

Creating Matrixes in Matlab

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Matlab Define Row and Column Vectors (Matrix)

```
% A column vector 4 by 1, with three numbers you fill in by yourself
col_vec = [5;2;3;10]
```

```
col_vec = 4x1
     5
     2
     3
    10
```

```
% Another column vector with 4 random numbers
col_vec_rand = rand(4,1)
```

```
col_vec_rand = 4x1
    0.5472
    0.1386
    0.1493
    0.2575
```

```
% A row vector 1 by 4
row_vec = [3,2,4,5]
```

```
row_vec = 1x4
     3     2     4     5
```

```
% A row vector 1 by 4 with random number
row_vec_rand = rand(1,4)
```

```
row_vec_rand = 1x4
    0.8407    0.2543    0.8143    0.2435
```

Matlab Define a Matrix

```
% A 2 by 3 matrix by hand
mat_a = [1,2,1;
         3,4,10]
```

```
mat_a = 2x3
     1     2     1
     3     4    10
```

```
% Another 2 by 3 matrix, now with random numbers
mat_rand = rand(2,3)
```

```
mat_rand = 2x3
    0.9293    0.1966    0.6160
    0.3500    0.2511    0.4733
```

```
% Another 2 by 3 matrix, now with random integers between 1 and 10
% rand draws between 0 and 1, ceil converts 0.1 to 1, 1.1 to 2, etc
mat_rand = ceil(rand(2,3)*10)
```

```
mat_rand = 2x3
```

4	6	10
9	6	3

Matlab Define a Square Matrix

```
% A 4 by 4 square matrix
mat_square = rand(4)
```

```
mat_square = 4x4
    0.7572    0.0759    0.9340    0.0119
    0.7537    0.0540    0.1299    0.3371
    0.3804    0.5308    0.5688    0.1622
    0.5678    0.7792    0.4694    0.7943
```

```
% or can define 4 by 4
mat_square = rand(4, 4)
```

```
mat_square = 4x4
    0.3112    0.2630    0.4505    0.1524
    0.5285    0.6541    0.0838    0.8258
    0.1656    0.6892    0.2290    0.5383
    0.6020    0.7482    0.9133    0.9961
```

```
% or can define 4 by 4, between 1 and 5 each number
mat_square = ceil(rand(4, 4)*5)
```

```
mat_square = 4x4
     1     1     1     3
     3     4     2     5
     1     5     2     1
     5     5     5     2
```

Identity Matrix

If a matrix A is square matrix with the same number of rows and columns, and all diagonal elements are 1 and non-diagonal elements are 0, then A is an identity matrix:

- $A_{i,j}$ are the value in the i th row and j th column of the matrix A
- A is an identity matrix, when: $A_{i,j} = 0$ if $i \neq j$, $A_{i,j} = 1$ if $i = j$

```
% 4 by 4 identity matrix
identity_4by4 = eye(4)
```

```
identity_4by4 = 4x4
     1     0     0     0
     0     1     0     0
     0     0     1     0
     0     0     0     1
```

When a matrix is multiplied by the identity matrix, you get the same matrix back, for example, multiplying random integer 4 by 4 matrix by the 4 by 4 identity matrix:

```
mat_square
```

```
mat_square = 4x4
     1     1     1     3
```

3	4	2	5
1	5	2	1
5	5	5	2

```
mat_square_times_identity = mat_square*identity_4by4
```

```
mat_square_times_identity = 4x4
1    1    1    3
3    4    2    5
1    5    2    1
5    5    5    2
```

When a row vector is multiplied by the identity matrix, you get the same vector back, for example, multiplying random integer 1 by 4 row vector by the 4 by 4 identity matrix:

```
row_vec
```

```
row_vec = 1x4
3    2    4    5
```

```
row_vec_times_identity = row_vec*identity_4by4
```

```
row_vec_times_identity = 1x4
3    2    4    5
```

When an identity matrix is multiplied by a column vector, you get the same vector back, for example, multiplying 4 by 4 identity matrix by random integer 4 by 1 column vector by the :

```
col_vec
```

```
col_vec = 4x1
5
2
3
10
```

```
col_vec_times_identity = identity_4by4*col_vec
```

```
col_vec_times_identity = 4x1
5
2
3
10
```

Lower-Triangular Matrix and Upper-Triangular Matrix

A lower triangular matrix is a square matrix where:

- Square matrix A is a **lower triangular** matrix, when: $A_{i,j} = 0$ if $i < j$
- Square matrix A is a **upper triangular** matrix, when: $A_{i,j} = 0$ if $i > j$

```
% lower triangular matrix of mat_a
lower_triangular = tril(mat_square)
```

```
lower_triangular = 4x4
1    0    0    0
3    4    0    0
```

1	5	2	0
5	5	5	2

```
% upper triangular matrix of mat_a
upper_triangular = triu(mat_square)
```

```
upper_triangular = 4x4
    1    1    1    3
    0    4    2    5
    0    0    2    1
    0    0    0    2
```

Three Dimensions Matrix (Tensor)

```
% 3 by 3 by 2, storing multiple matrixes together in ten_a
ten_a = zeros(3,3,2);
ten_a(:,:,1) = rand(3,3);
ten_a(:,:,2) = rand(3,3);
disp(ten_a);
```

```
(:,:,1) =
```

0.1455	0.5797	0.8530
0.1361	0.5499	0.6221
0.8693	0.1450	0.3510

```
(:,:,2) =
```

0.5132	0.2399	0.2400
0.4018	0.1233	0.4173
0.0760	0.1839	0.0497

```
% Creating four 2 by 3 matrixes
mat_rand = rand(2,3,4)
```

```
mat_rand =
mat_rand(:,:,1) =
```

0.9027	0.4909	0.3377
0.9448	0.4893	0.9001

```
mat_rand(:,:,2) =
```

0.3692	0.7803	0.2417
0.1112	0.3897	0.4039

```
mat_rand(:,:,3) =
```

0.0965	0.9421	0.5752
0.1320	0.9561	0.0598

```
mat_rand(:,:,4) =
```

0.2348	0.8212	0.0430
0.3532	0.0154	0.1690

```
disp(mat_rand);
```

```
(:,:,1) =
```

0.9027	0.4909	0.3377
0.9448	0.4893	0.9001

```
(:,:,2) =
```

0.3692	0.7803	0.2417
0.1112	0.3897	0.4039

```
(:,:,3) =
```

0.0965	0.9421	0.5752
0.1320	0.9561	0.0598

```
(:,:,4) =
```

0.2348	0.8212	0.0430
0.3532	0.0154	0.1690