Plots and Plotting

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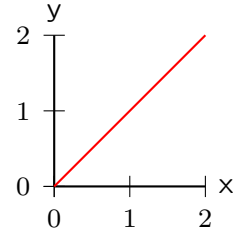
TUG 2008, Cork, Ireland

Note: Most plot options in this part require `\usepackage{pstricks-add}`.

1. Function Plots

The most natural (but *not* the only) way to make plots is `psgraph`:

```
\begin{psgraph}%
  (0,0)(2,2)%{2cm}{2cm}
  \psplot[linecolor=red]{0}{2}{x}
\end{psgraph}
```



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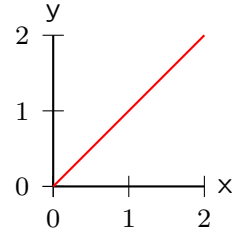
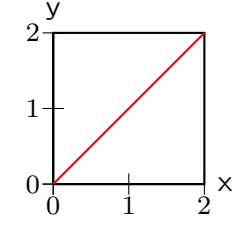
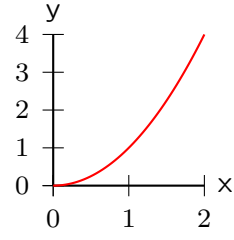



```
\begin{psgraph}[axesstyle=frame]%
  (0,0)(2,2){2cm}{2cm}
  \psplot[linecolor=red]{0}{2}{x}
\end{psgraph}
```



```
\begin{psgraph}%
  (0,0)(2,4){2cm}{2cm}
  \psplot[linecolor=red,
  algebraic]{0}{2}{x*x}
\end{psgraph}
```



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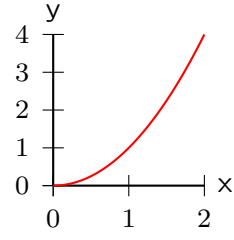
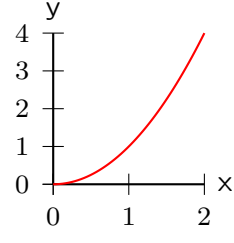
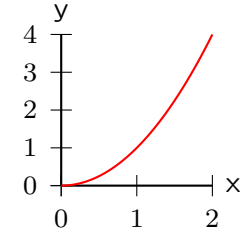
\begin{psgraph}%
  (0,0)(2,4){2cm}{2cm}
  \psplot[linecolor=red,
  algebraic]{0}{2}{x*x}
\end{psgraph}
```




```
\begin{psgraph}%
  (0,0)(2,4){2cm}{2cm}
  \psplot[linecolor=red]%
  {0}{2}{x x mul}
\end{psgraph}
```



```
\begin{psgraph}%
  (0,0)(2,4){2cm}{2cm}
  \psplot[linecolor=red,
  algebraic]{0}{2}{x*x}
\end{psgraph}
```

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\begin{psgraph}%
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  \psplot[linecolor=red]%
  {0}{2}{x x mul}
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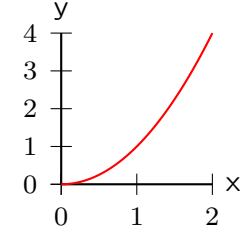
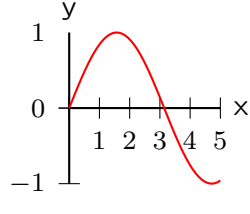



```
\begin{psgraph}%
  (0,0)(0,-1)(5,1){2cm}{2cm}
  \psplot[linecolor=red,
  algebraic]{0}{5}{sin(x)}
\end{psgraph}
```



2. Data Plots

plot.dat

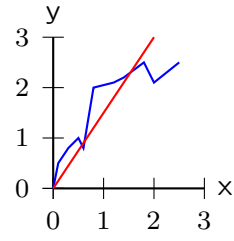
```
0    0.0
0.1  0.5
0.3  0.8
0.5  1.0
0.6  0.8
0.8  2.0
1.2  2.1
1.4  2.2
1.8  2.5
2.0  2.1
2.5  2.5
```

We can read the file:

```
\readdata{\Data}{plot.dat}
```

And now we can plot the file:

