Motilal Nehru College

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(Department Of Mathematics)

Combining Graphs

Combi6' presents "Section-3.8" belongs to Mathematica.

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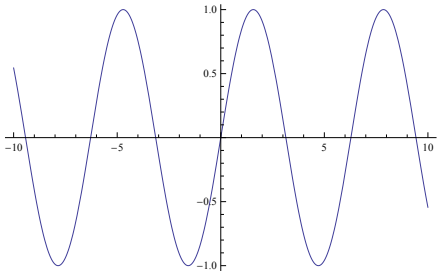
Introduction:

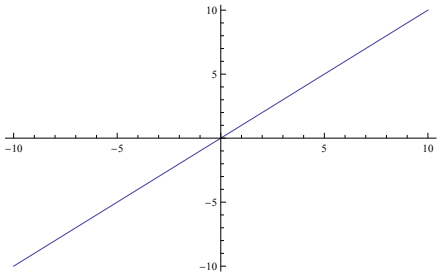
Working with graphics in Wolform Language, we may want to combine several graphics into a single image. The Wolform language can combine graphics by overlaying them or by embedding them together in different orders.There are many possibilities here, so we will address each in turn.

- **Example:-**

```
f[x_]:=Sin[x];
Plot[f[x],{x,-10,10}]
```




```
g[x_]:=x
Plot[g[x],{x,-10,10}]
```



Now the question is how we plot "f[x].g[x] or others " in the same graph?

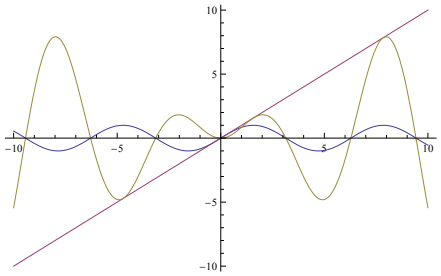
So answering to this type of questions our presentation topic "Section- 3.8" will help you.

So let's start

SuperImposing Plots :-

Two view two or more plots together, If you simply want to plot several functions on the same set of axes, enter a list containing these functions as the first argument to the Plot command and you will have it :

```
f[x_]:=Sin[x];
g[x_]:=x;
Plot[{f[x],g[x],f[x]*g[x]},{x,-10,10}]
```



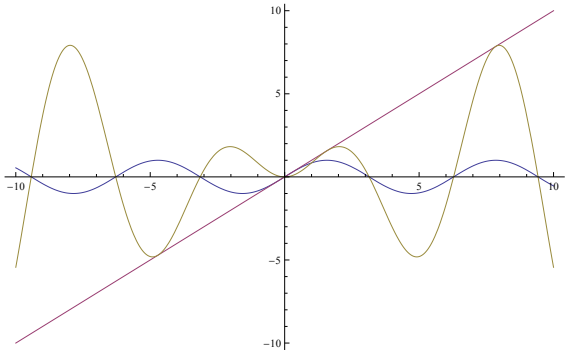
Comment :-

We see the three functions are given three distinct colors. To better distinguish between them we have another command.

- **Using Tooltip :-**

  Tooltip command wrap the list of functions. After using this command when we mouseover any curve in the resulting plot, a tooltip will pop up displaying the function's expression.

```
Plot[Tooltip[{f[x],g[x],f[x]*g[x]}],{x,-10,10}]
```



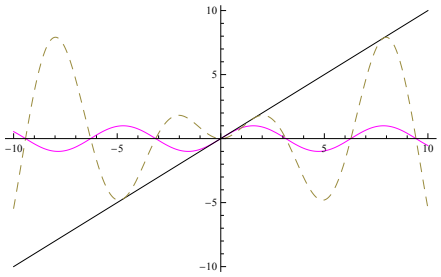
- **Comment :-**

  Output in printed form is indistinguishable from the prior output, so this feature is only useful in a live session. We another useful command.

