# MATH 3341 — Spring 2020

## Lab 01: Introduction to MATLAB and LaTeX

In this lab you will practice using the command window to carry out basic calculations, learn how to use the help function, MATLAB documentation, and record your input and output using the `diary` function. First, follow the Windows Intructions to create the working directory.

## 1 Arithmetics in MATLAB

(1) In the command window enter the command `diary('lab_01_output.txt')` this will create a `.txt` file. This will record all input and output in the command window until you type the command `diary off`.

(2) Type the command `beep off`. This will disable the sound that plays when there is an error in your code.

(3) Use the `help functionName` to search for the relevant function in the problems below. Consider your 'answer' to this question to be the output generated by the `help` command.

   (a) What type of logarithm does the `log(x)` function calculate?

   (b) Does the MATLAB default setting calculate trigonometric functions in radians or degrees?

(4) Carry out the following calculations using normal math operators:

   (a) $2 + 5$

   (b) $4^5$

   (c) $7 \cdot 6$

   (d) $3/8$

   (e) $54460 - 2342$

   (f) $\cos(50^\circ)$

   (g) $\sqrt{4}$

   (h) $\ln(3)$

   (i) $\sin\left(\frac{\pi}{2}\right)$

   (j) $e^{34}$

(5) For questions 4a – 4e, you must also carry out each calculation using functional notation for each operation. Use the `help` command and/or search the MATLAB documentation to find what the functional notation is for each operation.

(6) When you complete the above tasks enter the command `diary off`. This will stop recording the input and output in the command window.

Follow the Overleaf Instructions to set up an account, make a copy of the template, then upload `lab_01_output.txt` to the folder `src` on Overleaf. Next open `body.tex` under the folder `LaTeX`. In the last section of the report, you will reproduce the following using LaTeX. Once you finish, recompile, and submit the generated `.pdf` file to WyoCourses.

# 2 Basics of LaTeX

## 2.1 Simplifying Fractions

Consider the function

$$f(x) = \frac{x^2 - 1}{x + 1}.$$

To simplify this funciton we can factor the numerator and cancel like terms

$$\begin{aligned} f(x) &= \frac{x^2 - 1}{x + 1} \\ &= \frac{(x - 1)(x + 1)}{x + 1} \\ &= x - 1. \end{aligned}$$

## 2.2 Matrix

A general $3 \times 3$ matrix $A$ has the form

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}.$$

## 2.3 The Millennium Prize Problems

*The Millennium Prize Problems* are seven problems in mathematics that were stated by the **Clay Mathematics Institute** on May 24, 2000. The problems are

(1) Birch and Swinnerton-Dyer conjecture,

(2) Hodge conjecture,

(3) Navier–Stokes existence and smoothness,

(4) P versus NP problem,

(5) Poincaré conjecture,

(6) Riemann hypothesis,

(7) Yang–Mills existence and mass gap.

The Riemann zeta function is defined for complex s with real part greater than 1 by the absolutely convergent infinite series

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \frac{1}{1^s} + \frac{1}{2^s} + \frac{1}{3^s} + \cdots$$

The practical uses of the Riemann hypothesis include many propositions known true under the Riemann hypothesis, and some that can be shown to be equivalent to the Riemann hypothesis:

- Distribution of prime numbers,

- Growth of arithemtic functions,
- Large prime gap conjecture,
- Criteria equivalent to the Riemann hypothesis.