ES1060 **HW05** Due: Oct. 27, 2025
Fall 2025

Problem One
Simple Calculations:
Write a MATLAB script that assigns the following variables, a, b, c, and d and then calculates the values for w, x, y, and z.

- Be sure to include comments for your name, date, class, and assignment.
- Clear the command window and workspace variable at the beginning of your program.
- Run your file, then copy and paste your calculation results at the bottom of your script file. Change these results to comments.

$$a = 3 \qquad b = 7 \qquad c = 2 \qquad d = -4$$

$$w = 2a \qquad x = 10 + a - c + 2d \qquad y = \frac{a+b}{c+d} \qquad q = \frac{a}{2} + \frac{2b}{28} + \frac{c+d}{8}$$

Problem Two
Simple Calculations: Write a single **MATLAB script** (m-file) that performs the following 10 tasks.

- Remember to use plenty of comments to describe what your code is doing.
- Use the task letter as the variable in your script.
- Run your script and copy your results, as comments, at the bottom of your script file.
- Remember that MATLAB has a great set of help files. Type 'help' along with the function name in the command window if you are confused how to use something. For more detailed information and/or examples, the Help menu and MathWorks website are also great resources.

a) Create a row vector that contains the following numbers: 5, -3, 11, 0, 8, 6

```
>> a = [5, -3, 11, 0, 8, 6] % row vector of given values.
```

b) Create a row vector that begins at 4, does not pass 19, and increments by 3.

```
>> b = % row vector of given sequence
```

c) Calculate `a` plus `b`. Store result in `c`.

d) Multiply ('element by element') `a` and `b`.

e) Multiply `b` by the scalar `3`

f) Create a list of 5 evenly spaced numbers from 7 to 30 (inclusive).

g) Write one instruction to determine the square root of all elements in `c`.

h) Use a MATLAB function to total all of the elements of `b`.

k) Use the `rand` function to generate a single random number between 4 and 18.

Problem Three

Simple Function: Write a MATLAB function that contains the following items. Remember to apply the function concepts that we discussed in class. This function will convert temperatures supplied in degrees Celsius into temperature in degrees Fahrenheit and temperature in degrees Kelvin.

- Use **temp_convert** as your function name. ***Your function definition line is your first line of code.*** There should be no code, including comments, above this.
- The function has one input: ***TC***, which is temperature in Celsius
- The function will have two output values: ***TF***, the temperature in Fahrenheit, and ***TK***, the temperature in Kelvin.
- Your function will have a help block that describes the details of the function. This includes what the function does and a description of the inputs and outputs. Student header information should also be found here.
- Your function will convert the input temperature in Celsius into temperatures in Fahrenheit and Kelvin.
- Your function should work for scalar, vector and 2D array input. To determine, carefully consider if/when the dot operator may be needed. Try it on inputs that are vectors.
- At the command window, you will test your function with TC = 24.68.
- Include, ***as comments*** at the end of your file:
    - Your function call (What did you type in the command window to run this function?)
    - The results from when TC = 24.68

Problem Four

Simple Function: Write a MATLAB function that contains the following items. Remember to apply function concepts that we discussed in class. This function will determine the terminal velocity of a cloud droplet based on Stokes' law. According to this law, a droplet reaches its terminal velocity when gravitational (F_G) and drag (F_D) forces are opposite and equal to each other in magnitude.

Knowing that $F_G = \frac{4}{3} \cdot \pi \cdot r^3 \cdot \rho_l \cdot g$ and $F_D = 6 \cdot \pi \cdot \mu \cdot r \cdot v$

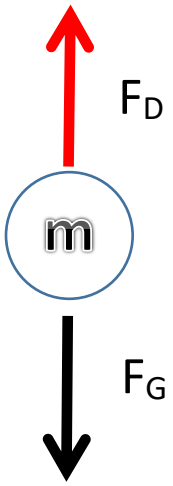
r, cloud droplet radius, [m]

ρ_l, density of liquid water, [1000 kg/m^3]

g, gravitational acceleration, [9.8 m/s^2]

μ, dynamic viscosity of air, [1.8 x 10^{-5} kg/(m s)]

v, terminal velocity of a cloud droplet, [m/s]



- Use **droplet_velocity** as your function name. ***Your function definition line is your first line of code.*** There should be no code, including comments, above this.
- The function has one input: ***r***, which is radius of the droplet(s) that you will be calculating the terminal velocity for.
- The function will have two output values: ***v***, the terminal velocity of the droplet(s) and ***t***, the time that the droplet(s) to fall
- Your function will have a help block that describes the details of the function. This includes what the function does and a description of the input and outputs. Student header information should also be found here.
- Your function will calculate the terminal velocity for the droplet(s). Keep in mind that F_G and F_D are equal and opposite, so setting these two quantities equal to one another is the first step towards calculating v.
- Using the velocities calculated and ignoring the droplet growth, your function will then estimate the time required for each droplet to fall in a cloudy air with a height of 1454 ft. This is the height of the Empire State Building, including its spire and antenna.
- Your function should work for scalar, vector and 2D array input. To determine, carefully consider if/when the dot operator may be needed. Try it on inputs that are vectors. i.e. Have it calculate for several droplet radius values at once.
- At the command window, you will test your function with r=[1, 10, 22] µm in radius.
- Include, ***as comments*** at the end of your file:
    - Your function call (What did you type in the command window to run this function?)
    - The results from when r=[1, 10, 22] µm