Introduction to *Mathematica*

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Graphing

- **2D Graphs: Plot[***f(x)***, {x,** *beginning value*, *ending value***}]**

```
Plot[x^2, {x, -4, 4}]
Plot[x^2, {x, -4, 4}, PlotRange → {{-6, 6}, {-5, 20}}]
```

- **3D Graphs: Plot3D[***f(x,y)***, {x,** *beg. value*, *end value***}, {y,** *beg. value*, *end value***}]**

```
Plot3D[x^2 + y, {x, -4, 4}, {y, -4, 4}]
```

- **Parametric Graphs: ParametricPlot[{***f(t)*, *g(t)***}, {t,** *beginning value*, *ending value***}]**

```
ParametricPlot[{Sin[2 t], Sin[3 t]}, {t, 0, 2 Pi}]
```

- **Polar Graphs: PolarPlot[***f(t)***, {t,** *beginning value*, *ending value***}]**
  Note: Before the first time, type <<Graphics` (that is a *backwards* apostrophe).

```
<< Graphics`
PolarPlot[Cos[t] + t, {t, 0, 2 Pi}]
```

- **Coordinate Graphs: ListPlot[{x, y}, {x, y}, {x, y}, {x, y}]**

```
ListPlot[{{1, 2}, {1, 1}, {3, 1}, {2, 3}, {2, 2}}]
ListPlot[{{1, 2}, {1, 1}, {3, 1}, {2, 3}, {2, 2}},
  PlotStyle -> PointSize[0.05]]
 (Note: To get the "→" type ->)
```

- **Multiple Graphs: Show[***Graph1*, *Graph2***]**

```
parab = Plot[x^2, {x, -4, 4}];
circ = ParametricPlot[{Cos[t], Sin[t]}, {t, 0, 2 Pi}];
Show[parab, circ]
```

- **Rotate 3D Graphs**

```
<< RealTime3D`      (Only need << RealTime3D` the first time.)
Plot3D[2 Sin[x] + 6 Cos[y], {x, -2, 8}, {y, 0, 15}]
```

PlotStyle Options: PlotStyle-> {*option1*, *option2*, *option3* . . .}

- **Hue: Try different values for Hue. Integer values are red and other colors are in between.**

```
Plot[x^2, {x, -4, 4}, PlotStyle → Hue[0.65]]
```

- **RGBColor: RGBColor[r, g, b] r, g, and b are values between 0 and 1, indicating the amount of red, green, and blue respectively.**

```
Plot[x^2, {x, -4, 4}, PlotStyle → RGBColor[0.5, 0.7, 0.2]]
```

- **Thickness: Choose a value between 0 and 1.**

```
Plot[x^2, {x, -4, 4}, PlotStyle → Thickness[0.02]]
```

- **Dashing: The value controls the length of the dashes.**

```
Plot[x^2, {x, -4, 4}, PlotStyle → Dashing[{0.05}]]
```

- **Combinations: Use a list { } to apply multiple options.**

```
Plot[x^2, {x, -4, 4}, PlotStyle → {Hue[0.65], Dashing[{0.05}]}]
```

Expressions and Equations

- **Expression Operations**

```
3 x^2 + 2 x - 4 x^2 + 7 x + 4
```
Automatically simplifies

Or try : `Simplify[3 x^2 + 2 x - 4 x^2 + 7 x + 4]`

```
TraditionalForm[3 x^2 + 2 x - 4 x^2 + 7 x + 4]
Expand[(x - 3) (2 x - 5) (x + 4)]
Factor[3 x^3 - 2 x^2 - 11 x + 10]
```

- **Solving Equations**

```
Solve[3 x^2 - 2 x + 5 == 4 x + 3, x]
```
Single Equation (Note : use double =)

```
Solve[{2 x + 3 y == 5, x - 3 y == 1}, {x, y}]
```
System of Equations

Functions

- **Defining the Function:**

`FunctionName[variable_] :=` Expression with **`variable`** in it

- **Example**

```
myfcn[x_] := x^2;
myfcn[3]
Plot[myfcn[x], {x, -2, 2}]
```

Getting Help on Functions

- **For a syntax summary, input "?" before the word and press Shift-Enter. Example: `?Plot`**
- **For immediate lookup in the Help menu, place the cursor on the function and press F1**
- **More Options: To see options for a particular function, use Options[function]**

```
Options[Plot]
```