

MATLAB tutorial
Data inputting, graph plotting and linear regression

Sichi LI, William F. Schneider

1. Input data (matrix creating)

Useful link:

<http://www.mathworks.com/help/matlab/math/creating-and-concatenating-matrices.html>

For example, if we want to input 4 values (1,2,3,4) into a dataset, we can simply type in:

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

By doing so, MATLAB will know A is a dataset containing 1,2,3,4.

*Remark: A is just the name of this dataset. You can specify any name for this dataset.

2. Graph plotting

Useful link:

<http://www.mathworks.com/help/matlab/ref/plot.html>

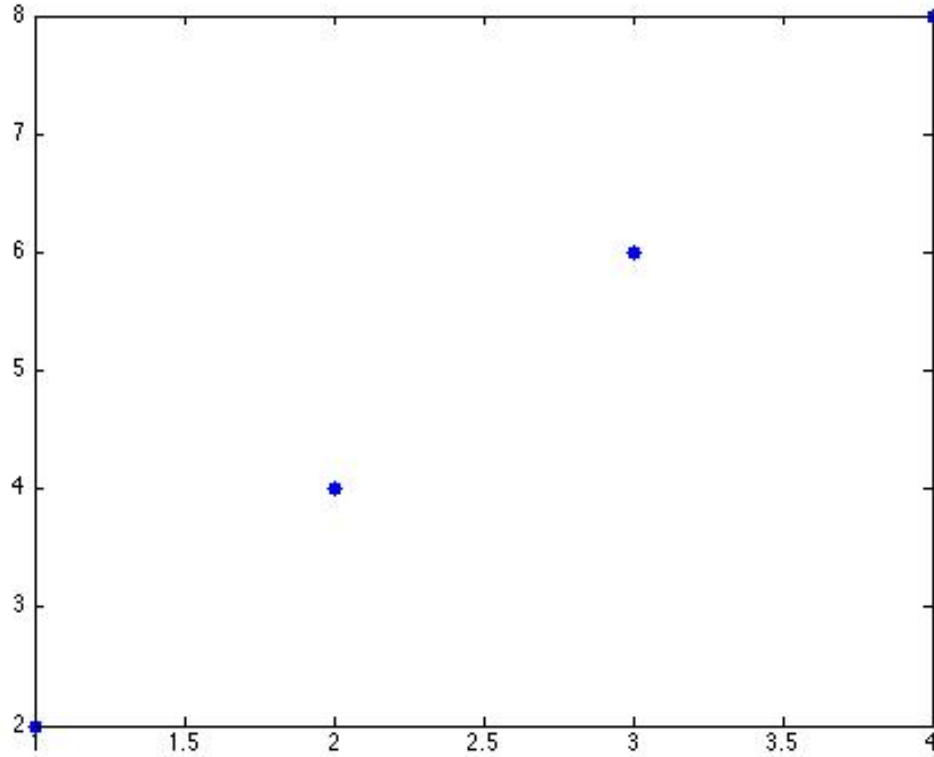
For example, if we want to plot a x vs. y of the following data,

x	y
1	2
2	4
3	6
4	8

We can write a script,

```
x=[1 2 3 4];  
y=[2 3 6 8];  
plot(x,y)
```

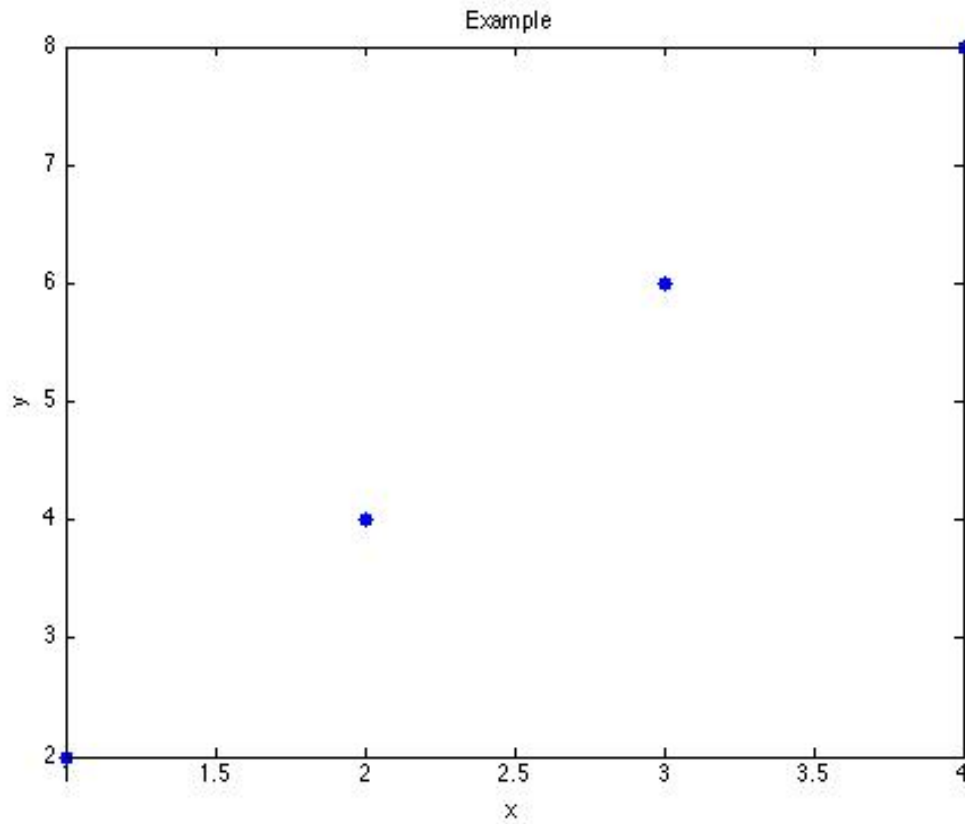
MATLAB will generate a plot like this:



You can further decorate the plot by adding title, label of x axis, y axis by typing the following script,

```
title('Example')  
xlabel('x')  
ylabel('y')
```

Then you will have a plot like this,

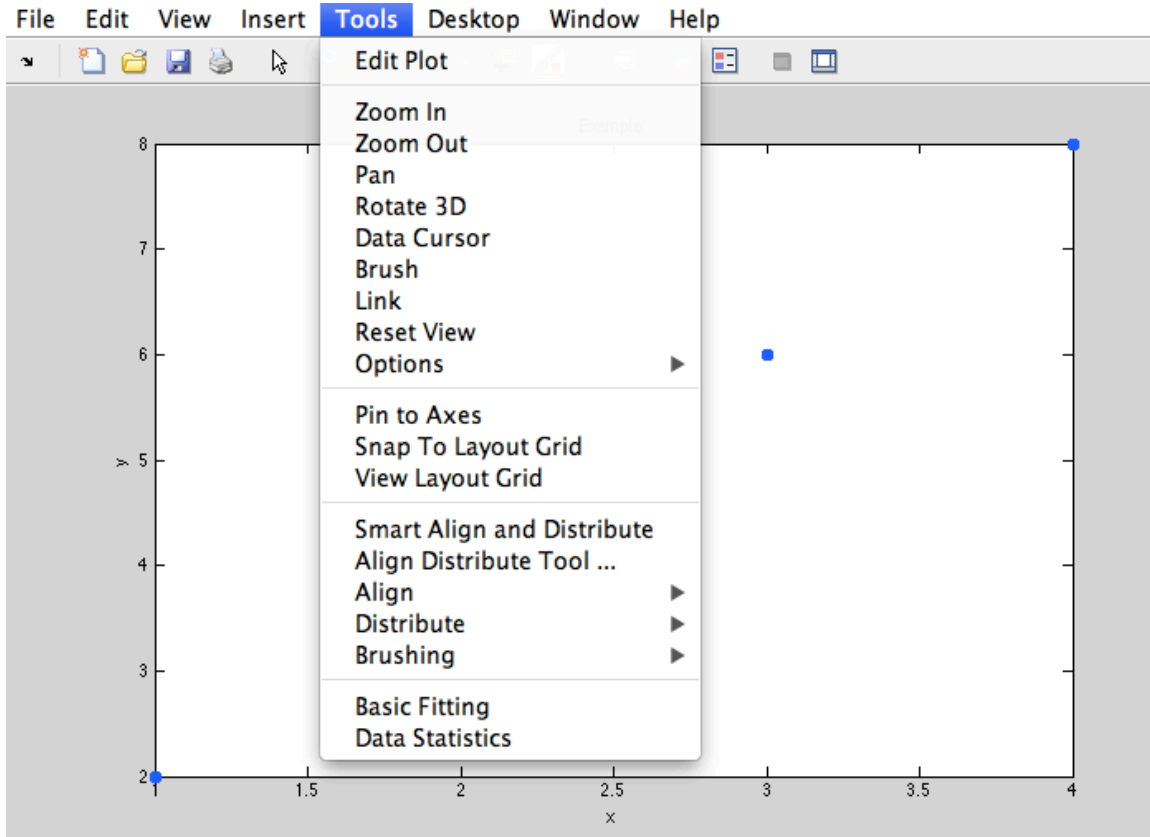


There are a lot of options to decorate your plot. You can read the link shown above if you are interested in advanced techniques of graph plotting.