- **Using PlotStyle :-**

  ***PlotStyle* use to change the appearence of the three functions. *This is sometimes useful for printed output when using black and white printed.* Just set PlotStyle to a list of three directives. These will be applied to the function (In ordered listed).**

```
Plot[{f[x],g[x],f[x]*g[x]},{x,-10,10},
PlotStyle→{Magenta,Black,Dashing[{.02}]}]
```



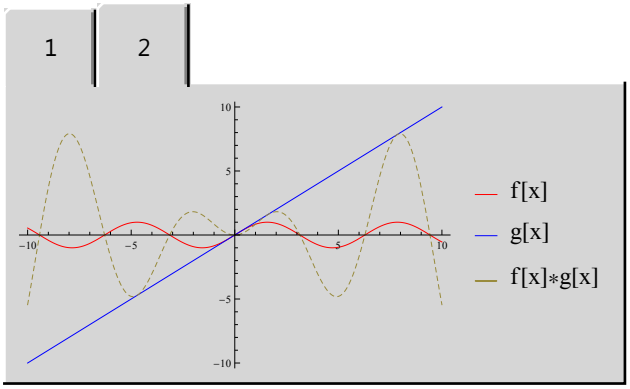
- **Comment :-**

  ***This is some times useful for printed output when using black and white printed.* With a little extra work we can add something more interesting.**

- **Using PlotLegends :-**

  The option *PlotLegends* is set to the list of labels to be placed in the legend box. In this case we just used the function themselves, but textual expressions or strings (expressions enclosed in double quotes) are also fine.

```
TabView[{Plot[{f[x],g[x],f[x]*g[x]},{x,-10,10},
PlotStyle→{Red,Blue,Dashing[{.01}]},
PlotLegends→{f[x],g[x],f[x]*g[x]}],
Plot[{f[x],g[x],f[x]*g[x]},{x,-10,10},PlotStyle→{Red,Blue,Dashing[{.01}]},
PlotLegends→{"f[x]","g[x]","f[x]*g[x]"}]}]
```



- **Note :-**

  In older version of mathematica (*Mathematica*- 7.0) *Plotlegends* command some times doesn't work . So we need to give a command *Needs["PlotLegends"]* for working this command.

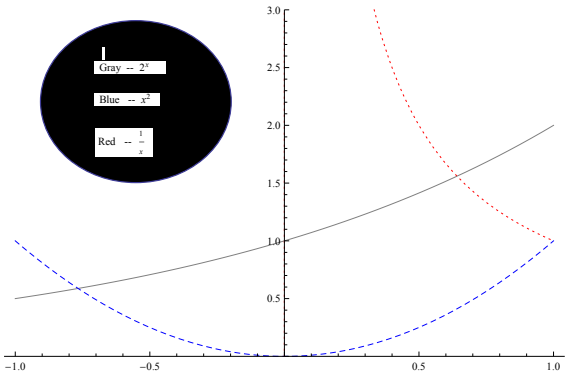
  - **Comment :-**

    We can change the position using *LegendPosition* command. *Ex- the setting [-1,-1] placed the legend in the lower left .*

Using Drawing Tool :-

Simply plot your functions , then click on the output image and use the drawing tools to place on it.

```
Plot[{2^x, x^2, 1/x}, {x, -1, 1}, PlotRange→{0, 3}, PlotStyle→{Gray, Directive[Dashed, Blue],
Directive[Dotted, Red]}]
```



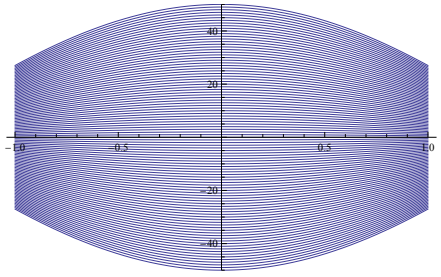
Comment :-

Here we have used the drawing tools to add a legend.

