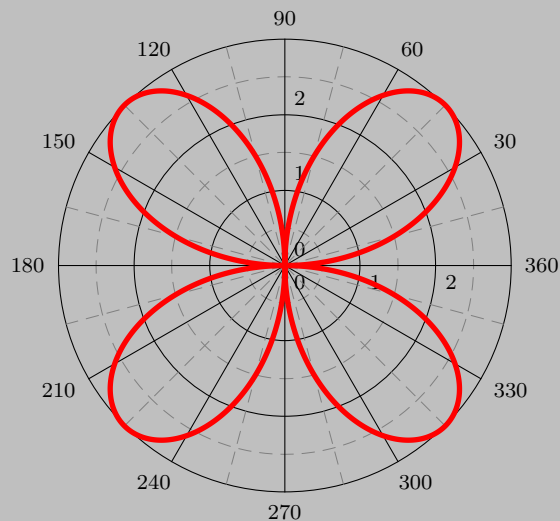


PSTricks

pst-plot plotting data and functions v.1.15

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This version of `pst-plot` uses the extended keyval handling of `pst-xkey` and has a lot of the macros which were recently in the package `pstricks-add`. This documentation describes only the new and changed stuff. For the default behaviour look into the documentation part of the base `pstricks` package. You find the documentation here: <http://mirrors.ctan.org/graphics/pstricks/base/doc/>.

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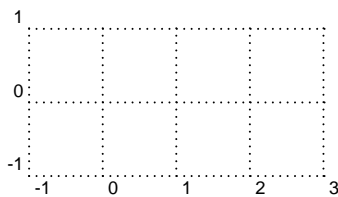
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Part I.

Basic commands, connections and labels

| | |
|--|-----------------------|
| gridlabels=<i>dim</i> | Default: 10pt |
| The size of the numbers used to mark the grid. | |
| gridlabelcolor=<i>color</i> | Default: black |
| The color of the grid numbers. | |
| subgriddiv=<i>int</i> | Default: 5 |
| The number of grid subdivisions. | |
| subgridwidth=<i>dim</i> | Default: .4pt |
| The width of subgrid lines. | |
| subgridcolor=<i>color</i> | Default: gray |
| The color of subgrid lines. | |
| subgriddots=<i>num</i> | Default: 0 |
| Like griddots , but for subdivisions. | |

Here is a familiar looking grid which illustrates some of the parameters:



```
1 \psgrid[subgriddiv=1,griddots=10,gridlabels=7pt](-1,-1)(3,1)
```

Note that the values of **xunit** and **yunit** are important parameters for **\psgrid**, because they determine the spacing of the divisions. E.g., if the value of these is 1pt, and then you type

```
1 \psgrid(0,0)(10in,10in)
```

you will get a grid with 723 main divisions and 3615 subdivisions! (Actually, **\psgrid** allows at most 500 divisions or subdivisions, to limit the damage done by this kind of mistake.) Probably you want to set **unit** to .5in or 1in, as in

```
1 \psgrid[unit=.5in](0,0)(20,20)
```

11 Plots



The plotting commands described in this part are defined in `pst-plot.tex` / `pst-plot.sty`, which you must load first (for various simple and more elaborated examples, you can refer to the two articles published by Herbert Voß

and Laura E. Jackson in *Die TeXnische Komödie* in 2002 [33] and [81] (in German)).⁵

The `\psdots`, `\psline`, `\pspolygon`, `\pscurve`, `\psecurve` and `\psccurve` graphics objects let you plot data in a variety of ways. However, first you have to generate the data and enter it as coordinate pairs (x, y) . The plotting macros in this section give you other ways to get and use the data. (Section 26 tells you how to generate axes.)

To parameter

plotstyle=style

Default: line

determines what kind of plot you get. Valid styles are dots, line, polygon, curve, ecurve, ccurve. E.g., if the **plotstyle** is polygon, then the macro becomes a variant of the `\pspolygon` object.

You can use arrows with the plot styles that are open curves, but there is no optional argument for specifying the arrows. You have to use the **arrows** parameter instead.



Warning: No PostScript error checking is provided for the data arguments. Read Appendix L.4 before including PostScript code in the arguments.

There are system-dependent limits on the amount of data T_EX and PostScript can handle. You are much less likely to exceed the PostScript limits when you use the line, polygon or dots plot style, with **showpoints=false**, **linearc=0pt**, and no arrows.

