**HOMEWORK #5**

***Due: Class 6b***

**To be submitted in Class 6B:**

*Individually:*

1. Hardcopy printout of your function m-file, *vector\_sort\_yourlogin.m*.

2. Hardcopy printout of your function m-file, *square\_root.m*.

3. Hardcopy printout of your function m-file, *series\_sum\_yourlogin.m*.

4. Hardcopy printout of your function m-file, *e\_estimate\_yourlogin.m*.

5. Hardcopy printout of your function m-file, *model\_rocket\_yourlogin.m*.

**To be submitted electronically before Class 6B:**

*Individually:*

1. Your function m-files, *vector\_sort\_yourlogin.m*.

2. Your function m-file, *square\_root.m*.

3. Your function m-file, *series\_sum\_yourlogin.m*.

4. Your function m-file, *e\_estimate\_yourlogin.m*.

5. Your function m-file, *model\_rocket\_yourlogin.m*.

# Reading Assignment

**Ideas to Innovation Textbook:**

Chapter 26: pp. 605-613.

**Mathworks Tutorials (Optional but Recommended):** Much (but not all) of the content

in the above reading is represented visually in the following Interactive MATLAB

Tutorial materials available through the MathWorks website,

www.mathworks.com/purduefirstyear/matlabtutorial. The recommended segments for

this week are:

Programming in MATLAB

* Flow and Loop Control
  + Flow Control
  + Writing WHILE Loops

# MATLAB In-Class Activity

***This is to be completed individually.***

***This problem is added to your homework grade.***

Complete activity 3 from class 4b.

***Deliverable: Hardcopy printout of your function m-file, vector\_sort\_yourlogin.m. Upload your m-files to your Faculty Instructor’s Assignment Drop Box on Blackboard.***

# MATLAB In-Class Activity

***This is to be completed individually.***

***This problem is added to your homework grade.***

Complete activity 4 from class 4b.

***Deliverable: Hardcopy printout of your function file, square\_root.m. Upload your m-file to your Faculty Instructor’s Assignment Drop Box on Blackboard.***

# Determining the number of terms in a series

***This is to be completed individually.***

***This problem is part of your homework grade.***

Determine the number of terms in the series



where k = 1, 2, 3, … which are required for the sum of the terms to exceed a specified value.

1. Write a MATLAB function, named **series\_sum\_*yourlogin*.m,** which uses a loop to calculate the sum of the series expression shown above to exceed a specified value. The input is the specified value. The output is the number of terms required to exceed the specified value.
2. Open your MATLAB function template file and save it as **series\_sum\_yourlogin.m**.
3. In the Calculation section, use a loop structure to check that the input value is positive.
4. In the Calculation section, use a loop structure to calculate the expression shown above until the specified value has been exceeded.
5. Test your function at the command line using the following test cases. Using comments in the OUTPUT section of your function, paste what is displayed by your function.
6. Specified\_value = 0
7. specified\_value = 25
8. specified\_value = 2000

***Deliverables: Hardcopy printout of your function file, series\_sum\_yourlogin.m. Upload your m-file to your Faculty Instructor’s Assignment Drop Box on Blackboard.***

# Estimating the value of e

***This is to be completed individually.***

***This problem is part of your homework grade.***

The function f(x) = ex can be represented in a Taylor series by



1. Write a MATLAB function, named **e\_estimate\_*yourlogin*.m,** which uses a loop to calculate the Taylor series expression shown above to a desired level of accuracy. The accuracy is defined as the absolute value of the difference of the MATLAB exp(x) expression and the Taylor series expression. The inputs are the desired accuracy and the value of x. The output is the value of the Taylor series approximation for ex.
2. Open your MATLAB function template file and save it as **e\_estimate\_yourlogin.m**.
3. In the Calculation section, use a loop structure to calculate the expression shown above until the desired accuracy has been achieved.
4. In the Output section, use the **fprintf** command to display ‘exp(*x value* *entered*) = *your calculated value*’. Your results should be displayed to 5 decimal places.
5. Test your code with the following test cases and paste the results at the end of the script file as comments.
6. x = 2, desired accuracy = 0.001
7. x = -4, desired accuracy = 0.0001
8. x = 12.3, desired accuracy = 0.00005

***Deliverables: Hardcopy printout of your function file, e\_estimate\_yourlogin.m. Upload your m-file to your Faculty Instructor’s Assignment Drop Box on Blackboard.***

# Modeling the flight path of a model rocket

***This is to be completed individually.***

***This problem is added to your homework grade.***

Several professors in First-Year Engineering would like to launch model rockets from a barge located on the Wabash River. The professors plan to launch the rockets at different velocities (Vrocket) and at different launch angles, (the greek letter theta), which is measured from horizontal. To launch each rocket safely, the professors need you to calculate the vertical height (Y) and horizontal distance (X) of the rocket as it flies through the air and the time just before it lands in the water.

Barge

**Vrocket**

Vhorizontal

Vvertical

θ

The motion of each rocket can be described using the velocity and the launch angle measured from horizontal provided by the professors. The horizontal distance (X) and vertical height (Y) of the firework after it has been launched is calculated using:



where t is the time (s) and g is the acceleration due to gravity (9.81 m/s2).

1. Write a MATLAB function, named **model\_rocket\_*yourlogin*.m,** which will calculate the horizontal distance and vertical height. The inputs are the initial velocity in m/s and the angle  (theta) in degrees. The function does not return any outputs.

a. Utilize a while loop to output the vertical height and horizontal distance every second from when it leaves the barge until just before it would land on the water. Assume that the model rocket starts from height of 1 meter above the water.

b. The output should look like the following:

**For an initial velocity (m/s)of 56 and angle of 45 degrees:**

**At 0 seconds, the height is 0.00 m and distance is 0.00 m**

**...**

2. Test your function by using the inputs: Vrocket = 56 m/s and  = 45 degrees. Your output should be:

**For an initial velocity (m/s)of 56 and angle of 45 degrees:**

**At 0 seconds, the height is 0.00 m and distance is 0.00 m**

**At 1 seconds, the height is 34.69 m and distance is 39.60 m**

**At 2 seconds, the height is 59.58 m and distance is 79.20 m**

**At 3 seconds, the height is 74.65 m and distance is 118.79 m**

**At 4 seconds, the height is 79.91 m and distance is 158.39 m**

**At 5 seconds, the height is 75.36 m and distance is 197.99 m**

**At 6 seconds, the height is 61.01 m and distance is 237.59 m**

**At 7 seconds, the height is 36.84 m and distance is 277.19 m**

**At 8 seconds, the height is 2.86 m and distance is 316.78 m**

3. Run your function for Vrocket = 87 m/s and  = 61 degrees and paste the results, as comments, into your function file.

***Deliverables: Hardcopy printout of your function file, model\_rocket\_yourlogin.m. Upload your m-file to your Faculty Instructor’s Assignment Drop Box on Blackboard.***