First of all, do everything in the *command window* for now. (It is the big one front and center.) We are only commanding Matlab to do things for us. Remember, computers should make math easier once you know how to use them.

You can certainly do more sophisticated things in Matlab than just tell it to do stuff. Later in your mathematical careers, you will need to write your own functions, which you will do in a script file. Then you tell Matlab to do stuff with your functions. These functions are programs. If this becomes necessary in this course, we will discuss script files later. You can also come talk to me about writing functions in script files if you are interested!

Would you like to use the computer more to help with your linear algebra? What are you curious about? Email me with what you would like to know!

1. Project 1: Matrix Multiplication

**Definition 1.** *Windows in your workspace and assignment statements.*

You can assign values to variables or strings of variables. For instance, typing

\[ x = 2 \]

and pressing enter/return tells Matlab "When you see \( x \), that means 2." This is called an *assignment statement*, and it assigns the value of 2 to the variable \( x \). Notice that when you type \( x = 2 \) in the command window and press enter, a few things happen on your screen.

1. \( x = 2 \) appears in the *Command Window*.
2. On the upper right, in the box called *Workspace*, you can see \( x \) appears under "Name," and to the right of that under "Value" 2 appears. This workspace keeps track of the variables you have named.
3. In the lower right, in the box called *Command History*, \( x = 2 \) appears. This box keeps track of your command history.

Caps matter, so when you then type \( X = 3 \), a new assignment occurs.

Some questions:

- After assigning values to \( x \) and \( X \), type \( x \) into the command window and press return/enter. What happens?
- Try typing \( 2 = z \) in the Command Window. What happens? Why do you think that is?
- Can you make any assignment you want? What happens if you try to assign the value of 3 to the symbol 2? Would you try to do that with \( 2=3 \) or \( 3=2 \)? What happens when you do that?
- What do you think happens when you type \( xX \) and press return/enter? Give it a try.
- What happens when you type \( xX = 5 \)? Check if the values of \( x \) and \( X \) were affected by typing them into the command window.

---

1. This is the default position. This can be changed, but please don’t... If someone has changed the positioning at some point in the quarter, then know that the command window is labeled.

2. Same comment: the positioning of the windows can be changed, but please don’t. The default settings are described below. All windows are labeled.
You can also assign a value to a string of letters as we did with \( xX \). The example in Definition 2 is also an assignment statement.

**Definition 2.** *Writing a matrix in Matlab.*

\[
\text{Mat} = \begin{bmatrix} 3/17 & 0 & 0 \\ 1 & 2 & 3 \\ 6 & 7 & 8 \end{bmatrix}
\]

and \( \text{Mat} = [3/17, 0, 0; 1, 2, 3; 6, 7, 8] \)

both give the matrix

\[
\begin{bmatrix}
3/17 & 0 & 0 \\
1 & 2 & 3 \\
6 & 7 & 8
\end{bmatrix}
\]

Note that I have spaces in the second example where I use commas. This is not necessary, but I thought it would be easier to read.

Moreover, you have assigned this matrix to the variable \( \text{Mat} \). When you type \( \text{Mat} \) again, Mathlab will think that you want this matrix. You can always reassign \( \text{Mat} \) by writing \( \text{Mat} = 2 \), which will make \( \text{Mat} \) the number 2 and not a matrix or by writing \( \text{Mat} = \) another matrix. So the general format for defining a matrix is

\[
\text{MatrixName} = \{\text{Row 1 entries separated by spaces or commas ; Row 2 entries separated by spaces/commas ; ...]\}
\]

**Definition 3.** *Multiplication (Matrices and otherwise)*

After you assign values to \( A \) and \( B \),

\[ A \ast B \]

is the product. If \( A \) and \( B \) are matrices, then \( A \ast B \) is traditional matrix multiplication.

If for whatever reason you want to multiply two matrices entry by entry, you do that with a dot followed by the astrix:

\[ A \ast B \]

(Of course the matrices have to be the same size.)

**Definition 4.** *Raising things to a power/Exponents*

Let \( n \) be a real number. After you assign a value to \( A \),

\[ A \wedge n \]

is \( A \) raised to the power \( n \). (i.e. \( A \wedge 2 \) is \( A \) squared, and \( A \wedge 25 \) is \( A \) to the 25th power.) If \( A \) is a matrix, then the power is the power of the matrix with respect to traditional matrix multiplication. For instance \( A^4 = A \ast A \ast A \ast A \).

Again, if you would like to raise each entry of a matrix to a certain power, you can do that with a dot.

\[ A \wedge 5 \]

raises each entry of the matrix \( A \) to the fifth power, or \( A \ast A \ast A \ast A \ast A \).

**Definition 5.** *Help: using the documentation*

If there is something you think you should be able to do like control the number of digits you see, type help or doc and a keyword.

\[
\begin{align*}
\text{help keyword} \\
\text{doc keyword}
\end{align*}
\]

For instance, “help digits” helped me make the following entry, Definition 2.
**Definition 6.** *Decimal Expansion - how many digits do you want to see?*
If you want to see a lot of decimals (15) you can change the format of how your answers get displayed by typing

\[
\begin{align*}
\text{format long} \\
\text{format short}
\end{align*}
\]

The latter changes the number of digits past the decimal displayed back to the default, which is four. The commands

\[
\begin{align*}
\text{vpa(expression, number of digits)} \\
\text{digits}
\end{align*}
\]

also alter the number of digits you see. If you only want to change the digits you see in one line of the code, vpa will do it. For instance, if I want to see the matrix in Definition ?? expanded to forty decimal places, you can type vpa(Mat,40). This will only expand the upper left entry because it is the only non-whole number.

Use help or doc from Definition ?? to view the syntax for digits.

**Definition 7.** *Looking at parts of a matrix and summing the entries in a column*
If you want to see just one entry of a matrix or even an entire row or column, then you can type

\[
\begin{align*}
\text{Mat(i,j)} & \quad \text{will return the entry in the i\text{th} row and j\text{th} column} \\
\text{Mat(:,j)} & \quad \text{will return all of the row entries in the j\text{th} column, or the j\text{th} column} \\
\text{Mat(i,:)} & \quad \text{will return all of the column entries in the i\text{th} row, or the j\text{th} row} \\
\text{sum(Mat)} & \quad \text{will add all of the entries in a matrix} \\
\text{sum(Mat(:,j))} & \quad \text{will add all of the entries in the j\text{th} column}
\end{align*}
\]