ESC 251 **Homework 2** **Due: September 2**

Show all work.

1) (1 pt) For each quantity in the list below, indicate if the quantity is an integer or a double precision variable.

   a) The length of a side of a triangle - double precision because the side length could be 1.5

   b) The number of marbles in a bag - integer

   c) The volume of a pyramid - double precision

   d) The temperature of a sidewalk - double precision Though temperatures are often reported to the nearest whole number, temperatures of 70.5 are possible.

   e) The number of people in front of you in line at a store - integer

2) (4 pts) Each of the problems below has a problem with the transcription of the given formula into MATLAB. Correct the transcription error for each case. In addition, use MATLAB to compute the value of the expression for $x = \pi, y = -3$.

   a)

$$z = \frac{1}{x+y}$$

```
>> z = (1/x+y)
```

   b)

$$z = \sqrt[4]{x}$$

```
>> z = x^1/4
```

   c)

$$z = \cos^2(x+y)$$

```
>> z = cos(x+y^2)
```

   d)

$$z = x^2 - 4xy + y^2$$

```
>> z = x^2 - 4xy + y^2

---------------------------------------
>> x = pi;
>> y = -3;
>> z = 1/(x+y)
z =
    7.0625
>> z = x^(1/4)
z =
    1.3313
>> z = cos(x+y)^2
z =
    0.9801
>> z = x^2 -4*x*y + y^2
z =
    56.5687
```

3) (3 pts) There is a good reason why MATLAB has the `nthroot` function that is listed at the end of the Introduction to MATLAB notes. Suppose you wanted to compute the cube root of -1. Type the following into MATLAB

```
>> x = -1;
>> y = x^(1/3)
```

Do you get the result you expected? Why do you get the answer you are getting?

You wind up getting

```
>> x = -1;
>> y = x^(1/3)
y =
    0.5000 + 0.8660i
```

This is the first principle root of -1 (via De Moivre's Formula) rather than the -1 you would normally expect. This is an unexpected consequence of MATLAB using complex variables when it thinks it needs to.

If you use the `nthroot` function instead, you get the value you would expect

```
>> x = -1;
>> y = nthroot(x,3)
y =
    -1
```

4) (1 pt) You have probably spent most of your academic life being told that you can't take the natural logarithm of a negative number. Use MATLAB to compute the natural logarithm of any negative number you want. What type of number do you get?

You get a complex number. A negative real number a can always be written in polar form as

$$a = |a|e^{i\pi}.$$

When you take the log of this, you get

$$\begin{aligned} \ln(a) &= \ln(|a|e^{i\pi}) \\ &= \ln(|a|) + \ln(e^{i\pi}) \\ &= \ln(|a|) + \pi i \end{aligned}$$