

# A short tutorial for MATLAB beginners!

## Download MATLAB from W&M website:

<https://www.wm.edu/offices/it/services/software/licensedsoftware/mathstats/matlabstud/index.php>

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## MATLAB for Students

- Version: MATLAB r2017b
- Operating System: Windows, Macs, Linux
- Users: William & Mary Students (also available for **Faculty**)
- Installation: Send a request to [support@wm.edu](mailto:support@wm.edu) including your name and W&M email address. We will create a Mathworks account that will allow you to download the latest version and authorize your software.

You will need to contact the Technology Support Center to request a Mathworks account. Please see the **Install Notes** below.

- **Online Help**
- **Technical Literature**
- **Books**
- **Software Updates**

## Calculating eigenvalues & eigenvectors:

- $e = \text{eig}(A)$  returns a column vector containing the eigenvalues of square matrix  $A$ .
- $[V, D] = \text{eig}(A)$  returns diagonal matrix  $D$  of eigenvalues and matrix  $V$  whose columns are the corresponding right eigenvectors, so that  $AV = VD$ .

### Command Window

```
>> A = [1 2 3;  
        4 5 6;  
        7 8 9]
```

```
A =
```

```
     1     2     3  
     4     5     6  
     7     8     9
```

```
>> e = eig(A)
```

```
e =
```

```
16.1168  
-1.1168  
-0.0000
```

## Matrix Multiplication:

- $A*B$
- `mtimes(A,B)`

```
>> A
A =
     1     2     3
     4     5     6
     7     8     9

>> B
B =
     1     0     0
     0     2     0
     0     0     3

>> A*B
ans =
     1     4     9
     4    10    18
     7    16    27

>> |
```

## Tensor Product:

- Tensor product is also known as Kronecker product.
- $K = \text{kron}(A,B)$

```
>> A
A =
     1     2     3
     4     5     6
     7     8     9

>> B
B =
     1     0     0
     0     2     0
     0     0     3

>> K=kron(A,B)
K =
     1     0     0     2     0     0     3     0     0
     0     2     0     0     4     0     0     6     0
     0     0     3     0     0     6     0     0     9
     4     0     0     5     0     0     6     0     0
     0     8     0     0    10     0     0    12     0
     0     0    12     0     0    15     0     0    18
     7     0     0     8     0     0     9     0     0
     0    14     0     0    16     0     0    18     0
     0     0    21     0     0    24     0     0    27
```

## Vector norm / matrix norm:

- $n = \text{norm}(v)$  returns the **Euclidean norm** of vector  $v$ .
- $n = \text{norm}(v,p)$  returns the **generalized vector p-norm**.

```
>> v = [1 2 3 4]
n = norm(v)
```

```
v =
```

```
1      2      3      4
```

```
n =
```

```
5.4772
```

## Singular Value Decomposition

- $s = \text{svd}(A)$  returns the **singular values** of matrix  $A$  in descending order.
- $[U,S,V] = \text{svd}(A)$  performs a singular value decomposition of matrix  $A$ , such that  $A = U*S*V'$ .

### Command Window

```
>> A
```

```
A =
```

```
1      2      3
4      5      6
7      8      9
```

```
>> svd(A)
```

```
ans =
```

```
16.8481
1.0684
0.0000
```

← Singular values in descending order

```
>> [U,S,V] = svd(A)
```

```
U =
```

```
-0.2148    0.8872    0.4082
-0.5206    0.2496   -0.8165
-0.8263   -0.3879    0.4082
```

← Give three matrices for SVD:  $USV = A$

```
S =
```


```
16.8481    0    0
0    1.0684    0
0    0    0.0000
```

```
V =
```

```
-0.4797   -0.7767   -0.4082
-0.5724   -0.0757    0.8165
-0.6651    0.6253   -0.4082
```

## More Information: MATLAB Documentation

[https://www.mathworks.com/help/index.html?s\\_tid=CRUX\\_lftnav](https://www.mathworks.com/help/index.html?s_tid=CRUX_lftnav)

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