- **If you need to superimpoe a large number of plots, you can use "Mathematica's Table" command to generate list of functions :**
- **Table Command :-**

  Table[expr,n] generates a list of n copies of expr. Table[expr,{i,imax}] generates a list of the values of expr when i runs from 1 to...

```
Plot[Table[{n*Cos[x]},{n,-50,50}],{x,-1,1},PlotRange→50]
```



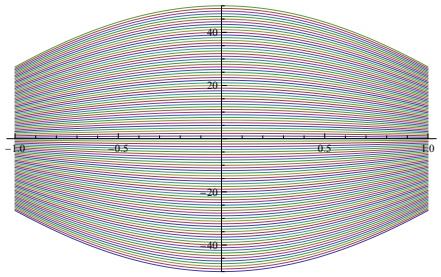
  - **Comment :-**

    The example above , the processing time is reduced and curves become individually colored if one replaces *Table[f[t+x],{t,min,max}]* by *Evaluate[Table[f[t+x],{t,min,max}]]* .

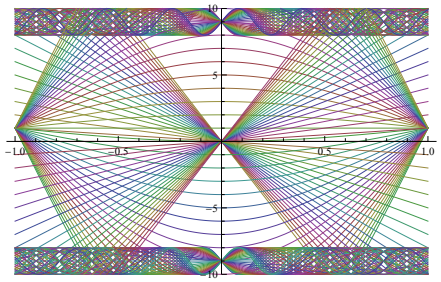
Using Evaluate :-

Evaluate[expr] causes expr to be evaluated even if it appears as the argument of a function whose attributes specify that it should be held.

```
Plot[Evaluate[Table[{n*Cos[x]},{n,-50,50}],{x,-1,1},PlotRange→50]]
```




```
Plot[Evaluate[Table[{Sin[m*y]-9,Sin[m*y]+9,m*y,m*Cos[ y  Pi/2]+1},
{m,-20,20}],{y,-1,1},PlotRange→10]]
```



- **Producing Filled Plots :-**

  Filling is an option for *ListPlot, Plot, Plot3D,* and related functions that specifies what filling to add under points, curves, and surfaces.

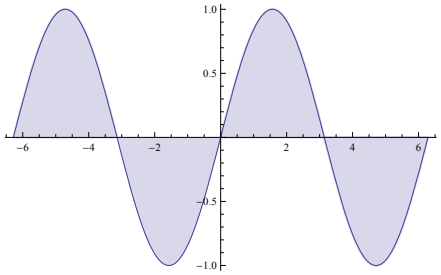
  - **The following settings can be used:**

None	**no filling (default)**
Axis	**fill to the axis**
Bottom	**fill to the bottom of the plot**
Top	**fill to the top of the plot**
v	**fill to value v**
{m}	**fill to the m^{th} object**
{i1->p1,i2->p2,...}	**fill from object ik to pk**
{i1->{p1,g1},...}	**use directive gk for the k^{th} filling**
{i1->{p1,{g1-,g1+},...}}	**use g1- below and g1+ above**

Example :-

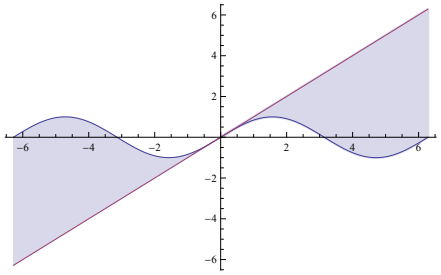
One can shade the region between a plot and the axes as follows:

```
Plot[Sin[x], {x, -2 Pi,2 Pi}, Filling -> Axis]
```



And one can shade the region between two curves like so :

```
Plot[{Sin[x],x}, {x, -2 Pi,2 Pi}, Filling →{1}]
```

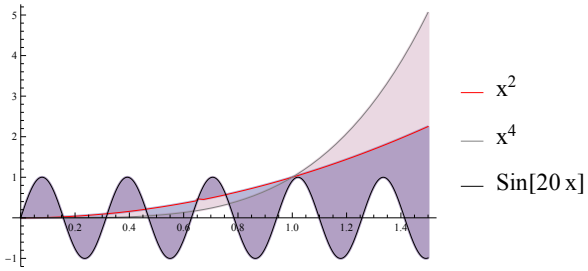


- Now *Filling* command becomes more intersting when we have more than two graphs. There are many ways to shade the various regions between them.

  Below, filling is added from the first to the third, and from the second function to the top of the plot.