Note that the lists of data generated or used by the plot commands cannot contain units. The values of `\psxunit` and `\psyunit` are used as the unit.

\fileplot*[par]{file}

\fileplot is the simplest of the plotting functions to use. You just need a file that contains a list of coordinates (without units), such as generated by Mathematica or other mathematical packages. The data can be delimited by curly braces { }, parentheses (), commas, and/or white space. Bracketing all the data with square brackets [] will significantly speed up the rate at which the data is read, but there are system-dependent limits on how much data T_EX can read like this in one chunk. (The [*must* go at the beginning of a line.) The file should not contain anything else (not even `\endinput`), except for comments marked with %.

⁵For plotting commands in three dimensions, see the ‘pst-3dplot’ contribution package [54] from Herbert Voß.

`\fileplot` only recognizes the line, polygon and dots plot styles, and it ignores the `arrows`, `linearc` and `showpoints` parameters. The `\listplot` command, described below, can also plot data from file, without these restrictions and with faster T_EX processing. However, you are less likely to exceed PostScript's memory or operand stack limits with `\fileplot`.

If you find that it takes T_EX a long time to process your `\fileplot` command, you may want to use the `\PSTtoEPS` command described on page 160. This will also reduce T_EX's memory requirements.

`\dataplot*[par]{commands}`

`\dataplot` is also for plotting lists of data generated by other programs, but you first have to retrieve the data with one of the following commands:

`\savedata{command}[data]`
`\readdata{command}{file}`

data or the data in *file* should conform to the rules described above for the data in `\fileplot` (with `\savedata`, the data must be delimited by [], and with `\readdata`, bracketing the data with [] speeds things up). You can concatenate and reuse lists, as in

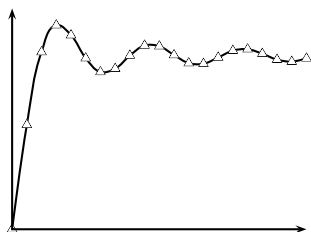
```
1 \readdata{\foo}{foo.data}
2 \readdata{\bar}{bar.data}
3 \dataplot{\foo\bar}
4 \dataplot[origin={0,1}]{\bar}
```

The `\readdata` and `\dataplot` combination is faster than `\fileplot` if you reuse the data. `\fileplot` uses less of T_EX's memory than `\readdata` and `\dataplot` if you are also use `\PSTtoEPS`.

Here is a plot of Integral(sin(x)). The data was generated by Mathematica, with

```
1 Table[{x,N[SinIntegral[x]]},{x,0,20}]
```

and then copied to this document.



```
1 \psset{xunit=.2cm,yunit=1.5cm}
2 \savedata{\mydata}[
3   {{0, 0}, {1., 0.946083}, {2., 1.60541}, {3., 1.84865}, {4., 1.7582},
4   {5., 1.54993}, {6., 1.42469}, {7., 1.4546}, {8., 1.57419},
5   {9., 1.66504}, {10., 1.65835}, {11., 1.57831}, {12., 1.50497},
6   {13., 1.49936}, {14., 1.55621}, {15., 1.61819}, {16., 1.6313},
7   {17., 1.59014}, {18., 1.53661}, {19., 1.51863}, {20., 1.54824}}]
8 \dataplot[plotstyle=curve,showpoints=true,
9   dotstyle=triangle]{\mydata}
10 \psline{<->}(0,2)(0,0)(20,0)
```


\listplot*[*par*]{*list*}

\listplot is yet another way of plotting lists of data. This time, *list* should be a list of data (coordinate pairs), delimited only by white space. *list* is first expanded by T_EX and then by PostScript. This means that *list* might be a PostScript program that leaves on the stack a list of data, but you can also include data that has been retrieved with **\readdata** and **\dataplot**. However, when using the line, polygon or dots plotstyles with **showpoints=false**, **linearc=0pt** and no arrows, **\dataplot** is much less likely than **\listplot** to exceed PostScript's memory or stack limits. In the preceding example, these restrictions were not satisfied, and so the example is equivalent to when **\listplot** is used:

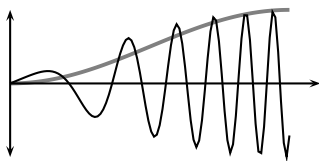
```
1 ...
2 \listplot[plotstyle=curve,showpoints=true,
3   dotstyle=triangle]{\mydata}
4 ...
```