```
\begin{psgraph}(0,0)(3,3){2cm}{2cm}
  \dataplot[linecolor=blue]{\Data}
  \psplot[algebraic,linecolor=red]%
  {0}{2}{1.5*x}
\end{psgraph}
```



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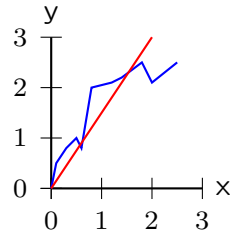
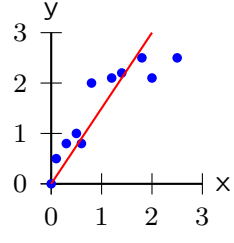
  {0}{2}{1.5*x}
\end{psgraph}
```




```
\begin{psgraph}(0,0)(3,3){2cm}{2cm}
  \dataplot[showpoints=true,
  linecolor=blue,
  linestyle=none]{\Data}
  \psplot[algebraic,linecolor=red]%
  {0}{2}{1.5*x}
\end{psgraph}
```



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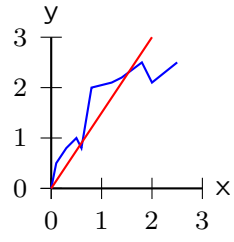


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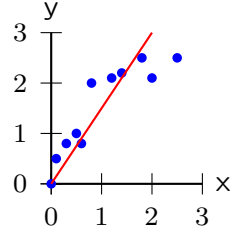
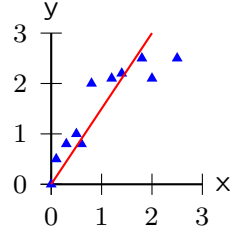
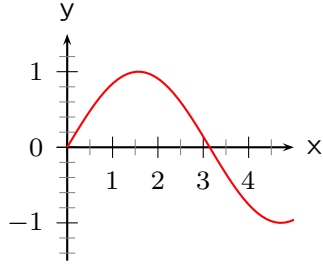



```
\begin{psgraph}(0,0)(3,3){2cm}{2cm}
  \dataplot[showpoints=true,
  linecolor=blue, linestyle=none,
  dotstyle=triangle*]{\Data}
  \psplot[algebraic,linecolor=red]%
  {0}{2}{1.5*x}
\end{psgraph}
```



3. Axes, Axes, Axes. . .

```
\begin{psgraph}[arrows=->,
  xsubticks=2, ysubticks=5]%
  (0,0)(0,-1.5)(5,1.5){3cm}{3cm}
  \psplot[linecolor=red,
  algebraic]{0}{5}{sin(x)}
\end{psgraph}
```



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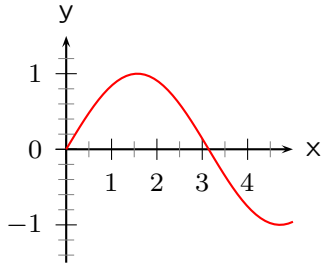
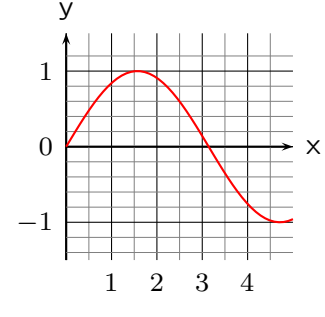


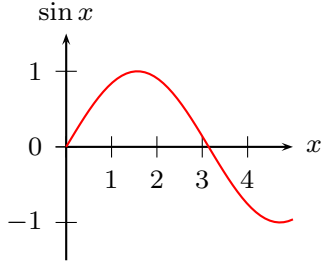
We can make a grid using the proper `ticksize`. Note that `subticksize` is relative to ticksize:

```
\begin{psgraph}[arrows=->,
  xsubticks=2, ysubticks=5,
  xticksize=-1.5 1.5,
  xsubticksize=1,
  yticksize=0 5,
  ysubticksize=1]%
  (0,0)(0,-1.5)(5,1.5){3cm}{3cm}
  \psplot[linecolor=red,
  algebraic]{0}{5}{sin(x)}
\end{psgraph}
```



We can change axes labels. Note that this must be done *before* `psgraph`:

```
\psset{xAxisLabel={$x$},
  yAxisLabel={$\sin x$}}
\begin{psgraph}[arrows=->]%
  (0,0)(0,-1.5)(5,1.5){3cm}{3cm}
  \psplot[linecolor=red,
  algebraic]{0}{5}{sin(x)}
\end{psgraph}
```



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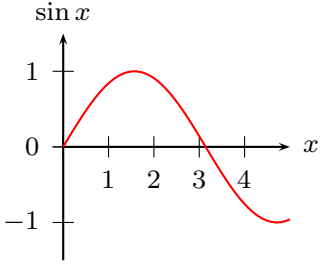
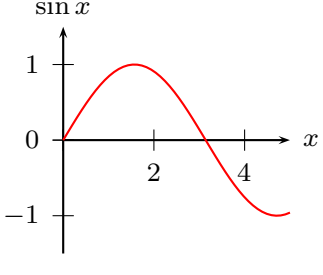