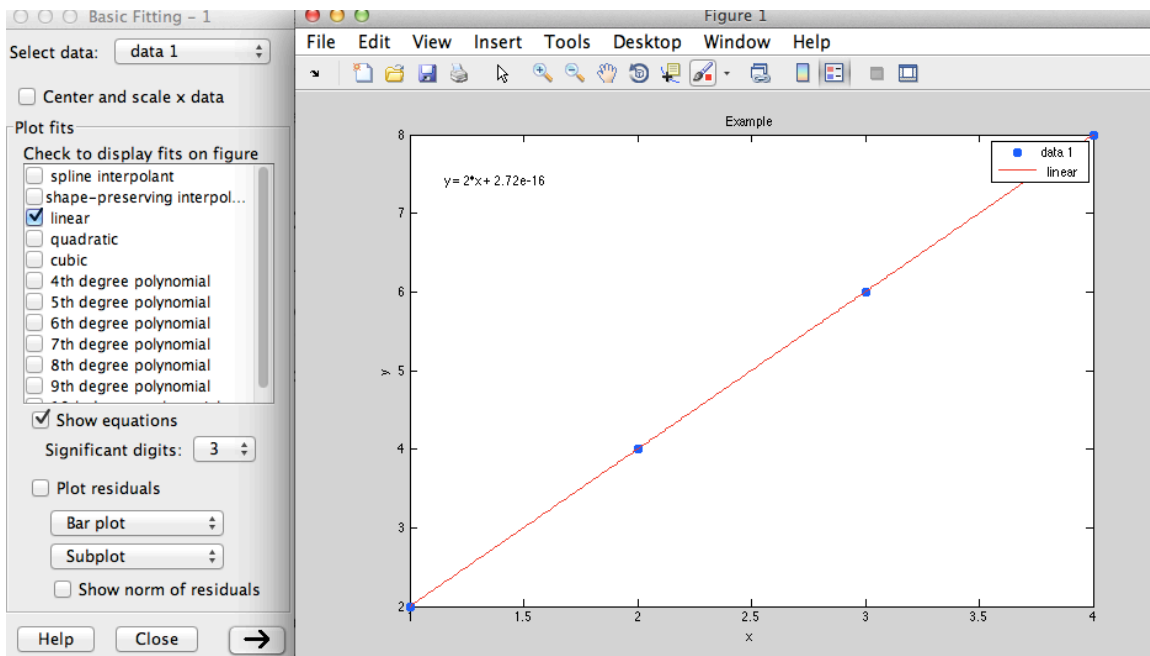
3. Linear regression of data

As we have four (x,y) combinations in our dataset, we may want to linearly approximate a function that can well describe the relationship between x and y .