\psplot*[*par*]{*x_{min}*}{*x_{max}*}{*function*}

\psplot can be used to plot a function $f(x)$, if you know a little PostScript. *function* should be the PostScript code for calculating $f(x)$. Note that you must use x as the dependent variable. PostScript is not designed for scientific computation, but **\psplot** is good for graphing simple functions right from within T_EX. E.g.,

```
1 \psplot[plotpoints=200]{0}{720}{x sin}
```

plots $\sin(x)$ from 0 to 720 degrees, by calculating $\sin(x)$ roughly every 3.6 degrees and then connecting the points with **\psline**. Here are plots of $\sin(x)$ $\cos((x/2)^2)$ and $\sin^2(x)$:

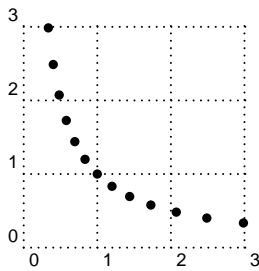


```
1 \psset{xunit=1.2pt}
2 \psplot[linecolor=gray,linewidth=1.5pt,plotstyle=curve]%
3   {0}{90}{x sin dup mul}
4 \psplot[plotpoints=100]{0}{90}{x sin x 2 div 2 exp cos mul}
5 \psline{<->}(0,-1)(0,1)
6 \psline{->}(100,0)
```

\parametricplot*[*par*]{*t_{min}*}{*t_{max}*}{*function*}

This is for a parametric plot of $(x(t), y(t))$. *function* is the PostScript code for calculating the pair $x(t) y(t)$.

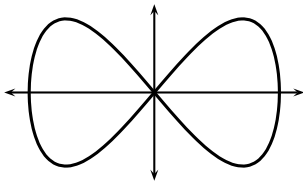
For example,



```
1 \parametricplot[plotstyle=dots,plotpoints=13]%
2 {-6}{6}{1.2 t exp 1.2 t neg exp}
```

plots 13 points from the hyperbola $xy = 1$, starting with $(1.2^{-6}, 1.2^6)$ and ending with $(1.2^6, 1.2^{-6})$.

Here is a parametric plot of $(\sin(t), \sin(2t))$:



```
1 \psset{xunit=1.7cm}
2 \parametricplot[linewidth=1.2pt,plotstyle=ccurve]%
3 {0}{360}{t sin t 2 mul sin}
4 \psline{<->}(0,-1.2)(0,1.2)
5 \psline{<->}(-1.2,0)(1.2,0)
```

The number of points that the `\psplot` and `\parametricplot` commands calculate is set by the

plotpoints=*int*

Default: 50

parameter. Using `curve` or its variants instead of `line` and increasing the value of **plotpoints** are two ways to get a smoother curve. Both ways increase the imaging time. Which is better depends on the complexity of the computation. (Note that all PostScript lines are ultimately rendered as a series (perhaps short) line segments.) Mathematica generally uses `lineto` to connect the points in its plots. The default minimum number of plot points for Mathematica is 25, but unlike `\psplot` and `\parametricplot`, Mathematica increases the sampling frequency on sections of the curve with greater fluctuation.

Part II.

New commands

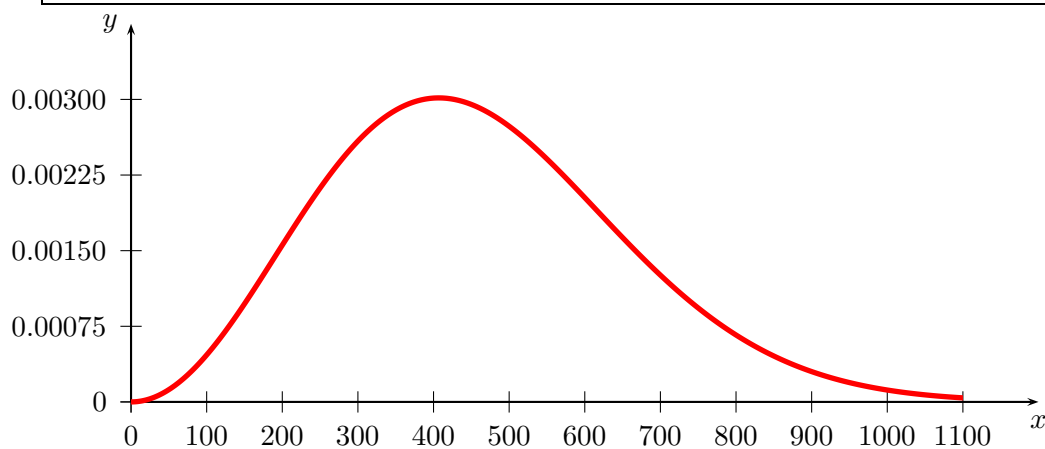
1. Extended syntax for `\psplot`, `\psparametricplot`, and `\psaxes`

