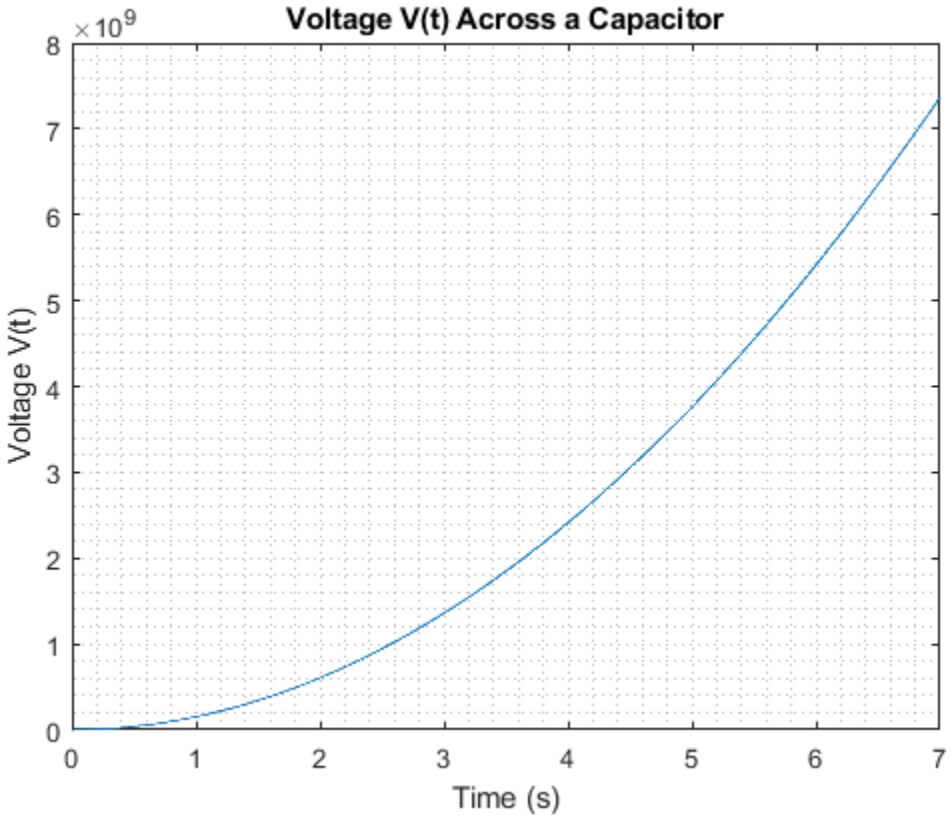
for part a the expression is: 2/r

for part b the rate of increase is: 1.0376

Problem 11.21

```
clear
close all
clc

% Problem presentation
%{
The equation for the voltage v(t) across a capacitor as a function of
 time
is v(t) = 1/c[int(0,t) i(t)dt+Q(o)]
where i(t) is the applied current and Q(o) is the initial charge.
 Suppose
that C = 10^-7F and Q(o) = 0. If the applied current is
i(t) = 0.3 +0.1e^-5tsin(25pit), use MATLAB to compute and plot the
 voltage
v(t) for 0<=t<=7 seconds.
%}


% Pseudocode
% Initialize variables
% Perform calculations
% Display results

% Initialize variables
syms t
```

```
eq1 = 0.3+0.1*exp(-5*t).*sin(25*pi*t);
C = 10^-7;
Qo = 0;
i_t = @(t)0.3+0.1*exp(-5*t).*sin(25*pi*t);
k = 1;

% Perform calculations
%itgrl = int(eq1,t);
v_t(1) = 0;
for t = 0:0.01:7
    v_t(k+1) = (1/C)*(integral(i_t,0,t(end))+Qo)+v_t(k);
    k = k+1;
end

% Display results
t = 0:0.01:7;
plot(t,v_t(2:end)), xlabel('Time (s)'), ylabel('Voltage V(t)')
grid minor
title('Voltage V(t) Across a Capacitor')
```



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