Introduction to vectors and matrices

In MATLAB, row vector:

```
>>x=[6  12  5]
x =      6      12     5
```

OR

```
>>x=[6 ,12 ,5]
x =      6      12     5
```

In MATLAB, column vector:

```
>>x=[6 ; 12 ; 5]

x =


     6
    12
     5
```

```
>> x=[6+i ;12 ;5]

x =


   6.0000 + 1.0000i
  12.0000
   5.0000
```

```
>> x=0:1:10
x =
      0      1      2      3      4      5      6      7      8      9     10

>> x=10:-1:0
x =
     10      9      8      7      6      5      4      3      2      1      0

>> x=1:.1:1.5
x =
    1.0000    1.1000    1.2000    1.3000    1.4000    1.5000
```

:

```
>> x5=x(5)
x5 =    1.4000

>> x6=x(6)
x6 =    1.5000
```

```
>> x(7)
??? Index exceeds matrix dimensions.
```

```
>> x=[1;2;3] ; 3*x

ans =
      3
      6
      9
```

```
>> x=[1;2] ; y=[0;-2]; z=x+y
z =
      1
      0
>> z+ [2 2]
??? Error using ==> plus
```

```
>> y=x.'

y =

   6.0000 + 1.0000i  12.0000   5.0000
```

```
>> y=x'

y =

   6.0000 - 1.0000i  12.0000    5.0000
```

```
>> A=[1,2,3 ; 4 6 7 ; 1 3 4]

A =
     1     2     3
     4     6     7
     1     3     4

>> A23=A(2,3)
A23 =     7
```

```
>> A=[1 1 ; 1 2] ; A*[1 ; 2 ; 4]
??? Error using ==> mtimes
Inner matrix dimensions must agree.
```

$$\begin{pmatrix} A_{1,1} & A_{1,2} \\ A_{2,1} & A_{2,2} \end{pmatrix} \begin{pmatrix} B_{1,1}x_1 + B_{1,2}x_2 \\ B_{2,1}x_1 + B_{2,2}x_2 \end{pmatrix} = \begin{pmatrix} A_{1,1}\left(B_{1,1}x_1 + B_{1,2}x_2\right) + A_{1,2}\left(B_{2,1}x_1 + B_{2,2}x_2\right) \\ A_{2,1}\left(B_{1,1}x_1 + B_{1,2}x_2\right) + A_{2,2}\left(B_{2,1}x_1 + B_{2,2}x_2\right) \end{pmatrix}$$

$$= \begin{pmatrix} \left(A_{1,1}B_{1,1} + A_{1,2}B_{2,1}\right)x_1 + \left(A_{1,1}B_{1,2} + A_{1,2}B_{2,2}\right)x_2 \\ \left(A_{2,1}B_{1,1} + A_{2,2}B_{2,1}\right)x_1 + \left(A_{2,1}B_{1,2} + A_{2,2}B_{2,2}x_1\right)x_2 \end{pmatrix}$$

$$= \begin{pmatrix} \left(A_{1,1}B_{1,1} + A_{1,2}B_{2,1}\right) & \left(A_{1,1}B_{1,2} + A_{1,2}B_{2,2}\right) \\ \left(A_{2,1}B_{1,1} + A_{2,2}B_{2,1}\right) & \left(A_{2,1}B_{1,2} + A_{2,2}B_{2,2}\right) \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

$$\begin{pmatrix} A_{1,1} & A_{1,2} \\ A_{2,1} & A_{2,2} \end{pmatrix} \begin{pmatrix} B_{1,1} & B_{1,2} \\ B_{2,1} & B_{2,2} \end{pmatrix} = \begin{pmatrix} \left(A_{1,1}B_{1,1} + A_{1,2}B_{2,1}\right) & \left(A_{1,1}B_{1,2} + A_{1,2}B_{2,2}\right) \\ \left(A_{2,1}B_{1,1} + A_{2,2}B_{2,1}\right) & \left(A_{2,1}B_{1,2} + A_{2,2}B_{2,2}\right) \end{pmatrix}$$

In general: $[AB]_{i,j} = \sum_k A_{i,k}B_{k,j}$.

“Sum across ith row of first matrix, down jth col of second.

VISUALIZE:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \qquad B = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}$$

$$[AB]_{ij} = \sum_k A_{i,k} B_{k,j} = \begin{bmatrix} a_{i1} & a_{i2} & a_{i3} \end{bmatrix} \begin{bmatrix} b_{1j} \\ b_{2j} \\ b_{3j} \end{bmatrix}$$