

Name : \_\_\_\_\_

Class Number: \_\_\_\_\_

## ENGR 11: Lesson 1, Part 2 Suggested Problems

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### Theoretic Problems: Discussed in notes

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#### 1. What's is a function?

- A. What does the word *function* refer to in mathematics? Please explain in as much detail as possible.
  - B. What does the word *function* refer to in MATLAB? Please explain in as much detail as possible.
  - C. What is the difference between the interpretation of the word function in these different contexts?
  - D. What is the general pattern for the syntax (format, structure) of a function? Give two examples (using distinct functions) of how this pattern works in practice.
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#### 2. What's is a variable?

- A. What does the word *variable* refer to in mathematics? Please explain in as much detail as possible.
  - B. What does the word *variable* refer to in MATLAB? Please be sure to mention the three important attributes of variables in MATLAB.
  - C. What happens in MATLAB when we define a new variable?
  - D. What pattern do we use in MATLAB when defining scalar-valued variables?
  - E. Once we type a command like `x = 5` into the Command Window and then press  , what happens within MATLAB?
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### Problems Solved in Jeff's Notes

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#### 2. Eg. Use MATLAB's native `sqrt` function in all of the following ways:

- A. Input a number into the argument of the `sqrt` function
  - B. Define a scalar-valued variable and input variable into argument of the `sqrt` function
  - C. Input a computable expression, made up of numbers & variables, into the argument of `sqrt`
  - D. Input a computable expression, made up of numbers, variables, and at least one function call, into the argument of the `sqrt` function
  - E. Create a computable expression with the output of `sqrt` used in another arithmetic operation.
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#### 3. Eg. Open MATLAB's documentation center using the Help (drop-down) menu. Then, search the phrase Elementary Math and open the MATLAB Documentation article with this title. Click on each of the various lists provided in this article. Read the individual names of each function in the list and the associated one sentence description for each item. There are 10 separate lists (as seen below).

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|----------------------------|---|
| 1.Arithmetic               | 6.Discrete Math                           |
| 2.Trigonometry             | 9.Cartesian Coordinates System Conversion |
| 3.Exponents and Logarithms | 8.Special Functions                       |
| 4.Descriptive Statistics   | 9.Cartesian Coordinates System Conversion |
| 5.Complex Numbers          | 10.Constants and Test Matrices            |

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This exercise should take you some time. The point of this exercise is to expose you to all of the native math functions that are available in MATLAB. In this class, we will rely on a small subset of these functions. However, if you plan to use this software in the future, this initial introduction will help get you oriented to the wide variety of tools that you can use in MATLAB.

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4. Eg. Execute the command `x = 9`. Then, assign a new value to the variable `x` using the command `x = 4*x - 12`. Explain how the command `x = 4*x - 12` differs from the mathematical statement

$$x = 4x - 12.$$


Be sure to refer back to your knowledge of the assignment operator versus the equals sign from Lesson 1.

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5. What are some of the ways that we should be careful when choosing variable names in MATLAB? In your answer, please address each of the following items:
- A. How many rules are there for naming variables in MATLAB?
  - B. What are the rules for naming variables in MATLAB? Try to define a variable that breaks each rule individually. For example, try to define a variable that breaks rule 1. What happens when you do this? Continue this exercise until you have officially broken all the rules.
  - C. What does the phrase *MATLAB's keywords* refer to? How many such words are there in MATLAB?
  - D. What command can we use to check MATLAB's list of keywords?
  - E. In MATLAB, which takes precedence: variable names or function names? Why is this discussion of precedence important when choosing a variable name?
  - F. What command can we use to check whether a proposed name for a variable is already in use within MATLAB?
  - G. Is MATLAB case sensitive. For example, if we set `a = 3` and then `A = 12`, what value is stored in the Workspace for variable `a`?
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6. Below is a list of some popular predefined variables in MATLAB.

`pi`    `i`    `j`    `inf`    `NaN`    `clock`    `date`    `eps`    `ans`

Please (briefly) describe to what each variable refers. Then, type each of these variables into the Command Window individually and press . What recommendations does Jeff have for redefining these variables to be a different value?

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7. Below is a list of some popular commands to manage variables in MATLAB

`clear`                      `who`                      `whos`

Please (briefly) describe what outcome results from executing each command in the Command Window.

- A. Use the `who` command to display a list of all variables currently stored in memory
- B. Use the `clear` command to delete a specific variable value from the Workspace
- C. Use the `whos` command to display an enhanced list of all variables currently stored in memory
- D. Use the `clear` command to remove all variable values from the Workspace

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### Suggested Problems

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9. Calculate each of the following expressions by writing commands in the Command Window.

$$\begin{array}{lll} \text{A. } \left( \frac{5}{\sqrt{300}} + \frac{6.4^6}{91} \right)^{1/3} + \frac{120}{0.25} & \text{B. } \sqrt[5]{e + \frac{456.789}{123}} + \pi^4 & \text{C. } \left| 11^{10/7} - \frac{71 \times 10}{\sqrt{12}} \right| \\ \text{D. } + \frac{\cos\left(\frac{5\pi}{6}\right)}{1 + \sin(80^\circ)} & \text{E. } \log_{10}(87) + \frac{9!}{\log_2(512)} & \text{F. } \ln\left(57.2^{-1/2}\right) + \tan(45^\circ) \end{array}$$

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10. Write a MATLAB command in the Command Window to enter a fraction with  $-41.8 + \sqrt{\pi}$  in the numerator and  $\arctan(1) + e^4$  in the denominator.

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### Optional Challenge Problems

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12. Calculate a numerical value for the expression  $\lceil \pi \rceil + \lfloor e^4 \rfloor$ . Note:  $f(x) = \lceil x \rceil$  is called the *ceiling function* while  $f(x) = \lfloor x \rfloor$  is known as the *floor function*.
13. Explain the history behind the phrase *software bug*. Where did this terminology come from?
14. Let  $a = 48$  and  $b = 180$ . Use native MATLAB functions to do each of the following:
- A. Find the least common multiple of  $a$  and  $b$
  - B. Find the greatest common factor of  $a$  and  $b$
  - C. Find the prime factors of the least common multiple of  $a$  and  $b$
  - D. Calculate the value  $\binom{7}{4}$  (hint: this is read as “seven choose four” and known as a binomial coefficient)