

Basic plotting tutorial

<http://matlab.cheme.cmu.edu/2011/08/01/basic-plotting-tutorial/>

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It is a good idea to add these lines to the top of your m-files

- close all % close all figure windows that are open
- clear all % clear all the variables currently stored in memory
- clc % clear the commands in the command window

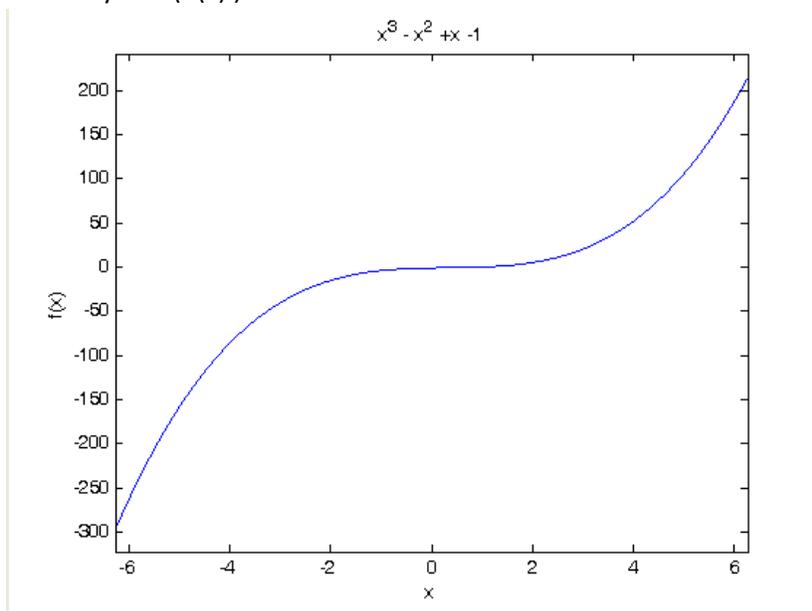
% Plotting functions in Matlab

% This m-file describes some very basic ways to plot functions in Matlab.

ezplot with functions described as strings

you can quickly plot a function of one variable with the ezplot command.

```
ezplot('x^3 - x^2 + x -1')  
xlabel('x')  
ylabel('f(x)')
```



plotting two functions with ezplot

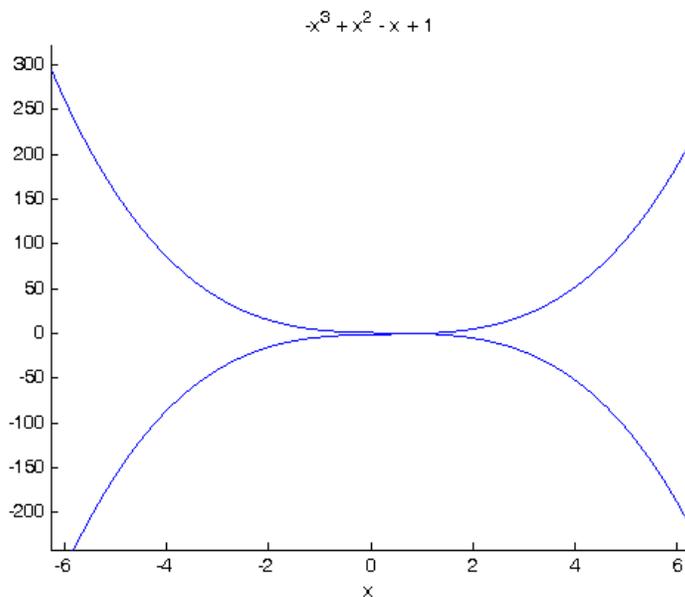
if you try to plot another function, you will see the first function disappear. We have to tell Matlab what do with the hold command

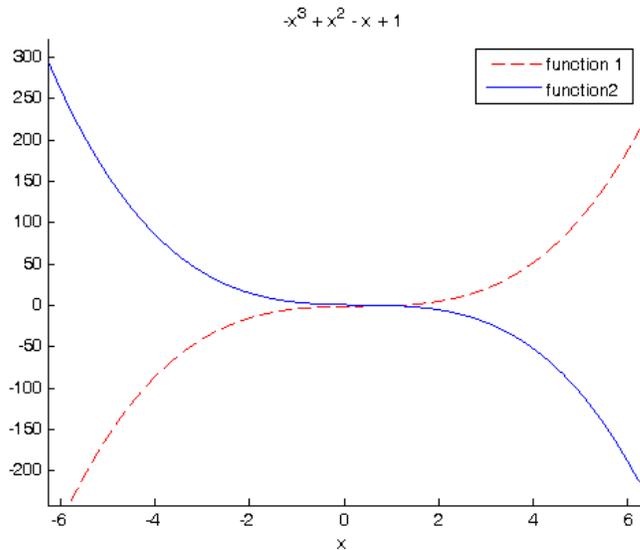
```
figure
hold on
ezplot('x^3 - x^2 + x -1')
ezplot('-x^3 + x^2 - x + 1')
hold off
```