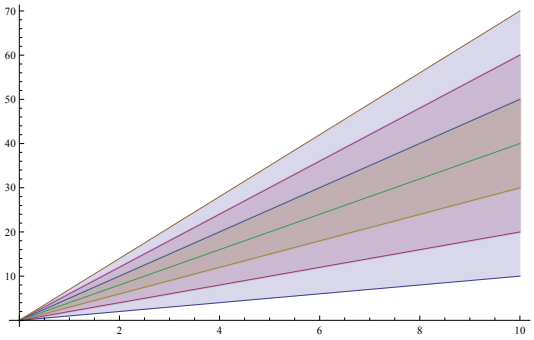
Example-1

```
Plot[{x^2, x^4,Sin[20 x]}, {x, 0,1.5},PlotLegends→{x^2,x^4,Sin[20 x]},PlotStyle→{Red,Gray,Bla
Filling →{1→{3},2→{3},3→{1}}]
```



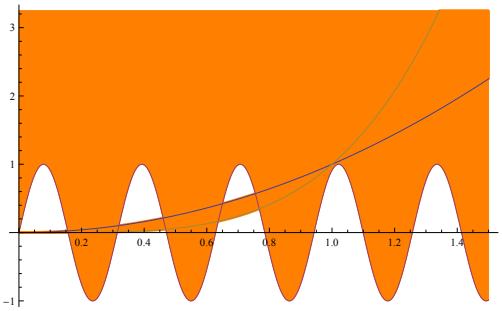
Example-2

```
Plot[Evaluate[Table[ n x, {n, 7}]], {x,0, 10},
Filling -> {1→{7},2→{6},3→{5},4→{4}}]
```



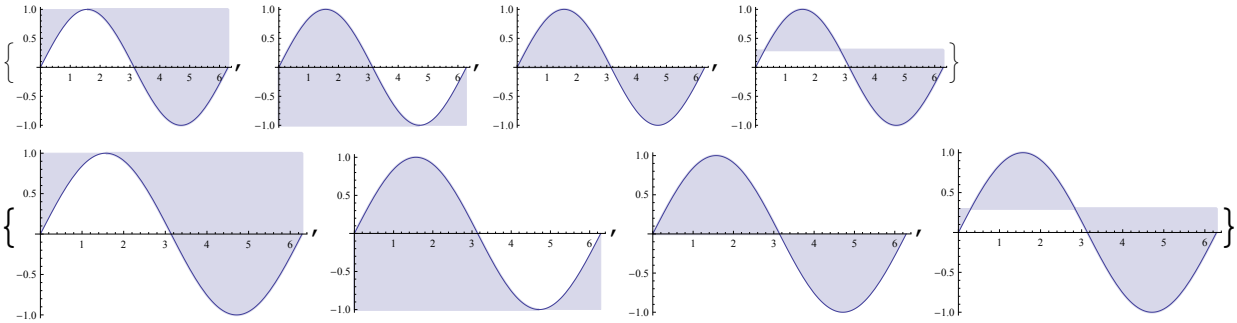
Example-3

```
Plot[{x^2,Sin[20x],x^4},{x,0,1.5},Filling→{1→{3},2→Top},FillingStyle→Orange,
PlotRange→Automatic]
```



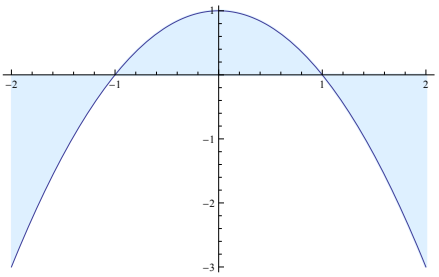
Example-4

```
Table[Plot[Sin[x], {x, 0, 2 Pi},Filling → f], {f, {Top, Bottom, Axis, 0.3}}]
```



Example-5

```
Plot[1-x^2,{x,-2,2},Filling→Axis,FillingStyle→LightBlue]
```



Superimposing Graphics :-

We can superimpose two or more graphs or picture using *Show* command.