There is now a new optional argument for `\psplot` and `\psparametricplot` to pass additional PostScript commands into the code. This makes the use of `\pstVerb` in most cases superfluous.

```
\psplot [Options] {x0}{x1} [PS commands] {function}
\psparametricplot [Options] {t0}{t1} [PS commands] {x(t) y(t)}
\psaxes [Options] {arrows} (x0,y0)(x1,y1)(x2,y2) [Xlabel,Xangle] [Ylabel,Yangle]
```

The macro `\psaxes` has now four optional arguments, one for the setting, one for the arrows, one for the x-label and one for the y-label. If you want only a y-label, then leave the x one empty. A missing y-label is possible. The following examples show how it can be used.

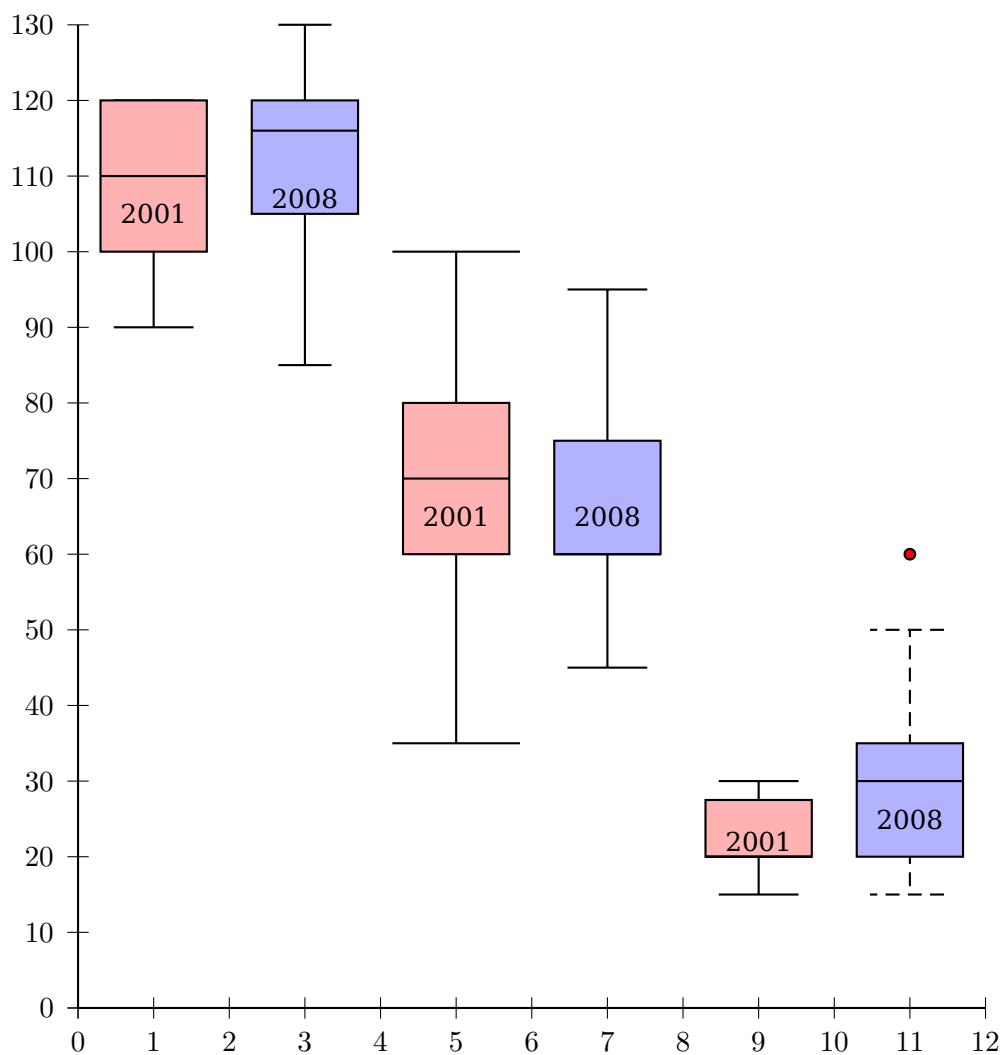
```
1 \begin{pspicture}(-1,-0.5)(12,5)
2   \psaxes[Dx=100,dx=1,Dy=0.00075,dy=1]{->}(0,0)(12,5)[$x$,-90][$y$,180]
3   \psplot[linecolor=red, plotstyle=curve,linewidth=2pt,plotpoints=200]{0}{11}%
4     [ /const1 3.3 10 8 neg exp mul def
5       /s 10 def
6       /const2 6.04 10 6 neg exp mul def ] % optional PS commands
7     { const1 x 100 mul dup mul Euler const2 neg x 100 mul dup mul mul exp
8       mul 2000 mul}
8 \end{pspicture}
```