% Note that you cannot easily tell which graph is which because the two
% lines are the same color. Lets change the color and style of the first
% plot to be red and dashed, and add a legend so we can see which line is
% which. We do that by saving a reference to each figure in a variable so
% we can use the set function to modify each graph.

```
figure
hold on
h1 = ezplot('x^3 - x^2 + x -1');
h2 = ezplot('-x^3 + x^2 - x + 1');
hold off

set(h1,'color','r','linestyle','--')
legend('function 1','function2')
```





defining and plotting functions

strings are not always convenient to plot, especially if there are a lot of numbers in the equations, or if there are multiple variables. Let's plot the van der Waal's equation of state to show this

$$f(V) = V^3 - \frac{pnb + nRT}{p}V^2 + \frac{n^2a}{p}V - \frac{n^3ab}{p} = 0$$

% numerical values of the constants

```
a = 3.49e4;
b = 1.45;
p = 679.7;
T = 683;
n = 1.136;
R = 10.73;
```

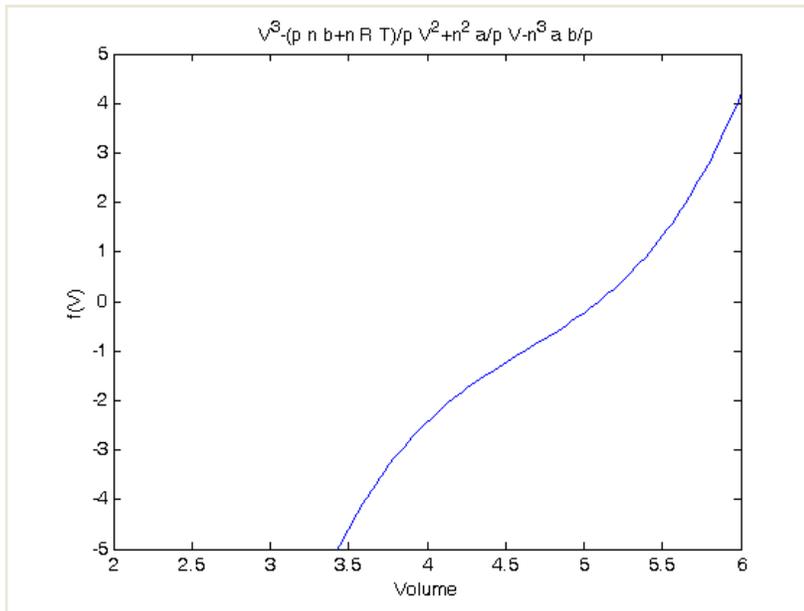
% we define a function handle that is f(V)

```
f = @(V) V.^3 - (p*n*b+n*R*T)/p*V.^2 + n^2*a/p*V - n^3*a*b/p;
```

```
figure
ezplot(f)
```

%the large scale of the y-axis makes it difficult to see where the function
%is equal to zero, so we change the limits of each axis.

```
xlim([2 6])
ylim([-5 5])
xlabel('Volume')
ylabel('f(V)')
```



%it appears that $f(V) = 0$ around $V=5$

$f(4.9)$

$f(5.1)$

ans =

-0.4486

ans =

0.0145

we can add these two points to the figure with the plot command. Here we add them as red circles.

hold on

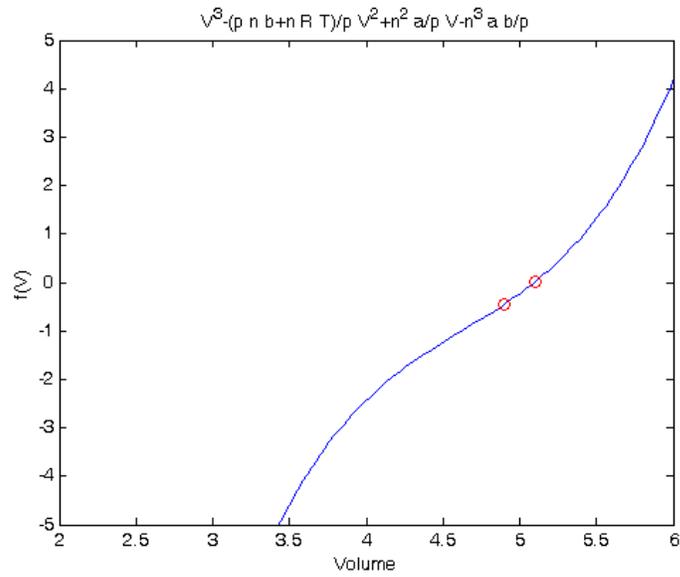
`plot(4.9,f(4.9),'ro')`

`plot(5.1,f(5.1),'ro')`

hold off

% The zero is definitely between $V=4.9$ and $V = 5.1$ because f changes sign

% between these two points.



%alternatively, we could tell ezplot to plot f from x=4 to x=6 like this
 figure
 ezplot(f,[4 6])