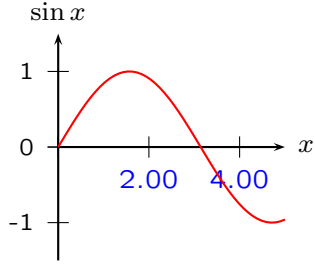
We can change the spacing of the ticks:

```
\psset{xAxisLabel={$x$},
  yAxisLabel={$\sin x$}}
\begin{psgraph}[arrows=->, Dx=2,
  Dy=1]%
  (0,0)(0,-1.5)(5,1.5){3cm}{3cm}
  \psplot[linecolor=red,
  algebraic]{0}{5}{sin(x)}
\end{psgraph}
```



We can completely redefine labels:

```
\psset{xAxisLabel={$x$},
  yAxisLabel={$\sin x$}}
\renewcommand{\pshlabel}[1]{%
  \textcolor{blue}{#1.00}}
\renewcommand{\psvlabel}%
  [1]{{\small#1}}
\begin{psgraph}[arrows=->, Dx=2,
  Dy=1]%
  (0,0)(0,-1.5)(5,1.5){3cm}{3cm}
  \psplot[linecolor=red,
  algebraic]{0}{5}{sin(x)}
\end{psgraph}
```

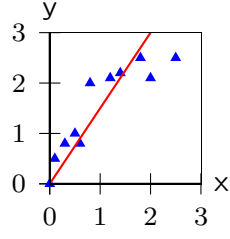


Or create trig scale, log scale and many other things. . .

4. Trimming The Plot

Normally plot is very closely cropped:

```
\fbox{\begin{psgraph}(0,0)(3,3){2cm}{2cm}
  \dataplot[showpoints=true,linecolor=blue,
  linestyle=none,dotstyle=triangle*]{\Data}
  \psplot[algebraic,linecolor=red]%
  {0}{2}{1.5*x}
\end{psgraph}}
```



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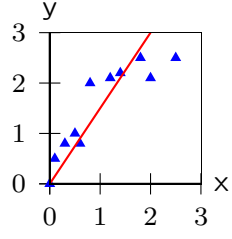
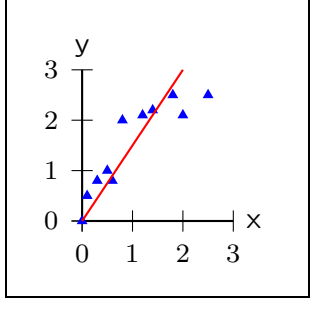
  \psplot[algebraic,linecolor=red]%
  {0}{2}{1.5*x}
\end{psgraph}}
```



But we can improve this, setting trim *before* `psgraph`

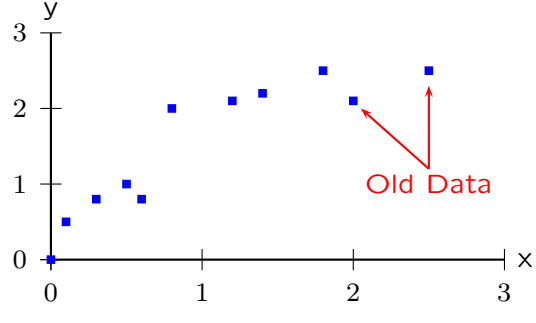
```
\psset{llx=-1cm, lly=-1cm, urx=1cm, ury=1cm}
\fbox{%
  \begin{psgraph}(0,0)(3,3){2cm}{2cm}
    \dataplot[showpoints=true,linecolor=blue,
    linestyle=none,dotstyle=triangle*]{\Data}
    \psplot[algebraic,linecolor=red]%
    {0}{2}{1.5*x}
  \end{psgraph}}
```



5. Putting Things On A Plot

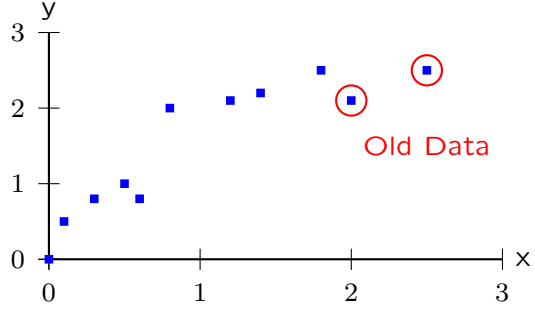
It is very convenient to have "plot coordinates" in psgraph:

```
\begin{psgraph}(0,0)(3,3){6cm}{3cm}
  \dataplot[showpoints=true,linecolor=blue,
  linestyle=none,dotstyle=square*]{\Data}
  \rput(2.5,1){\textcolor{red}{Old Data}}
  \psline[linecolor=red,arrows=->](2.5,1.2)(2.05,2)
  \psline[linecolor=red,arrows=->](2.5,1.2)(2.5,2.3)
\end{psgraph}
```



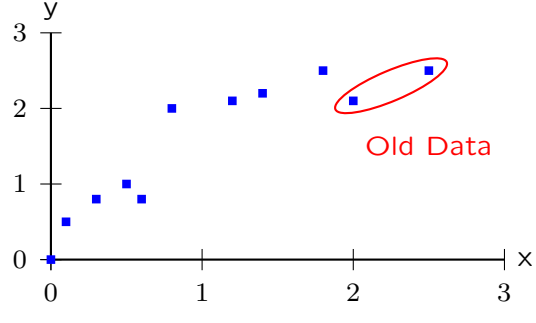
Or, maybe better:

```
\begin{psgraph}(0,0)(3,3){6cm}{3cm}
  \dataplot[showpoints=true,linecolor=blue,
  linestyle=none,dotstyle=square*]{\Data}
  \rput(2.5,1.5){\textcolor{red}{Old Data}}
  \pscircle[linecolor=red](2.0,2.1){0.2}
  \pscircle[linecolor=red](2.5,2.5){0.2}
\end{psgraph}
```



Even better:

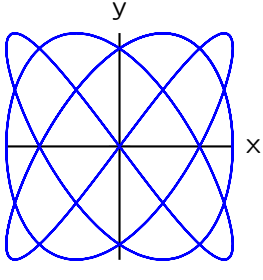
```
\begin{psgraph}(0,0)(3,3){6cm}{3cm}
  \dataplot[showpoints=true,linecolor=blue,
  linestyle=none,dotstyle=square*]{\Data}
  \rput(2.5,1.5){\textcolor{red}{Old Data}}
  \rput{23}(2.25,2.3){\psellipse[linecolor=red](0.4,0.2)}
\end{psgraph}
```



6. Parametric And Polar Plots

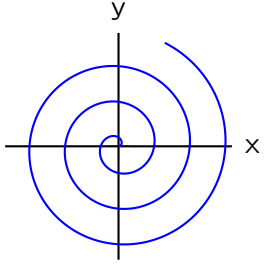
Lissajous curve is the parametric plot of $(\cos(nt), \sin(mt))$.

```
\begin{psgraph}[Dx=3, Dy=3](0,0)(-1,-1)(1,1){3cm}{3cm}
  \parametricplot[linecolor=blue,plotpoints=500,algebraic]{0}{20}{
   cos(3*t) | sin(4*t)}
\end{psgraph}
```



And Archimedes's Spiral

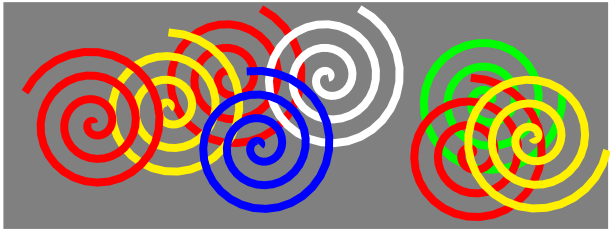
```
\begin{psgraph}[Dx=3, Dy=3](0,0)(-1,-1)(1,1){3cm}{3cm}
  \psplot[linecolor=blue,plotpoints=500,
  algebraic,polarplot]{0}{20}{x/20}
\end{psgraph}
```



7. Plots Without psgraph

You *can* use plots outside of psgraph.

```
\newcommand{\spiral}{\psplot[plotpoints=100,algebraic,polarplot]{0}{20}{x/20}}
\begin{pspicture}(8,3)
  \psframe[linestyle=none,fillcolor=gray,fillstyle=solid](0,0)(8,3)
  \psset{linewidth=3pt}
  \psset{linecolor=blue}
  \rput{-60}(6.4,1.7){\spiral}
  ...
  \rput(4,-0.5){\Large Starry Night}
\end{pspicture}
```



Starry Night