First experiments with Mathematica

1 Get access

You can find the instruction to install Mathematica on your computer for free here:

https://web.engr.oregonstate.edu/∼phamt3/Resource/Wolfram-Mathematica-with-JupyterLab.pdf

Alternatively (and more simply), you can use the cloud-based version of Mathematica* here:

https://www.wolframcloud.com

If you do not have a Wolfram account, please create one. Watch the following video to get started:

https://youtu.be/5wsfG80oD1g

2 First experiments

(1) Type `35/6`, then `Shift+Enter`.

(2) Type `N[35/6]` (notice the square brackets), then `Shift+Enter`.

(3) Type `Sqrt[2]` (notice the capitalized S), then `Shift+Enter`.

(4) Type `N[%]`, then `Shift+Enter`.

(5) Type `Sin[Pi]` (notice the capitalized S and P), then `Shift Enter`.

(6) Type `34^100;` (with the semicolon), then `Shift Enter`.

(7) Type `34^100` (without semicolon), then `Shift Enter`.

You may have noticed that the function `N` is to evaluate a numerical value of an expression. Each function's name is capitalized and used with square brackets (not with parentheses as we usually write). The semicolon is to hold the output. One uses it when output is too long or not of interest. Next, try the following:

(8) `Exp[1]`, then `Shift+Enter`.

(9) `Log[2]`, then `Shift+Enter`.

(10) `f[x_] := Sin[x]+Cos[x]` (notice the dash after `x`), then `Shift+Enter`.

(11) `f[Pi]+f[Pi/4]`, then `Shift+Enter`.

(12) `Clear[f]`, then `Shift+Enter`.

(13) `f[Pi]+f[Pi/4]`, then `Shift+Enter`.

The natural logarithm function is named `Log` in Mathematica (not `ln`). `Exp` is the exponential function. Command (10) is to define a function. The dash is required in order to tell Mathematica that we are defining the function f. The function `Clear` is to remove a defined variable from the memory.

*limited to about 8 minutes of computation per month. File in the cloud storage will be deleted after 60 days.

3 Plot the graph of a function

First, let us plot functions of one variable, for example the sine function `sin(x)`. Try the following commands:

(14) `Plot[Sin[x], {x,0,2*Pi}]`, then `Shift+Enter`.

(15) For decoration, try (Figure 1)

```
Plot[Sin[x], {x,0,2*Pi}, PlotStyle -> {Red, Dashed}]
```

Then `Shift+Enter`.

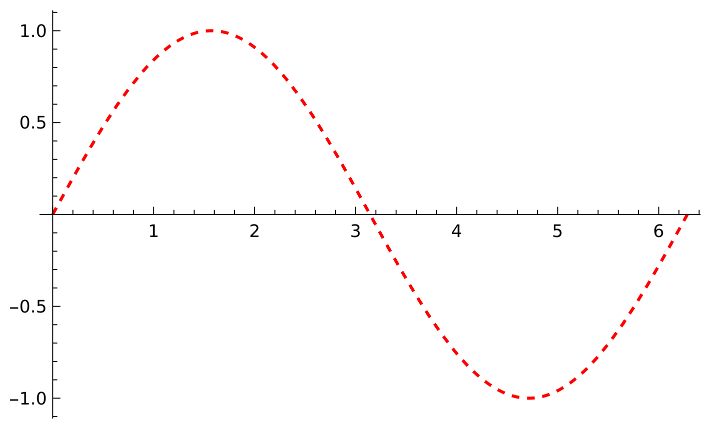

Figure 1

(16) You can also give the function a name before plotting it. For example,

```
f[x_] := Sin[x];
Plot[f[x], {x,0,2*Pi}, Filling->Axis]
```

Then `Shift+Enter`. Note that the dash following x within the brackets is no longer used because f was already defined.

Next, let us plot functions of two variables, for example

$$f(x, y) = x^2 \sin(y)$$

We will use the command **Plot3D** instead of **Plot**. Try the following commands (Figure 2):

(17) `Plot3D[x^2*Sin[y], {x,-2,2}, {y,-Pi,Pi}]`, then `Shift+Enter`.