Show :-

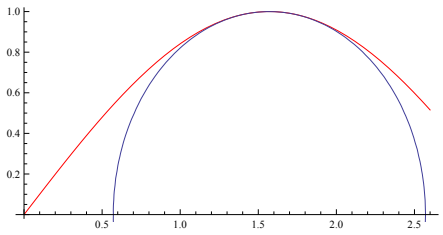
We can use this command two basic types:

[1] Show[graphics,options] = shows graphics with the specified options added.

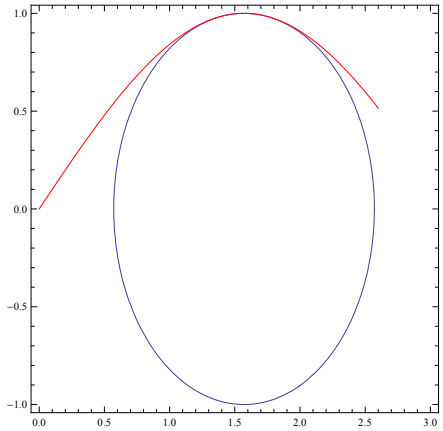
[2] Show[g1,g2,...] = shows several graphics combined.

Now we demonstrate this by assigning names to the component images and suppressing their individual output with semicolons.

```
p1= Plot[Sin[x],{ x, 0, 2.6}, AspectRatio→0.5,PlotStyle→Red];
p2= ContourPlot[( x-π/2)^2 +y^2==1 ,{x, 0, 3},{ y, -1, 1 }];
Show[p1, p2]
```



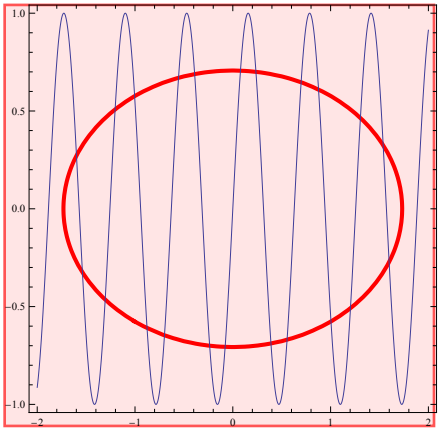

```
Show[p2,p1]
```



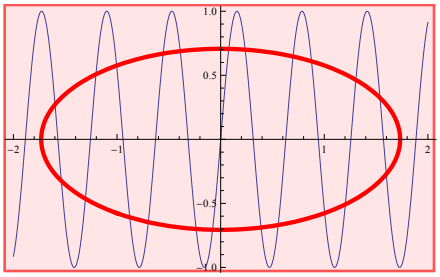
Note :- The order of the component images listed within *Show* is the order in which they are rendered.

one more example to show this is:-

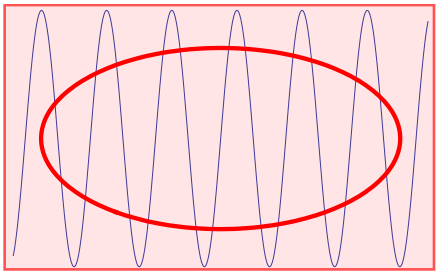
```
ellipse=ContourPlot[(x^2)/3+2*y^2==1,{ x,- 2, 2},{ y, -1,1},
ContourStyle→Directive[Red,Thickness[.01]]];
squiggle= Plot[Sin[10 x],{x, -2,2},PlotStyle→Directive[Dash,Thickness[.01]]];
Show[ellipse,squiggle]
```




```
Show[squiggle,ellipse]
```




```
Show[squiggle,ellipse,Axes→False]
```

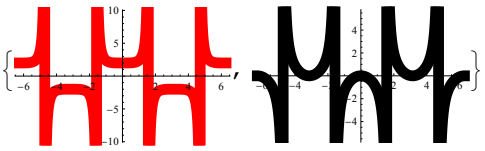


Comment :- One may also include within *Show* any option accepted by *Graphics*. Such option can be used to override setting inherited from the component images. Also keep in mind that while *Show* is an extremly useful and versatile command, it is often not needed. To plot two function together, for instance, recall that one can simply provide a list of the two function as the first argument to *Plot*.

Graphics *Side-by-side* :-

It is used in arranging graphics *Side-by-Side* and to simply create a list of graphics.