2. New Macro \psBoxplot

A box-and-whisker plot (often called simply a box plot) is a histogram-like method of displaying data, invented by John Tukey. The box-and-whisker plot is a box with ends at the quartiles Q_1 and Q_3 and has a statistical median M as a horizontal line in the box. The "whiskers" are lines to the farthest points that are not outliers (i.e., that are within $3/2$ times the interquartile range of Q_1 and Q_3). Then, for every point more than $3/2$ times the interquartile range from the end of a box, is a dot.

The only special optional arguments, beside all other which are valid for drawing lines and filling areas, are `IQLfactor`, `barwidth`, and `arrowlength`, where the latter is a factor which is multiplied with the `barwidth` for the line ends. The `IQLfactor`, preset to 1.5, defines the area for the outliers.



```

1 \begin{pspicture}(-1,-1)(12,14)
2 \psset{yunit=0.1,fillstyle=solid}
3 \savedata{\data}[100 90 120 115 120 110 100 110 100 90 100 100 120 120 120]
4 \rput(1,0){\psBoxplot[fillcolor=red!30]{\data}}

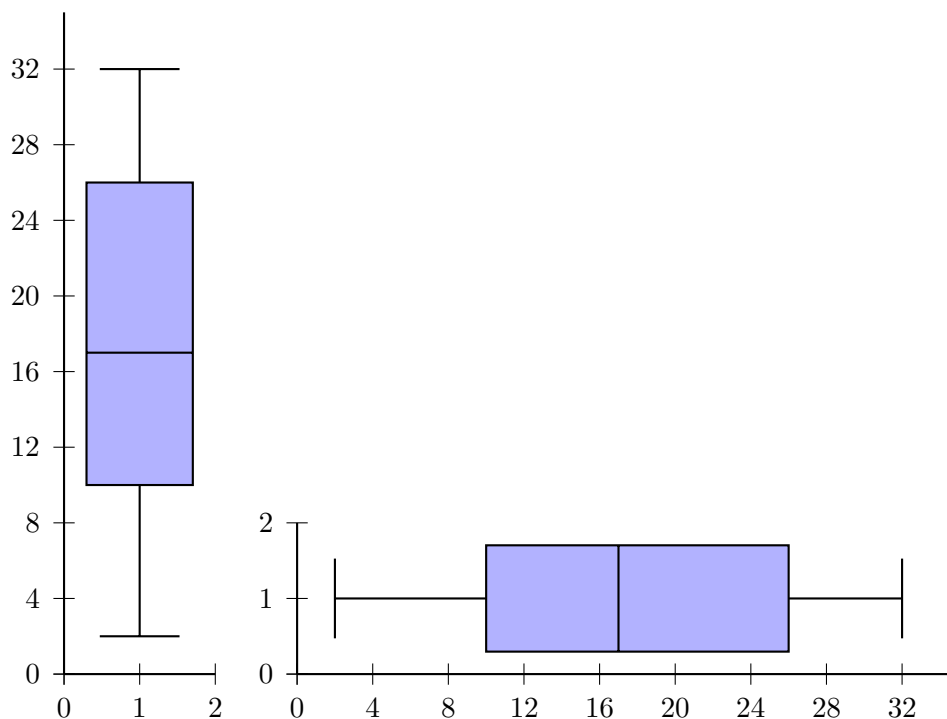
```

```

5 \rput(1,105){2001}
6 \savedata{\data}[90 120 115 116 115 110 90 130 120 120 120 85 100 130 130]
7 \rput(3,0){\psBoxplot[arrowlength=0.5,fillcolor=blue!30]{\data}}
8 \rput(3,107){2008}
9 \savedata{\data}[35 70 90 60 100 60 60 80 80 60 50 55 90 70 70]
10 \rput(5,0){\psBoxplot[barwidth=40pt,arrowlength=1.2,fillcolor=red!30]{\data}}
11 \rput(5,65){2001}
12 \savedata{\data}[60 65 60 75 75 60 50 90 95 60 65 45 45 60 90]
13 \rput(7,0){\psBoxplot[barwidth=40pt,fillcolor=blue!30]{\data}}
14 \rput(7,65){2008}
15 \savedata{\data}[20 20 25 20 15 20 20 25 30 20 20 20 30 30 30]
16 \rput(9,0){\psBoxplot[fillcolor=red!30]{\data}}
17 \rput(9,22){2001}
18 \savedata{\data}[20 30 20 35 35 20 20 60 50 20 35 15 30 20 40]
19 \rput(11,0){\psBoxplot[fillcolor=blue!30,linestyle=dashed]{\data}}
20 \rput(11,25){2008}
21 \psaxes[dy=1cm,Dy=10](0,0)(12,130)
22 \end{pspicture}

