COMP1200-MatLab - Lab 02
Due 11:59pm – Thursday – September 8
Submit `Lab02.m` via Blackboard

Before you start writing your program:

Read these instructions including the development plan. A development plan is a process that guides you through solving a problem. Use it as a guide when writing the m-script file solution for the following problem.

NOTE: You will see later that the spelling and casing of file names is very important in MATLAB. Your submitted file(s) MUST be spelled and cased as instructed. [-5 points per file for not doing so.]

***Problem*: Lab02.m**

On a hot Saturday afternoon, you and your friends notice an empty baby swimming pool on the lawn of your apartment complex. So, why not see if you can fill it with water from water balloons thrown from your second floor balcony.

In Lab02, you will begin solving this problem by calculating the distance a water balloon will travel given the balloon launch angle (theta) in degrees, balloon launch velocity (v) in min/sec, and the thrower's height in feet. Note that the height **`yo`** is the sum of the balcony height and the thrower's height.

$$d = \frac{v\cos\theta}{g}\left(v\sin\theta + \sqrt{(v\sin\theta)^2 + 2gy_0}\right)$$

You are to write a MATLAB program (a m-script file) that (1) builds a vector of balloon launch angles (theta) in degrees, (2) uses the given input values for balloon launch angles (theta), balloon launch velocity (v) in ft/sec, and the thrower's height in feet to compute the distance that a water balloon will travel, and (3) displays the results.

***Problem Constants*:**

```
BAL_HEIGHT = 12;      % balcony height in feet
G = 32;               % gravitational acceleration in ft/s2
```

***Problem Inputs*:**

balloon launch angle (theta) in degrees	5 to 85 step 10	a vector
balloon launch velocity (v) in ft/sec	51	a scalar
thrower's height in feet	6	a scalar

Problem Outputs:

distances that a water balloon will travel	a vector

Instructions:

- ☐ Insert comments at the top and throughout each file
  - Include the follow comments at the beginning of this (and ALL) files.
    - % your name
    - % assignment number
    - % date you completed the assignment
    - % a short narrative about what the file does
  - Use your development plan as a guide for comments throughout each file
- ☐ Use `clc` and `clear all` at the beginning of your program.
- ☐ Use descriptive variable names.
- ☐ Use Sample Input/Output as a guide.
- ☐ No extra output, i.e., use semicolons!

-5 points per file for absence of any of these required comments at the top

New commands:
`cosine, sine`
`format`
`transpose`
`disp`

- ☐ Assign the input values.
  - Use colon notation to build the theta vector.
- ☐ Compute distance vector.
  - It helps to break the large equation into parts and solve for each.
  - The results of some parts will be a vector. Keep this in mind when using multiplication. Note: Squaring a variable is multiplication.
  - Combine the parts to compute the distance.
- ☐ Create a two column table (thetas and distances) . See pp. 30-31 in your text.
  - Show the results using two decimal places using the format command.
  - Use `disp(table)` to display the table.

Sample Input/Output:

```
    5.00    61.41
   15.00    76.38
   25.00    89.21
   35.00    96.69
   45.00    96.45
   55.00    87.39
   65.00    69.76
   75.00    45.00
   85.00    15.54
```

Submit via Blackboard:

`Lab02.m` MATLAB script file


```
================================================================================
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SOFTWARE DEVELOPMENT PLAN

   Name:          J Hundley
   Assignment:    Lab02
   Date:          August 27, 2011

PROBLEM SOLVING IN ENGINEERING AND SCIENCE
Always use a systematic problem-solving strategy.

1. STATE THE PROBLEM:
---Describe the problem to be solved for the assignment.
Calculate the distance a water balloon will travel given the balloon launch
angle (theta) in degrees, balloon launch velocity (v) in min/sec, and the
thrower's height in feet.
```

2. DESCRIBE THE INPUT AND OUTPUT REQUIREMENTS:
---List and describe the following as needed to solve the problem, as needed.
---***Include units where needed***.

CONSTANTS (known values that don't change):

```
BAL_HEIGHT = 12;     % balcony Height in feet          [a scalar]
G = 32;              % gravitational acceleration      [a scalar]
```

INPUT (values needed to find the output):

```
balloon launch angle (theta) in degrees   [a vector]
balloon launch velocity (v) in ft/sec     [a scalar]
thrower's height in feet                  [a scalar]
```

OUTPUT (unknowns):

```
horizontal distance (feet) that a water balloon travels  [a vector]
```

Relevant formulas:
(for complicated equations, it may be helpful to divide it into parts)

$$d = \frac{v\cos\theta}{g}\left(v\sin\theta + \sqrt{(v\sin\theta)^2 + 2gy_0}\right)$$

3. WORK HAND EXAMPLES
---Solve the problem with a few hand examples.
---Record the input values used and the results

theta degrees	horizontal distance
5	61.41
45	96.45
85	15.54

4. DEVELOP AN ALGORITHM:
---Think about the steps used to solve the problem to solve the problem by hand and list them here to create an algorithm.
---The algorithm steps **should be used as comments** in your program as a guide.

```
*****INPUT*****
   get angle theta, velocity, and thrower's height
*****COMPUTATION*****
   compute the horizontal distance
*****OUTPUT*****
   display a table of thetas & horizontal distance for each
```

5. SOLVE THE PROBLEM:
---This step represents your writing a computer program to solve the problem.
---NOTE: Do not type your program here. Submit it as a computer program file.
---Use steps in your algorithm as comments in your program to guide the development of you program.

6. TEST THE SOLUTION:
---Run your program using the values from #3 to check for correctness.
---If there is an error, correct your program code and run again.