(18) You can also give the function a name before plotting it. Try the following:

```
f[x_,y_] := x^2*Sin[y];
Plot[f[x,y], {x,-2,2}, {y,-Pi,Pi}]
```

There are many interesting options you can use for 3D graphing. Take a look at this Wolfram's webpage.

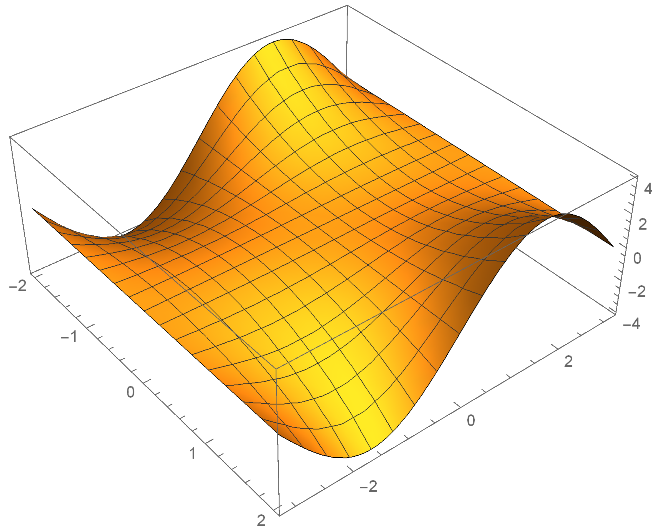

Figure 2: You can rotate the above surface with your mouse

4 Plot an equation

The commands **ContourPlot** and **ContourPlot3D** are used to plot an equation. **ContourPlot** plots an equation involving only 2 variables, say x and y. The result is the set of points (x, y) satisfying the equation.

(19) For example, to plot the ellipse

$$\frac{x^2}{4} + \frac{y^2}{9} = 1$$

we write (Figure 3)

```
ContourPlot[x^2/4+y^2/9==1,{x,-3,3},{y,-3,3}]
```

Note that the double equal sign "==" indicates an equation. The single equal sign "=" indicates a value-assignment.

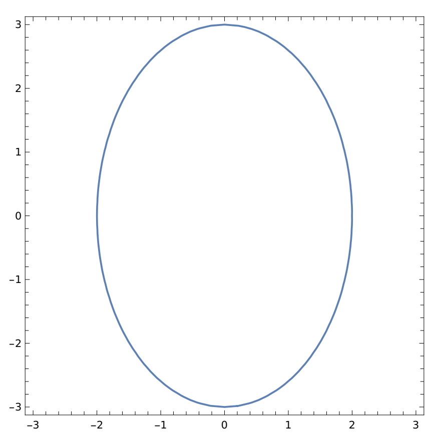

Figure 3

(20) The command **ContourPlot3D** plots an equation involving 3 variables, say x, y, and z. The

result is the set of points (x, y, z) satisfying the equation. For example, to plot the ellipsoid

$$\frac{x^2}{4} + \frac{y^2}{9} + z^2 = 1$$

we write (Figure 4)

```
ContourPlot3D[x^2/4+y^2/9+z^2==1,{x,-3,3},{y,-3,3},{z,-3,3}]
```

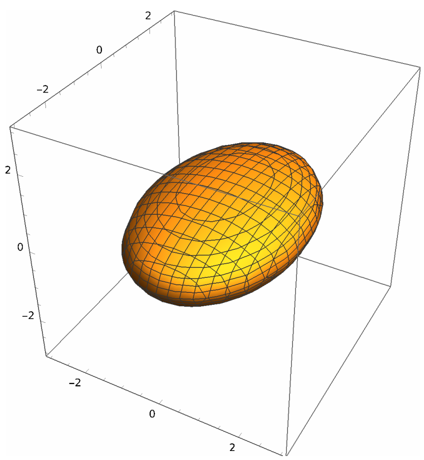

Figure 4

(21) Plot the following curves

(a) $x^2 - y = 1$

(b) $x^2 + y^3 = 1$

(c) $x^2 - y^2 = 1$

(22) Plot the following surfaces

(a) $x^2 - y + z^2 = 1$

(b) $z = x^2 - y^2$

(c) $xy + yz + zx = 1$

5 To turn in

Submit your implementation (codes and pictures) of Exercises (1) - (22) as a single pdf file.