```

The next example uses an external file for the data, which must first be read by the macro \readdata. The next one creates a horizontal boxplot by rotating the output with -90 degrees.



```

1 \readdata{\data}{boxplot.data}
2 \begin{pspicture}(-1,-1)(2,10)
3 \psset{yunit=0.25,fillstyle=solid}
4 \savedata{\data}[2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32]

```

```
5 \rput(1,0){\psBoxplot[fillcolor=blue!30]{\data}}
6 \psaxes[dy=1cm,Dy=4](0,0)(2,35)
7 \end{pspicture}
8 %
9 \begin{pspicture}(-1,-1)(11,2)
10 \psset{xunit=0.25,fillstyle=solid}
11 \savedata{\data}[2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32]
12 \rput{-90}(0,1){\psBoxplot[yunit=0.25,fillcolor=blue!30]{\data}}
13 \psaxes[dx=1cm,Dx=4](0,0)(35,2)
14 \end{pspicture}
```

3. The psgraph environment

This new environment `psgraph` does the scaling, it expects as parameter the values (without units!) for the coordinate system and the values of the physical width and height (with units!). The syntax is:

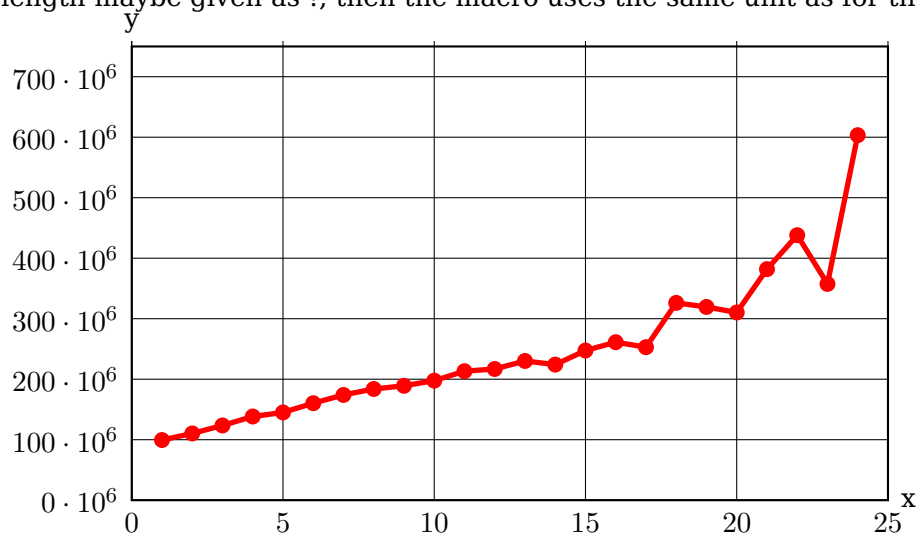
```
\psgraph [Options] {<arrows>}%
  (xOrig,yOrig) (xMin,yMin) (xMax,yMax) {xLength}{yLength}
...
\endpsgraph

\begin{psgraph} [Options] {<arrows>}%
  (xOrig,yOrig) (xMin,yMin) (xMax,yMax) {xLength}{yLength}
...
\end{psgraph}
```

where the options are valid **only** for the the `\psaxes` macro. The first two arguments have the usual PSTricks behaviour.

