Matlab / octave :-

```
A = [1,2,3;
     4,5,6;
     7,8,9;
     10,11,12]
```

4 x 3 Matrix ; for a new Row

(M, N) = size(A) → 4, 3

or

dim(A) → 4 3

A_23 = A(2,3) = 6

B = [1,3,4; 1,1,1]

A = [1,2,4; 5,3,2]

Add_AB = A+B

Sub_AB = A-B

Mult_AB = A*B

Div_AB = A/B

add_As = A+s

Matrix multiplication

$$\begin{bmatrix} 1 & 3 \\ 4 & 0 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 5 \end{bmatrix} = \begin{bmatrix} 16 \\ 4 \\ 7 \end{bmatrix} \begin{matrix} (1\times1)+(3\times5) \\ (4\times1)+(0\times5) \\ (2\times1)+(1\times5) \end{matrix}$$

3 x 2 * 2 x 1

= 3 x 1

Ex use of matrix in ML

House size

2104

1416

1534

852

$h_\theta(x) = -40 + 0.25x$

$$\begin{bmatrix} 1 & 2104 \\ 1 & 1416 \\ 1 & 1534 \\ 1 & 852 \end{bmatrix} \times \begin{bmatrix} -40 \\ 0.25 \end{bmatrix}$$

4 x 2 2 x 1

$$= \begin{bmatrix} 486 \\ 314 \\ 343 \\ 173 \end{bmatrix}$$

A_trans = A'

A_inv = inv(A)

Matrix multiplication

V = [1; 1; 1]

Av = A*V

=> eye(2) => Identity Matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

octave

A_trans = A'

A_inv = inv(A)

Matrix Matrix Multiplication (Ex)

House sizes:

2104
1416
1534
852

Have 3 competing Hypothesis

1. $h_\theta(x) = -40 + 0.25x$
2. $h_\theta(x) = 200 + 0.1x$
3. $h_\theta(x) = -150 + 0.4x$

$$\begin{bmatrix} 1 & 2104 \\ 1 & 1416 \\ 1 & 1534 \\ 1 & 852 \end{bmatrix} \times \begin{bmatrix} -40 & 200 & -150 \\ 0.25 & 0.1 & 0.4 \end{bmatrix} = \begin{bmatrix} 486 & 410 & 692 \\ 314 & 342 & 416 \\ 344 & 353 & 464 \\ 173 & 285 & 191 \end{bmatrix}$$

Matrix Multiplication properties:-

1. $A \times B \neq B \times A$ (Not commutative)
2. $A \times B \times C = A \times (B \times C) = (A \times B) \times C$ (Associative Holds)
3. Identity matrix $= I$, $AI = A = IA = A$ ($M \times N$, $\square n$) $= M \times n$

Inverse: Square matrices if it has an Inverse

$A = M \times M$ then $AA^{-1} = I = A^{-1}A$

A^{-1} = Inverse of A

0 doesn't have inverse

* Matrix that doesn't have inverse is called "singular" matrix.

Transpose: $A \begin{bmatrix} 1 & 2 & 0 \\ 3 & 5 & 9 \end{bmatrix}$ 2×3

$A^T = \begin{bmatrix} 1 & 3 \\ 2 & 5 \\ 0 & 9 \end{bmatrix}$ 3×2

- Mirroring 45° Axis

$A^T_{ij} = A_{ji}$