For this assignment, you should hand in both a written part and a printed part. For the printed part, you should copy and paste your MATLAB commands and output into a Word (or similar) document. Set the document font to Courier New. Remove any extraneous/erroneous commands and augment your MATLAB output to clearly indicate where one problem begins and the next one begins.

1) (2 pts) Define the following variables:

$$a = 1 + 2i;\ b = -1 + 2i.$$

Perform the following computations in MATLAB and verify the results by hand.

a) `a^2`

b) `a*b`

d) `a < b`

e) `a == b`

2) (1 pt) For a and b as defined in Problem 1), answer the following

a) What is `a'`?

b) What is `conj(a)`?

c) Explain why a) and b) are the same.

d) Are `a` and `b` complex conjugates? Why or why not?

3) (2 pts) Give the command that will create a row vector from -1 to 1 in steps of 0.1 and store it in the variable x. What are the dimensions of x (hint: use the `size` command)? Give the output from the following commands and explain the results. If you encounter an error, explain why the error occurs.

a) `x(2)`

b) `x(1:11)`

c) `x(0:22)`

d) `x(1:2:21)`

e) `x(21:-1:10)`

f) `x(1:.1:2)`

Is the last command safe to use?

4) (4 pts) Create the matrix

$$A = \begin{pmatrix} 2 & 4 & 6 \\ 3 & 6 & 9 \\ 4 & 8 & 12 \end{pmatrix}.$$

Give the output of each command and explain the results. If you encounter an error, explain why the error occurs.

a) `A(3,1)`

b) `A(2,3)`

d) `A(1,0)`

e) `A(:,2)`

f) `A(:,1:2:3)`

g) `A(1,:)`

h) `A(1:2,2:3)`

i) `A'`

Define `ii = [3 1]` and `jj = [3 2]`. Explain the output of

j) `A(:,jj)`

k) `A(ii,:)`

l) `A(ii,jj)`

5) (2 pts) Give the commands that will create the following quantities:

$$D = \begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}; \quad e = \begin{pmatrix} 6 & 9 \end{pmatrix}; \quad f = \begin{pmatrix} 4 \\ 8 \\ 12 \end{pmatrix}.$$

Now give the command that will use D, e and f to build the matrix A from Problem 4).

6) (6 pts) Create the following vectors in MATLAB:

$$w = \begin{pmatrix} 4 \\ 2 \\ 1 \end{pmatrix}; \quad x = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}; \quad y = \begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix}; \quad z = \begin{pmatrix} i \\ -i \\ 3i \end{pmatrix}.$$

Can the following operations be performed? If yes, give the result and verify by hand computation. If not, completely explain why not.

a) `x * w`

b) `w * w`

c) `w' * w`

d) `y' * z`

e) `y * z`

f) `y * y'`

g) `y .* w`

h) `y .* w'`

i) `x .* z`

j) `x ./ y`

7) (8 pts) Create the following quantities in MATLAB:

$$A = \begin{pmatrix} -1 & 3 & 4 \\ 6 & -2 & -9 \\ 3 & 1 & 0 \end{pmatrix}; \quad x = \begin{pmatrix} 3 \\ -2 \\ 0 \end{pmatrix}; \quad y = \begin{pmatrix} -3 & 4 & 1 \end{pmatrix}.$$

Can the following operations be performed? If yes, give the result and verify by hand computation. If not, completely explain why not.

a) `A * x`

b) `x * A`

c) `A * y`

d) `y * A`

e) `A' * x`

f) `A * y'`

g) `y' * A * x`

8) (6 pts) Create the following matrices in MATLAB:

$$A = \begin{pmatrix} 0 & 0 & 1 \\ 1 & -1 & -2 \\ -1 & 6 & 3 \end{pmatrix}; \quad B = \begin{pmatrix} 2 & -1 \\ 0 & 3 \\ -2 & 2 \end{pmatrix}; \quad C = \begin{pmatrix} 0 & 2 & -1 \\ -3 & 0 & 1 \end{pmatrix}.$$

Can the following operations be performed? If yes, give the result and verify by hand computation. If not, completely explain why not.

a) `A * B`

b) `A * C`

c) `C * A`

9) (2 pts) Let y be defined as in Problem 6). Perform the following calculations and verify the results by hand:

a) `z = y.^3`

b) `z = sqrt(y.*y)`

10) (4 pts) Let D be defined as in Problem 5). Perform the following calculations and verify by hand.

a) `C1 = D^2`

b) `C2 = D.^2`

Clearly explain the difference in these 2 calculations.

11) (2 pts) EXTRA CREDIT: You know that $\sqrt[3]{-1} = -1$. If you have MATLAB compute this, you get the following result:

```
>> (-1)^(1/3)
ans =
    0.5000 + 0.8660i
```

This is correct, but probably not what you expected. Explain how MATLAB obtained this result.