CHEN 1703 - HOMEWORK 3

Submit your MATLAB solutions via the course web site. Be sure to include your name and UNID in your m-file. Submit each solution seperately. Also be sure to document your solutions well. Include a description of the equations you are solving.

Problem 1 (5 pts)

Consider the projectile problem we discussed in class.

$$\begin{aligned} y &= y_0 + v_{y_0} t + \tfrac{1}{2} a t^2, \\ x &= x_0 + v_{x_0} t, \\ v_x &= v_{x_0}, \\ v_y &= v_{y_0} + a t, \end{aligned}$$

with $v_x = v\cos(\theta)$ and $v_y = v\sin(\theta)$. The speed is given in terms of v_x and v_y as $v = \sqrt{v_x^2 + v_y^2}$.

Calculate the position and speed of a projectile. Have the user enter:

- the initial angle, θ
- the initial speed, v_0
- The end time
- The number of points in time.

You must use arrays to store the values for t, x, y, v_x, and v_y.

When you run your script you should see something like the following:

```
Enter the ending time (s): 10
How many points in time? 6
Enter the initial speed (m/s): 12
Enter the angle (degrees): 64.8
Here is the position and speed as a function of time:
    t(s)       x(m)       y(m)       v(m/s)
         0          0          0   12.0000
    2.0000   10.2187    2.1158   10.1257
    4.0000   20.4374  -34.9683   28.7989
    6.0000   30.6561 -111.2525   48.2136
    8.0000   40.8748 -226.7366   67.7351
   10.0000   51.0935 -381.4208   87.2917
>>
```

NOTE:

- You can use the "disp" command to do all of the output. Just pack all of the numbers into a matrix. We have covered everything you need to know in class to accomplish this.
- The cos and sin functions in MATLAB require the angle in radians. Therefore, you will need to convert the angle from degrees to radians.

Problem 2 (5 pts)

Create a MATLAB program to convert temperature in Fahrenheit to Rankine, Celsius, and Kelvin. The following equations may be useful:

$$\begin{aligned} T_{\circ F} &= \tfrac{9}{5} T_{\circ C} + 32, \\ T_{\circ K} &= 273.15 + T_{\circ C}, \\ T_{\circ R} &= 459.67 + T_{\circ F}. \end{aligned}$$

The user should enter:

- The starting temperature in $^\circ F$
- The ending temperature in $^\circ F$
- The number of entries in the table

When you run your script you should see something like the following:

```
Enter the starting temperature (F): 0
Enter the ending temperature (F): 100
Enter the number of points in the table: 10
Fahrenheit   Rankine     Celsius     Kelvin
         0   459.6700   -17.7778   255.3722
   11.1111   470.7811   -11.6049   261.5451
   22.2222   481.8922    -5.4321   267.7179
   33.3333   493.0033     0.7407   273.8907
   44.4444   504.1144     6.9136   280.0636
   55.5556   515.2256    13.0864   286.2364
   66.6667   526.3367    19.2593   292.4093
   77.7778   537.4478    25.4321   298.5821
   88.8889   548.5589    31.6049   304.7549
  100.0000   559.6700    37.7778   310.9278
>>
```

NOTE: You can use the "disp" command to do all of the output. Just pack all of the numbers into a matrix. We have covered everything you need to know in class to accomplish this.

Problem 3 (5 pts)

Repeat problem 1 using Excel. Here use 10 points in time. Have the user enter the time increment, initial speed, and initial angle. The table should adjust accordingly. Your spreadsheet may look like the following (yellow indicates numbers to be changed by the user):

<>	A	B	C	D	E	F
1	Time Increment (s):		0.33		xo (m)	0.00
2					yo (m)	0.00
3	Initial speed (m/s):		10.00		vxo (m/s)	7.07
4	Initial angle (degrees		45.00		vyo (m/s)	7.07
5					a (m/s^2)	-9.80
6						
7						
8	Time (s)	x (m)	y (m)	v_x (m/s)	v_y (m/s)	v (m/s)
9	0.000	0.000	0.000	7.071	7.071	10.000
10	0.333	2.357	1.813	7.071	3.804	8.030
11	0.667	4.714	2.536	7.071	0.538	7.091
12	1.000	7.071	2.171	7.071	-2.729	7.579
13	1.333	9.428	0.717	7.071	-5.996	9.271
14	1.667	11.785	-1.826	7.071	-9.262	11.653
15	2.000	14.142	-5.458	7.071	-12.529	14.387
16	2.333	16.499	-10.179	7.071	-15.796	17.306
17	2.667	18.856	-15.988	7.071	-19.062	20.332
18	3.000	21.213	-22.887	7.071	-22.329	23.422

By changing the numbers in yellow, the remainder of the numbers should automatically update.