Assignment 1
Juan Silva
ECE 309
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Problem Set 1

Problem Set 1-1:

Calculate.

```
% a.
23^4 - 4 * 13^.5
% b.
4 * pi - 18^3
% c.
log10(37)
% d.
log(37)
% e.
sin(1)
% f.
cosd(60)
% g.
exp(2)
% h.
atan(1/2)
% i.
log2(64)
% j.
nthroot(32,5)
% k.
1 / sqrt(2) - nthroot(5,3)
```

Results

a) 2.7983e+05
b) -5.8194e+03
c) 1.5682
d) 3.6109
e) 0.8415
f) 0.5000
g) 7.3891
h) 0.4636
i) 6
j) 2
k) -1.0029

Problem Set 1-2:

Find the area of a circle with radius 5 inches.

```
radius = 5;              % radius in inches.
area = pi * radius^2     % area in inches squared.
```

Results

Area = 78.5398 inches squared

Problem Set 1-3:

Use the formulas V = I R (Ohm's Law) and P = V2/R to find the voltage (V) across and power (P) dissipated by a resistor if the current (I) through the resistor is 5 amps and the resistor value R is 100 ohms.

```
R = 100;                 % resistance in Ohms.
i = 5;                   % current in Amps.
v = i * R
p = v^2 / R
```

Results

V = 500 volts
P = 2500 watts

Problem Set 2

Problem Set 2-1:

Find the angle, θ, for the number: x = 1 + $\sqrt{5}$j.

```
degX = atan2d(sqrt(5),1)       % theta = arctan(b/a) in degrees
```

Results

θ = 65.9052°

Problem Set 2-2:

Find the magnitude of the complex number x above.

```
x = 1 + sqrt(5) * j;           % define cartesian coordinates
magX = abs(x)                  % find magnitude
```

Results

Magnitude = 2.4495

Problem Set 2-3:

Write x in the form re^jθ.

$$\mathrm{x} = 1 + \sqrt{5}\mathrm{i}$$

$$\mathrm{r} = \sqrt{\left(\sqrt{5}\right)^2 + (1)^2} = \sqrt{6}$$

$$\theta = \tan^{-1}\left(\frac{\sqrt{5}}{1}\right) = 65.91°$$

Results

$re^{\theta i} = \sqrt{6}\, e^{65.91i}$

Problem Set 2-4:

Change to polar form: y = 5 + 12j.

$$\mathrm{y} = 5 + \sqrt{12}\mathrm{i}$$

$$\mathrm{r} = \sqrt{(5)^2 + \left(\sqrt{12}\right)^2} = 13$$

$$\tan^{-1}\left(\frac{\sqrt{12}}{5}\right) = 67.38°$$

Results

$re^{\theta i} = 13\, e^{67.38i}$

Problem Set 2-5:

Change to Cartesian Coordinates: 2e^j60°.

$$2e^{60i}$$

$$2\left[\cos(60°) + i\sin(60°)\right]$$

$$2\left[\frac{1}{2} + i\frac{\sqrt{3}}{2}\right]$$

Results

$x + iy = 1 + 1.732i$

Problem Set 2-6:

Change to Cartesian Coordinates: 4e^0.2j.

$$4e^{0.2i}$$

$$4\left[\cos(0.2) + i\sin(0.2)\right]$$

$$4[0.98 + i(0.1987)]$$

Results

$x + iy = 3.92 + 0.7948i$

Problem Set 2-7:

Simplify: (4+j)/(5 – 2j), and write the answer in polar and rectangular form.

$$\frac{4+i}{5-2i} = \frac{4+i}{5-2i}\left(\frac{5+2i}{5+2i}\right) = \frac{18}{29} + \frac{13}{29}i$$

$$r = \sqrt{\left(\frac{18}{29}\right)^2 + \left(\frac{13}{29}\right)^2} = 0.765$$

$$\tan^{-1}\left(\frac{13}{18}\right) = 35.84°$$

Results

$x + iy = 0.62 + 0.448i$

$re^{\theta i} = 0.765\, e^{35.84i}$

Problem Set 2-8:

Simplify: (4+2j) * (2 + 5j), and write the answer in polar and rectangular form.

$$(4 + 2i) * (2 + 5i) = -2 + 24i$$

$$r = \sqrt{(-2)^2 + (24)^2} = 23.92$$

$$\tan^{-1}\left(\frac{24}{-2}\right) = -85.24 = °94.76°$$

Results

$x + iy = -2 + 24i$

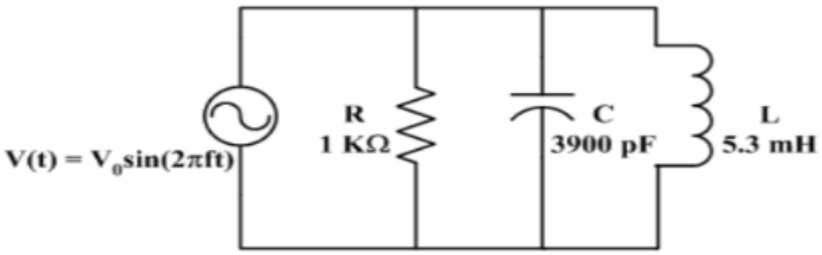
$re^{\theta i} = 23.92e^{94.76i}$

Problem Set 2-9:

Use phasors and MATLAB to find the impedance seen by the source and the current coming out of the source if the source voltage is: V(t) = 10 sin(2*pi*100t).

```
% Program Name: phasers.m
% Author: Juan Silva Last Modified: Jan. 30, 2018
% Description: This program calculates the impedance of the specified circuit
and plots the waveforms.

clear, clc, close all
format short, format compact
```




```
% *** Define variables ***

R = 1e3;          % Ohms
C = 3900e-12;     % Farads
L = 5.3e-3;       % Henries
Vs = 10;          % Volts
freq = 100;       % Hertz


% *** Start Code ***

w = 2 * pi * freq;           % Omega
xL = j * w * L;              % Impedence through inductor
xC = -j / (w * C);           % Impedence through capacitor
y = 1/R + 1/xL + 1/xC;       % total admittance
z = 1/y                      % total impedence

[zAng, zMag] = cart2pol(real(z),imag(z))     % get mag and deg (in rad)
zAngDeg =rad2deg(zAng)                       % convert rad to deg
current = Vs / z                             % current

[CurrentAng, CurrentMag] = cart2pol(real(current),imag(current))
currentAngDeg = rad2deg(CurrentAng)                % convert to polar
phase = (( 0.0075 - 0.005) / 0.01) * 360           % (dT / T) * 2pi

% *** Start Plots ***

t = 0 : 0.0001 : 0.02;                       % time in seconds
Vt = 10 * sin(2*pi*freq*t);                  % voltage
It = 3.1831 * sin(2*pi*freq*t - 1.5677);     % current

plot(t, Vt,'r', t, It, 'b--')
grid
title('Voltage and Current Waveforms')
xlabel('Time (s)')
legend('Vs(t)', 'Is(t)')
```

Results

```
Total Impedance = 0.0111 + 3.3301i Ohms
Current = 0.01 - 3.0029i Amps
Phase Angle = 90°
```