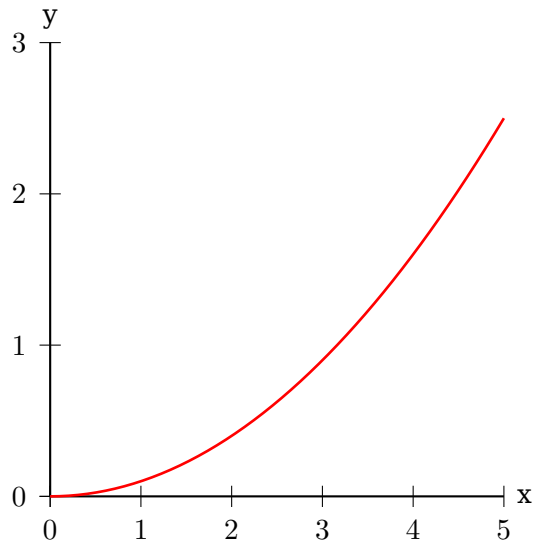
- if $(xOrig, yOrig)$ is missing, it is substituted to $(xMin, xMax)$;
- if $(xOrig, yOrig)$ **and** $(xMin, yMin)$ are missing, they are both substituted to $(0, 0)$.

The y-length maybe given as !; then the macro uses the same unit as for the x-axis.



```
1 \readdata{\data}{demo1.data}
2 \pstScalePoints(1,0.000001){}{% (x,y){additional x operator}{y op}
3 \psset{llx=-1cm, lly=-1cm}
4 \begin{psgraph}[axesstyle=frame,xticks=0 759,yticks=0 25,%
5   subticks=0,ylabelFactor=\cdot 10^6,
6   Dx=5,dy=100\psyunit,Dy=100](0,0)(25,750){10cm}{6cm} % parameters
7   \listplot[linecolor=red,linewidth=2pt,showpoints=true]{\data}
8 \end{psgraph}
```

