Tutorial 0: Some Matlab basics

In this tutorial you will learn some basic Matlab commands, such as how to enter matrices and vectors.

Entering and multiplying matrices and vectors

You enter a matrix by using square brackets and then just type the rows:

```
A = [1 2 3
     4 5 6];
```

Adding the semicolon (;) at the end of the line supresses the output.

```
A = [1 2 3
     4 5 6]
```

```
A = 2×3
     1     2     3
     4     5     6
```

Vectors can also be entered in this way:

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

You can multiply matrices and vectors by using the *

```
 A*x
```

```
ans = 2×1
    14
    32
```

If you want to multiply two matrices that are incompatible, then Matlab will give you an error.

```
A = [1 2 3
     4 5 6];
x = [1
     2];
A*x
```

```
Error using  *
Incorrect dimensions for matrix multiplication. Check that the number of columns in the first
matrix matches the number of rows in the second matrix. To operate on each element of the matrix
individually, use TIMES (.*) for elementwise multiplication.

Related documentation
```

Accessing elements of vectors or matrices

You can access an element of a matrix as follows. If you want the 3rd element in the 2nd row of **A** you write:

```
A(2,3)
```

```
ans = 6
```

If you want the 1st element in the 1st row of **A** you write:

```
A(1,1)
```

```
ans = 1
```

If you want to access a row of **A**, you use the ":" To get the first or second row of **A**, write:

```
A(1,:) % 1st row
```

```
ans = 1×3
     1     2     3
```

```
A(2,:) % 2nd row
```

```
ans = 1×3
     4     5     6
```

Here I used "comments," which start with the % sign. Comments can contain words, explanations or code, but the comments are not executed as part of the code.

If you want to access a column of **A**, you also use the ":" To get the first, second or or column of **A**, write:

```
A(:,1)
```

```
ans = 2×1
     1
     4
```

```
A(:,2)
```

```
ans = 2×1
     2
     5
```

Plotting graphs

Matlab can also plot functions. For example we can plot the function f(x) = sin(x) as follows. First we define a vector x where we want to evaluate the sin function.

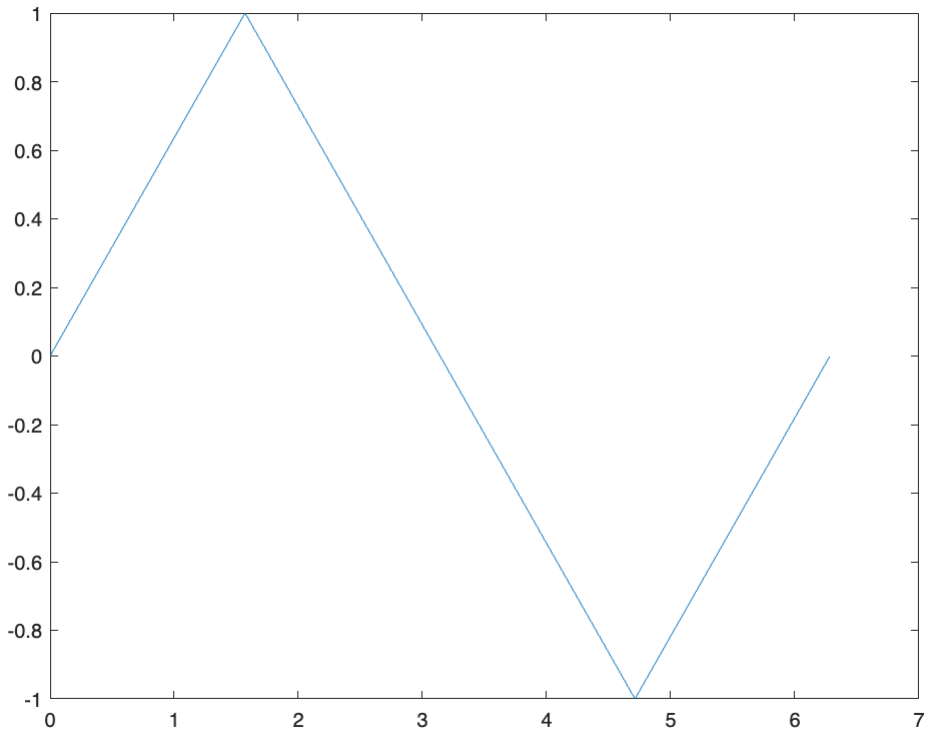
```
x = [0 pi/2 pi 3*pi/2 2*pi];
```

Now evaluate the sin function at these x:

```
f = sin(x);
```

Plot the result:

```
plot(x,f)
```



This does not look much like the sin function you know because we only evaluated sin(x) at 5 different locations. We can evaluate sin(x) at 0, 0.1, 0.2, 0.3, ... 2 pi, by using the following commands:

```
x = 0:0.1:2*pi;
```

This generates a vector x that has elements that are between 0 and 2pi in steps of 0.1. We can evaluate the sin function at these x:

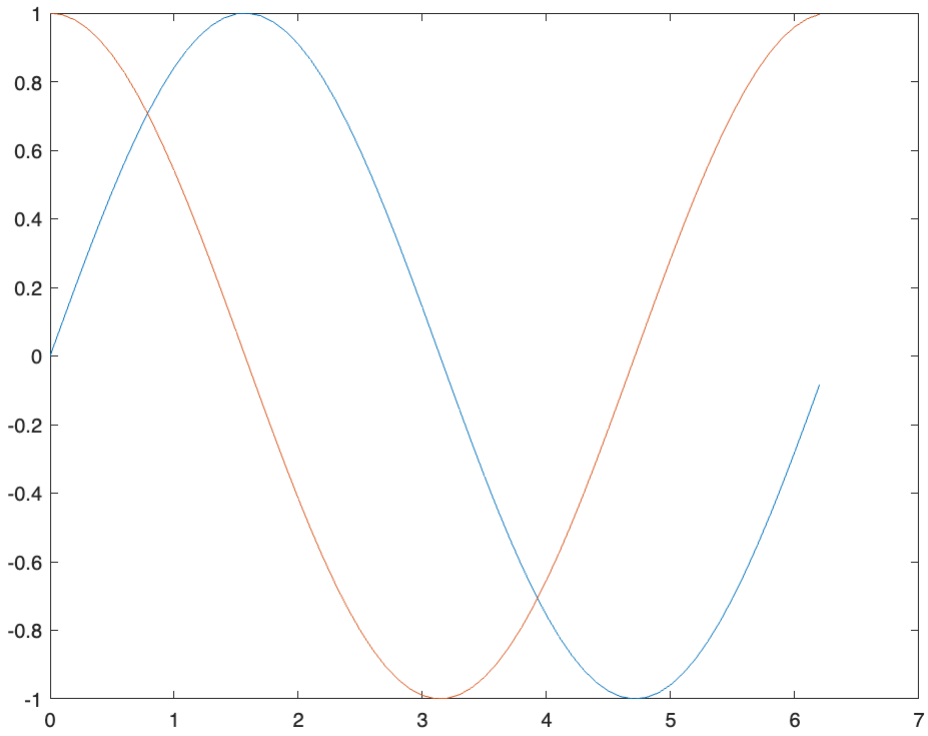
```
f = sin(x);
```

And plot the result:

```
plot(x,f)
```

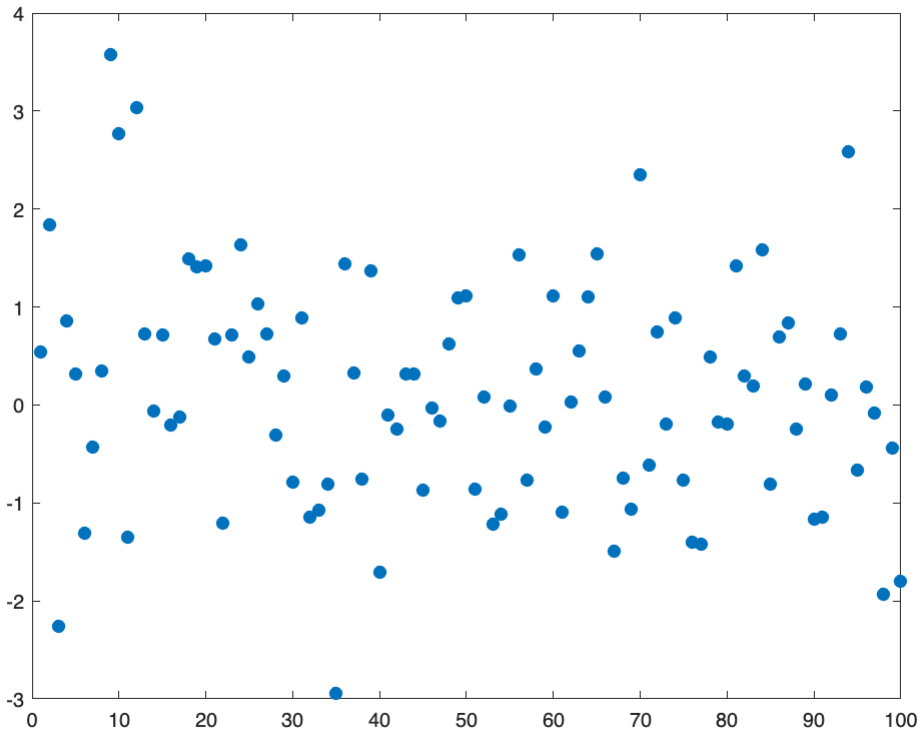
We can also plot the function g(x) = cos(x):

```
g = cos(x);
hold on, plot(x,g)
```



We can also plot just a bunch of points.

```
x = 1:100;
y = randn(100,1);
figure
plot(x,y,'.','MarkerSize',20)
```



Here, x are the numbers 1 through 100 in increments of 1 (x = [1 2 3 4 5 .... 100]) and y are 100 randomly generated numbers.

For loops

You can also implement for loops in Matlab. For example, you can have Matlab count to ten in a for loop.

```
for kk=1:10
    fprintf('%g\n',kk)
end
```

```
1
2
3
4
5
6
7
8
9
10
```

```
fprintf('Done.')
```

```
Done.
```

Here, 1:10 is a vector whose elements are the integers from 1 to 10.

When you specify a for loop, you can tell Matlab to perform a sequence of commands many times. For example, you can multiply a given number by 3:

```
n = 1; % From Ben: I messed with this a little bit
for kk=1:10
    n = n*3; % this replaces the number n by 3*n
end
n
```

```
n = 59049
```

This is of course the same as multiplying n by raising 3 to the power 10:

```
1*3^10
```

```
ans = 59049
```

For loops are useful to implement recursions, which you will learn about in subsequent tutorials.

Ending Certification from Ben Phan: I have read and understand what the code is doing (I am a bit confused for the last for loop example but I got it now).