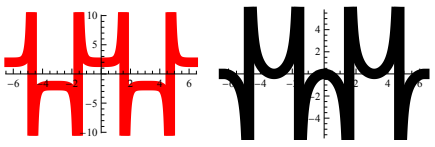
```
{a=Plot[Cos[x]+Sec[x],{x,-2π,2π},PlotStyle→Directive[Red,Thickness[.05]]],
b=Plot[Cos[x]-Sec[x],{x,-2π,2π},PlotStyle→Directive[Black,Thickness[.05]]]}
```



Comment :- The curly brackets enclosing the list seperated by commas are displayed in the output.

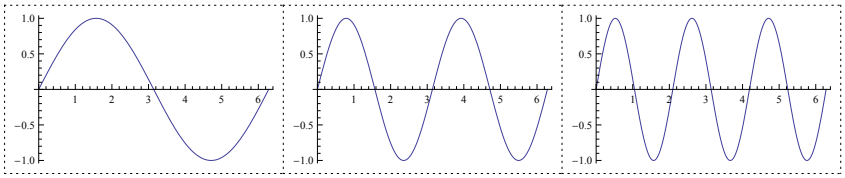
A better way to accomplish a side by side display is to use graphics row. It will integrate this list of individual Graphics objects into one graphic that can be resized or moved as a whole.

```
GraphicsRow[{a,b}]
```

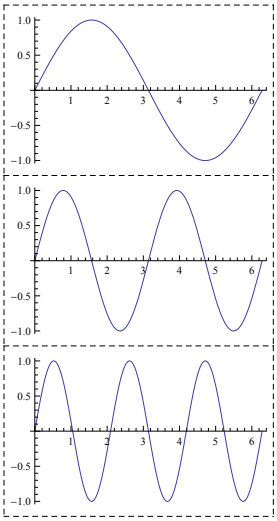


- **The list of graphics can be generated programmatically, using the command *Table*. The *Frame*, *FrameStyle*, and *Dividers* options may be used to add frames around each item, or to place divider lines between some of them.**

```
GraphicsRow[Table[Plot[Sin[m*x],{x,0,2π}],{m,3}],Frame→All,FrameStyle→Dotted]
```



```
GraphicsColumn[Table[Plot[Sin[m*x],{x,0,2π}],{m,3}],Frame→All,FrameStyle→Dashed]
```

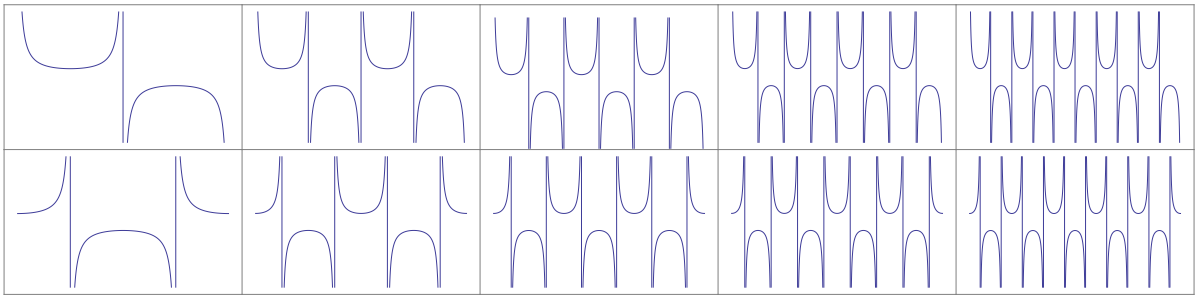


Graphics in a Grid :-

To lay out graphics in a grid pattern we have *GraphicsGrid* command . The syntax and many of the option are same as for *Grid*.

Question :- Make the following grid showing the plots of trigonometric functions i.e. the functions of the form *Csc[m x]* and *Sec[m x]*, for real parameters *m* and with domain $0<x<2\pi$.

```
GraphicsGrid[{Table[Plot[Csc[m x],{x,0,2Pi},Axes→False],{m,5}],
Table[Plot[Sec[m x],{x,0,2Pi},Axes→False],{m,5}]},Frame→All,FrameStyle→Gray]
```



There is a *GraphicGrid* command to lay out graphics in a grid pattern.

