Functions

# Instructions

Complete the problems below by creating MATLAB functions. Complete the assignment by posting an individual .m *for each problem* to the D2L folder. This is different than in the past. In this case you are going to have to submit two .m files, one for each function. *Note: this means that you will not be using the naming convention that we have used so far in this class!*

Read the problems carefully, they will instruct you how to name your .m files.

# Problems

1. A model for exponential growth or decay of a quantity is given by

Where *A(t)* and *A0* are the quantity at time *t* and time 0, respectively, and *k* is a constant unique to the specific application.

Write a function that uses this model to predict the quantity *A(t)* at time *t* from knowledge of *A0* and *A(t1)* at some other time *t1*. For function names and arguments, use

At = expGD(A0,At1,t1,t)

where the output argument At corresponds to *A(t)* and for input arguments use A0,At1,t1,t, corresponding to *A0, A(t1), t1,* and *t* respectively.

**If you want to test your function, the TAs will be testing it in the following two scenarios.**

1. **The population of Mexico was 67 million in the year 1980 and 79 million in 1986. Estimate the population in 2000 based on those numbers.**
2. **The half-life of a radioactive material is 5.8 years. How much of a 7-gram sample will be left after 30 years?**
3. Create a function file that calculates the trajectory of a projectile. The inputs to the function are the initial velocity and the angle at which the projectile is fired. The outputs from the function are the maximum height and distance. In addition, the function generates a plot of the trajectory (must include appropriate axis labels and title). I recommend using linspace to create an array of t values for plotting. The function should be called trajectory.

Physics review:

You can analyze the motion by considering horizontal and vertical components.

and

In the vertical direction the velocity and position of the projectile are given by:

and

The time it takes the projectile to reach the highest point () and the corresponding height are given by:

and

Finally, the total flying time is twice the time it takes the projectile to reach the highest point,

Remember, in the horizontal direction the velocity is constant, and the position of the projectile is given by:

**If you want to test your function, the TAs will test it with a projectile fired at 230 m/s at an angle of 39º.**