We can do it in the interface of graph plotting,



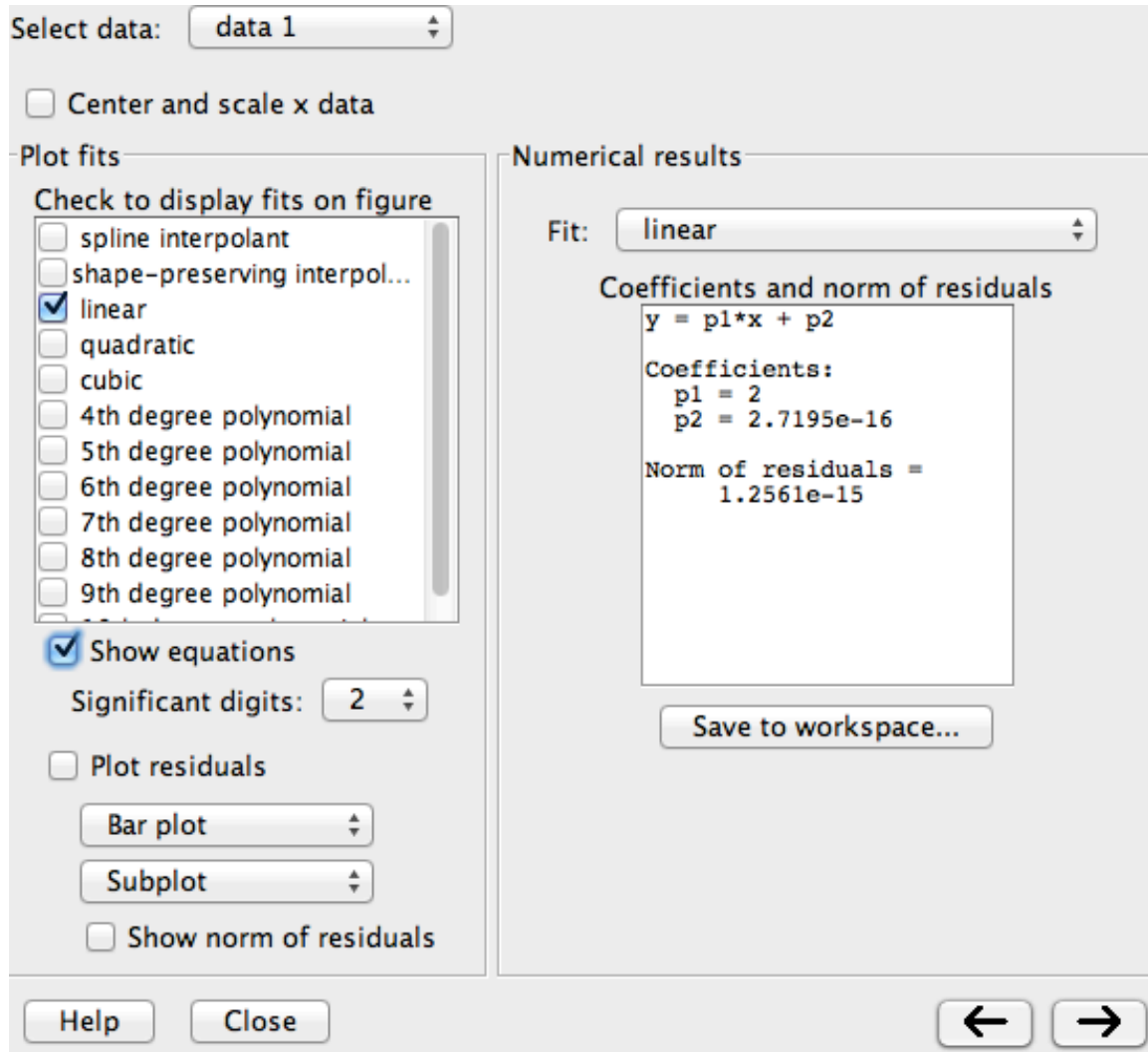
There is a *Basic Fitting* function under the *Tools*, click it.



Check *linear* and *Show equations*, a linear plot and its function will be automatically displayed.

If you want to know R^2 between the approximated function and your dataset, you

can check *Shown norm of residuals* and click



Select data: data 1

☐ Center and scale x data

Plot fits

Check to display fits on figure

- ☐ spline interpolant
- ☐ shape-preserving interpol...
- ☒ linear
- ☐ quadratic
- ☐ cubic
- ☐ 4th degree polynomial
- ☐ 5th degree polynomial
- ☐ 6th degree polynomial
- ☐ 7th degree polynomial
- ☐ 8th degree polynomial
- ☐ 9th degree polynomial

☒ Show equations

Significant digits: 2

☐ Plot residuals

Bar plot

Subplot

☐ Show norm of residuals

Numerical results

Fit: linear

Coefficients and norm of residuals

$y = p1 \cdot x + p2$

Coefficients:

$p1 = 2$

$p2 = 2.7195e-16$

Norm of residuals =

$1.2561e-15$

Save to workspace...

Help Close

The norm of residuals and the coefficients of your linear function will be displayed.

We can also do it by adding script,

```
mdl=fitlm(x,y);
```

The image shows a MATLAB Command Window with two tabs: 'question3.m' and 'untitled.m'. The 'question3.m' tab is active, displaying the following code:

```
1 - clear all
2 - x=[1 2 3 4];
3 - y=[2 4 6 8];
4 - plot(x,y, '.', 'MarkerSize',20)
5
6 - title('Example')
7 - xlabel('x');
8 - ylabel('y');
9
10 - mdl=fitlm(x,y);
```

Below the code editor, the 'Command Window' displays the output of the `fitlm` function. It shows the following statistics:

```
Number of observations: 5, Error degrees of freedom: 3
Root Mean Squared Error: 0.164
R-squared: 0.966, Adjusted R-Squared 0.954
F-statistic vs. constant model: 84.3, p-value = 0.00273
```

Then, it displays the model equation:

```
mdl =
Linear regression model:
y ~ 1 + x1
```

Next, it shows the estimated coefficients in a table:

	Estimate	SE	tStat	pValue
(Intercept)	0.082298	0.17234	0.47754	0.66561
x1	0.4771	0.051962	9.1817	0.0027319

Finally, it repeats the statistics shown at the top:

```
Number of observations: 5, Error degrees of freedom: 3
Root Mean Squared Error: 0.164
R-squared: 0.966, Adjusted R-Squared 0.954
F-statistic vs. constant model: 84.3, p-value = 0.00273
>> untitled
```

The description of linear regression and all useful information of the regression parameters will be shown in the *Command Window*.