For example if we want to grid the text we use the command *TextGrid*.

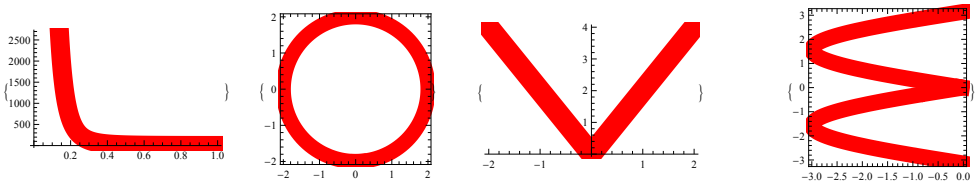
```
Text[Grid[{{"first","second"},{"third","fourth"}}]]
```

first	second
third	fourth

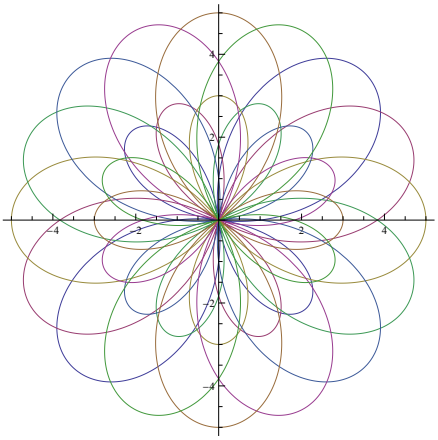
Comment :- The main difference between *Grid* and *GraphicsRow* or *GraphicsGrid* is that the output of these latter commands is a *single* graphic that may be edited as such, for instance using the drawing tools. The entire output can be resized by selecting it and dragging a handle. In a plain *Grid*, only the *individual* component graphics can be edited.

Some Applications :-

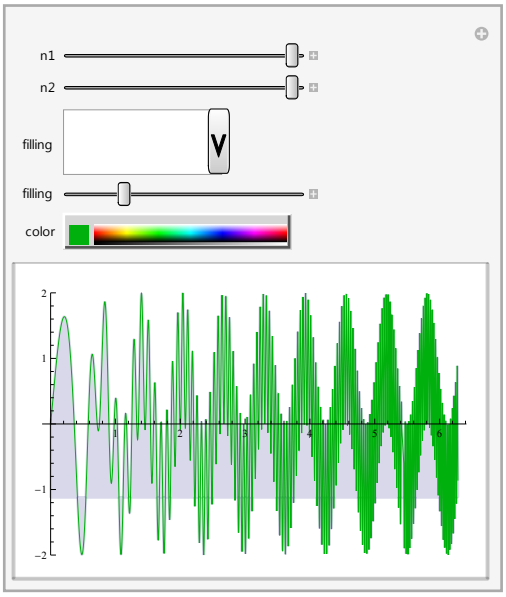
```
GraphicsRow[{{Plot[1/x^4,{x,0,1},PlotStyle→Directive[Red,Thickness[.1]]]},
{ContourPlot[x^2+y^2==4,{x,-2,2},{y,-2,2},ContourStyle→Directive[Red,Thickness[.1]]]},
{Plot[Abs[-2 x],{x,-2,2},PlotStyle→Directive[Red,Thickness[.1]]]},
{ContourPlot[x==-3 Abs[Sin[y]],{x,0,-3},{y,-Pi,Pi},ContourStyle→Directive[Red,Thickness[
```



```
PolarPlot[Evaluate[Table[1+4Sin[2(t+i Pi/8)],{i,0,7}]],{t,0,2 Pi}]
```



```
Manipulate[Plot[Sin[n1 x^2]+Sin[n2 x/3],{x,0,2 Pi},
Filling→filling,PlotRange→2,PlotStyle→ color],
{n1,1,20},{n2,1,30},{filling,{None,2,1.5,1,0.5,0,-0.5,-1,-1.5,-2}}
,{filling,-2,2},{color,Blue}]
```



- **Refrences** :-

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www.cambridge.org
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