



Math 615: 9/23/15

Input Types



Text fields: You can enter text into a cell by declaring it to be a “Text” cell. This will prevent it from being evaluated, and hence it will not produce any unwanted error messages. Click “Format,” then “Style,” then “Text.” You can also create titles, subsections, etc.

```
f[x_] := Cos[2 Pi x]
f[1]
```

Another way to enter text is to click the “+” sign above a cell. Notice this also gives you the option of “Free-form input.” Under this option, you type a command for *Mathematica* in plain English, and it will try to translate it into a formal *Mathematica* command.

 graph y=sin(x) from x=-2pi to x=2pi 
Plot[Sin[x], {x, -2 * Pi, 2 * Pi}]

Try to integrate a function.

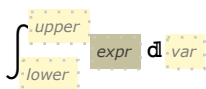
 integral of x^2 - x^4 + e^(2 x) 
Integrate[x^2 - x^4 + E^(2 * x), x]

Teaching yourself Mathematica





Free-form input - This is a good way to discover possible commands and their usage. Clicking on the *Mathematica* input will automatically replace your input, and the “+” symbol gives other possible expressions.

Classroom Assistant Palette - Open this under the Palettes menu. The “Basic Commands” contains most commands you will ever need, and the command will enter a template for you to fill in.

Integrate[, 



Auto-Completion - If you begin typing a command, *Mathematica* will suggest the rest of the command. You can also see the syntax by clicking the down arrows. For example, begin typing Sum, and ...

Sum[, {, , 

Documentation Center - This contains all the information about a command's usage along with examples. The sample code can be modified and rerun within the Documentation Center. For example, figure out how to graph both $\sin(x)$ and $\cos(x)$ on the same graph by looking up "Plot."

```
Plot[{Sin[x], Cos[x]}, {x, 0, 2 Pi}, PlotLegends -> "Expressions"]
```

Graphs of functions

Function(s) of 1-variable.

```
Plot[x^2, {x, -2, 2}]
```

```
Plot[{x^2, 2 x - 4}, {x, -2, 2}]
```

Function(s) of 2-variables.

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

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

```
Plot3D[{2 x - y + 5, 3 x - 2 + y, 4 x - 2 y + 10}, {x, -10, 10}, {y, -10, 10}]
```

2D and 3D Parametric Graphs

Function $f: \mathbf{R} \rightarrow \mathbf{R}^2$

```
ParametricPlot[{2 Cos[t], 7 Sin[t]}, {t, 0, 2 Pi}]
```

Two functions Function $f: \mathbf{R} \rightarrow \mathbf{R}^2$

```
ParametricPlot[{2 Cos[t], 7 Sin[t]}, {Cos[t], Sin[t]}, {t, 0, 2 Pi}]
```

Click on "More, Legends, Formulas" to get a legend like the following.

```
ParametricPlot[{2 Cos[t], 7 Sin[t]}, {Cos[t], Sin[t]}, {t, 0, 2 Pi}, PlotLegends -> "Expressions"]
```

Graphing previously defined functions. Note: the semicolon; prevents the output from being printed on the screen.

```
f[t_] := {2 Cos[t], 7 Sin[t]}
```

```
g[t_] := {Cos[t], Sin[t]}
```

```
ParametricPlot[f[t], {t, 0, 2 Pi}]
```

```
ParametricPlot[{f[t], g[t]}, {t, 0, 2 Pi}]
```

Function $\mathbf{R} \rightarrow \mathbf{R}^3$.

```
ParametricPlot3D[{Cos[t], Sin[t], t}, {t, 0, 4 Pi}]
```

Visualizing spans of vectors.

Parameterizing a line.

```
ParametricPlot[{2 - t, 1 + 3 t}, {t, -2, 2}]
```

Using scalar multiplication.

```
v0 = {2, 1};
```

```
v = {-1, 3};
```

```
ParametricPlot[v0 + r v, {r, -2, 2}]
```

Linear combinations of two vectors give a parametric function $\mathbf{R}^2 \rightarrow \mathbf{R}^2$.

```
v1 = {3, 1};
```

```
v2 = {1, 2};
```

```
ParametricPlot[r v1 + s v2, {r, -2, 2}, {s, -2, 2}]
```

Visualizing $\text{span}(w1)$, $\text{span}(w2)$, $\text{span}(w1, w2)$.

```
w1 = {1, 1, 0};
```

```
w2 = {-1, 2, 1};
```

```
ParametricPlot3D[r w1, {r, -2, 2}]
```

```
ParametricPlot3D[r w2, {r, -2, 2}]
```

```
ParametricPlot3D[r w1 + s w2, {r, -2, 2}, {s, -2, 2}]
```

What is the dimension of $\text{span}(v1, v2, v3)$ for given vectors? Let's check graphically.

```
v1 = {1, 0, 0};
```

```
v2 = {0, 1, 0};
```

```
v3 = {0, 0, 1};
```

```
ParametricPlot3D[{r1 v1 + r2 v2, r1 v3}, {r1, -2, 2}, {r2, -2, 2}]
```

```
v1 = {1, 0, 0};
```

```
v2 = {0, 1, 0};
```

```
v3 = {1, 1, 0};
```

```
ParametricPlot3D[{r1 v1 + r2 v2, r1 v3}, {r1, -2, 2}, {r2, -2, 2}]
```