# Matrices and Vectors

Matrices are 2-dimensional arrays:

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \\ j & k & l \end{bmatrix}$$

The above matrix has four rows and three columns, so it is a 4 x 3 matrix.

A vector is a matrix with one column and many rows:

$$\begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix}$$

So vectors are a subset of matrices. The above vector is a 4 x 1 matrix.

**Notation and terms**:

- $A_{ij}$ refers to the element in the ith row and jth column of matrix A.

- A vector with 'n' rows is referred to as an 'n'-dimensional vector.

- $v_i$ refers to the element in the ith row of the vector.

- In general, all our vectors and matrices will be 1-indexed. Note that for some programming languages, the arrays are 0-indexed.

- Matrices are usually denoted by uppercase names while vectors are lowercase.

- "Scalar" means that an object is a single value, not a vector or matrix.

- $\mathbb{R}$ refers to the set of scalar real numbers.

- $\mathbb{R}^n$ refers to the set of n-dimensional vectors of real numbers.

Run the cell below to get familiar with the commands in Octave/Matlab. Feel free to create matrices and vectors and try out different things.

```
1   % The ; denotes we are going back to a new row.
2   A = [1, 2, 3; 4, 5, 6; 7, 8, 9; 10, 11, 12]
3
4   % Initialize a vector
5   v = [1;2;3]
6
7   % Get the dimension of the matrix A where m = rows and n = columns
8   [m,n] = size(A)
9
10  % You could also store it this way
11  dim_A = size(A)
12
13  % Get the dimension of the vector v
14  dim_v = size(v)
15
16  % Now let's index into the 2nd row 3rd column of matrix A
17  A_23 = A(2,3)
18
```

Run

Reset

```
A =

    1    2    3
    4    5    6
    7    8    9
   10   11   12

v =

    1
    2
    3
```