EE322 Fall 2010: Lesson 2/PS02 (Worksheet): Solutions

Introduction

In this assignment, you will become more familiar with the functions that are available in MATLAB. Later in the course, you will find that in many cases, it will be necessary to write your own functions to suit your own needs.

I. Section 2.1

Straight from text…no answers provided

Run through the series of commands on pages 19-22. Note that when you create a plot, it is usually a good idea to plot pairs of values; that is, each x value has an associated y value. When you get to the plot command on page 24, it is actually plotting 5 pairs of values: (1,10), (2,20), (3,30), (4,40) and (5,50). The x-vector has the x coordinates, the y-vector holds the y coordinates.

1. After you use the plot command, it is common to label the axes. Run the following commands to label your axes:

```
xlabel('x-values')
ylabel('y-values')
title('x-y plot')
```

2. Close your plot window. Create a new m-file called "ps02.m". Put all of the commands you have run so far into this m-file, one command per line. You can copy and paste your commands from the "Command History" window if you don't want to type them.

   Save your m-file after filling entering all the commands. Type **ps02** at the command line and hit the <Enter> button. Your plot should have been generated again. If you get an error, you have a typo somewhere, most likely.

II. Section 2.2

Read over the "Precedence of Arithmetic Operations" portion of this section.

1. Compute the area of a triangle with height 26.37 cm and base 69.474 cm. _____ cm^2

```
h=26.37;, b=69.474;  % base and height are in cm
A=1/2 * b * h       % area is 916.0147.3 cm2
```

2. Compute the area of a triangle with height 14.31 in and base 10.15 cm. _____ cm^2

   Note: 1 in = 2.54 cm.

```
h=14.31 * 2.54;     % height given in inches, convert to cm
b=10.15;           % base and height are in cm
A=1/2 * b * h       % area is 184.4631 cm2
```

3. What is the value of $f(-0.31)$ if $f(x)$ is defined as:

$$f(x) = \frac{12x^3 - 12.45x^2 + 6x}{2.80x^3 - 18x^2 - 2.5}$$

$f(-0.31)$=_____

```
x=2.65;     % will evaluate the equation for this value of x
(12*x^3 -12.45*x^2 + 6*x)/(2.80*x^3 -18*x^2 -2.5)
% results in f(x) = -1.9764
```

OR something like this

```
x=2.65;
num=12*x^3 -12.45*x^2 + 6*x;
denom=2.80*x^3 -18*x^2 -2.5;
f=num/denom
```

4. Using the ideal gas law (PV=nRT), given the following parameters, find the mass in kg of the air in the wind tunnel.

Volume = 1075 m^3

Air temp = 23° C (note: K = °C + 273)

Air pressure = 94.25 kPa

Molar mass of air = 29.3 g/mole

Mass = _____ kg

```
P=94.25;            % pressure in kPascals
V=1075;             % volume in cubic meters
T=23+273;           % temperature given in deg C, convert to
deg K
MW=29.3;            % molar mass of air in kg/mole
R = 8.314;          % gas constant, in kPa m3/kmole K
n=(P*V)/(R*T);      % number of moles of air
m=n*MW              % mass = 1206.3 kg
```

Read over the "Array Operations" portion of this section.

1. Create an array called "x" of 6 linearly spaced elements between -17 and 37.5 (use the **linspace** function). What are the elements?

x = _____ _____ _____ _____ _____ _____

```
x=linspace(-17,37.5,6) % [-17 -6.1 4.8 15.7 26.6 37.5]
```

2. Create the array theta = [-35 0 35 70]. If these are amounts of degrees in an angle, how many radians do each value in degrees correspond to?

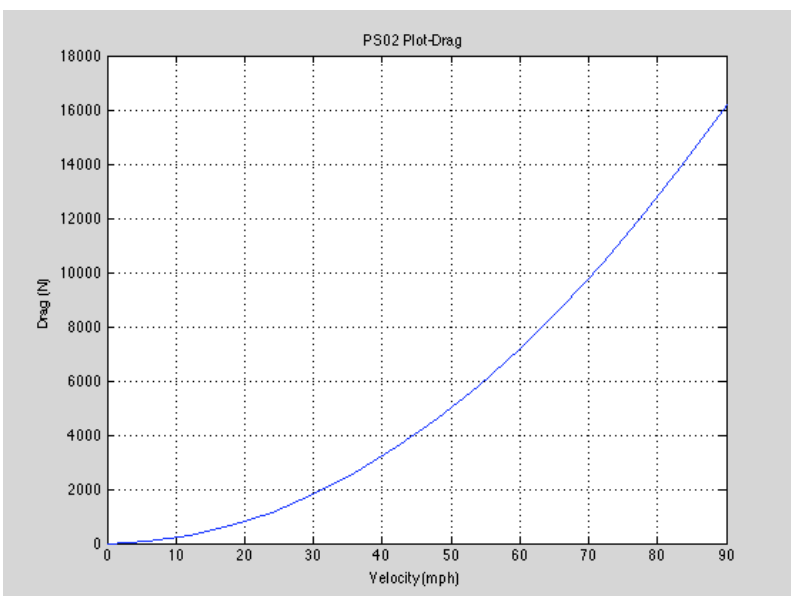
theta (radians) = _____ _____ _____ _____

```
theta = [-35 0 35 70];  % angles in degrees
theta_rad = theta * pi/180
% results in angles in radians [-0.6109 0 6109 1.2217]
```

3. Let's say you want to calculate the expected drag (in Newtons, N) on an aircraft model in a wind tunnel for a range of different velocities. Given the following drag equation and known parameters, create a new m-file called "ps02_drag.m" and enter the code necessary to calculate and plot the drag for velocities from 0 mph to 90 mph using an interval of 6 mph. Note: 1 N = 1 kg-m/s^2, and 1 mph = 0.44704 m/s.

```
% This is the code in my "ps02_drag.m" file
r = 1e-6;  % the "e" is another way to write "*10^"
A = 1;          % reference area
cd = 2.0019e7;  % coefficient of drag
V = 0:6:90;     % Analyze velocity from 0mph to 90mph
V1 = V*0.4470;   % convert mph to m/s
drag = cd*r*(V1.^2)*A/2;
table = [V', drag']; % single quote will display data in column

figure(1),plot(V,drag)
xlabel('Velocity (mph)')
ylabel('Drag (N)')
title('PS02 Plot-Drag'), grid on
```



4. Read over Example 2.3. Create a new m-file called "Example2_3.m" and enter the code called for in Example 2.3 of the text with the following change: calculate the velocity and acceleration at times 7, 12 and 23 sec. Record your results below.

Time	Velocity (m/s)	Acceleration (m/s^2)
7	_____	_____

12 _____ _____

23 _____ _____

```
% This is the code in my "Example2_3.m" file
% Example 2.3
clear, clc
time = [7 12 23]
velocity = 0.00001*time.^3 - 0.00488*time.^2 ...
    + 0.75795*time + 181.3566;
acceleration = 3 - 6.2e-5 * velocity .^2;
[time', velocity', acceleration']
%-----------------------------------------------------
%-----------------------------------------------------
```

Results in:

ans =

7.0000	186.4266	0.8452
12.0000	189.7666	0.7673
23.0000	196.3296	0.6102

For this assignment, turn in the above along with the plot from Example 2.3.