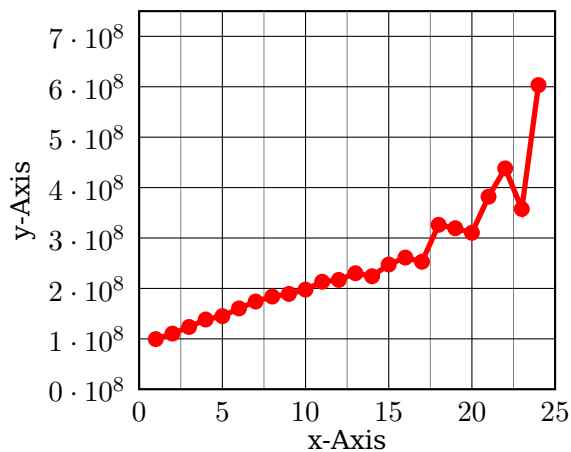
In the following example, the y unit gets the same value as the one for the x-axis.



```

1 \psset{llx=-1cm, lly=-0.5cm, ury=0.5cm}
2 \begin{psgraph}(0,0)(5,3){6cm}{!} % x-y-axis with same unit
3   \psplot[linecolor=red,linewidth=1pt]{0}{5}{x dup mul 10 div}
4 \end{psgraph}

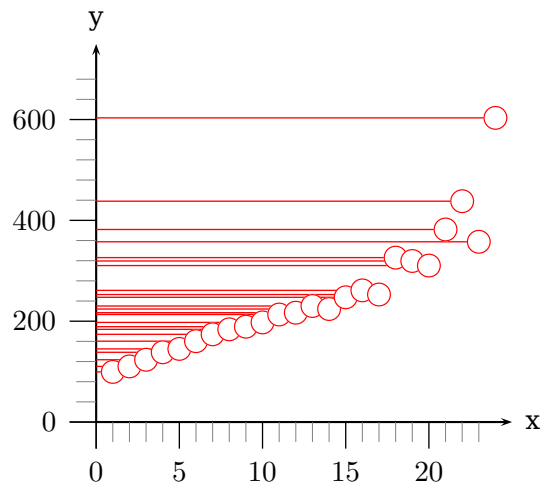
```



```

1 \readdata{\data}{demo1.data}
2 \psset{xAxisLabel=x-Axis,yAxisLabel=y-Axis,llx=-.5cm,lly=-1cm,ury=0.5cm,
3   xAxisLabelPos={c,-1},yAxisLabelPos={-7,c}}
4 \pstScalePoints(1,0.00000001){}{}
5 \begin{psgraph}[axesstyle=frame,xticks=0 7.5,yticks=0 25,subticks=1,
6   ylabelFactor=\cdot 10^8,Dx=5,Dy=1,xsubticks=2](0,0)(25,7.5){5.5cm}{5cm}
7   \listplot[linecolor=red,linewidth=2pt,showpoints=true]{\data}
8 \end{psgraph}

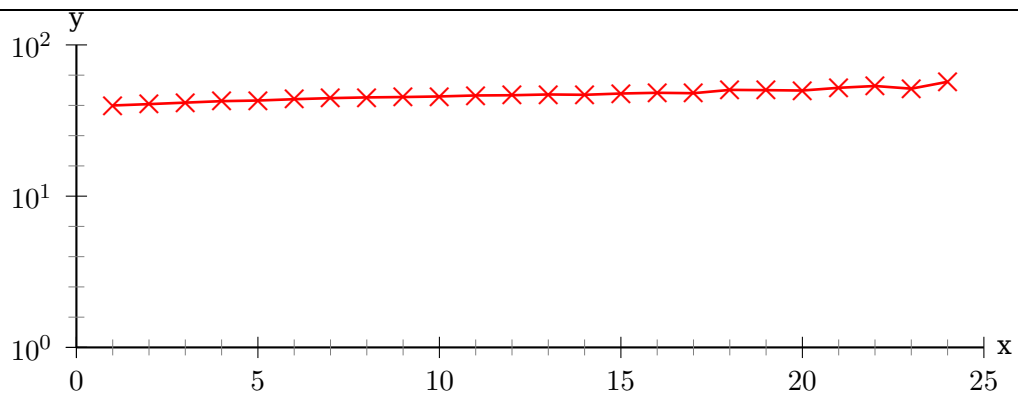
```



```

1 \readdata{\data}{demo1.data}
2 \psset{llx=-0.5cm,lly=-1cm}
3 \pstScalePoints(1,0.000001){}{}
4 \psgraph[arrows=->,Dx=5,dy=200\psyunit,Dy=200,subticks=5,ticks=-10pt 0,
5   tickwidth=0.5pt,subtickwidth=0.1pt](0,0)(25,750){5.5cm}{5cm}
6 \listplot[linecolor=red,linewidth=0.5pt,showpoints=true,dotscale=3,
7   plotstyle=LineToYAxis,dotstyle=o]{\data}
8 \endpsgraph

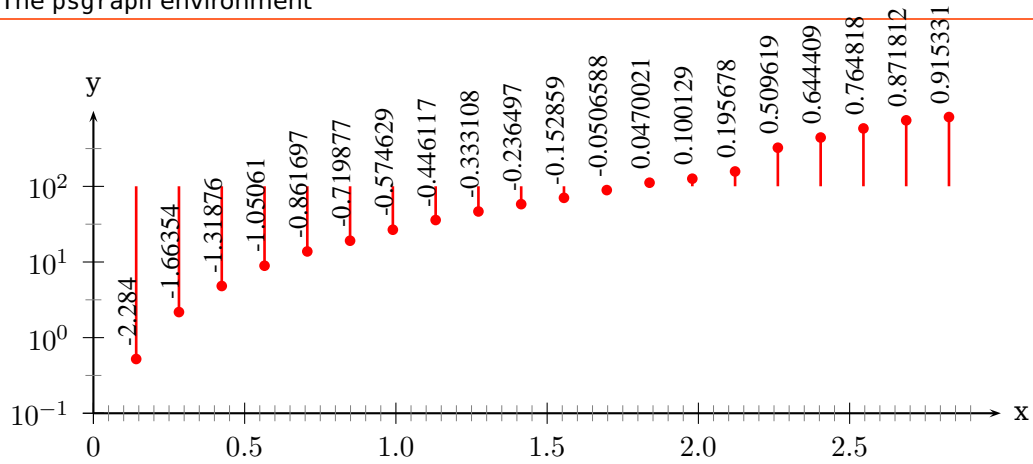
```



```

1 \readdata{\data}{demo1.data}
2 \pstScalePoints(1,0.2){}{log}
3 \psset{lly=-0.75cm}
4 \psgraph[ylogBase=10,Dx=5,Dy=1,subticks=5](0,0)(25,2){12cm}{4cm}
5   \listplot[linecolor=red,linewidth=1pt,showpoint,dotstyle=x,dotscale=2]{\data
6     }
7 \endpsgraph

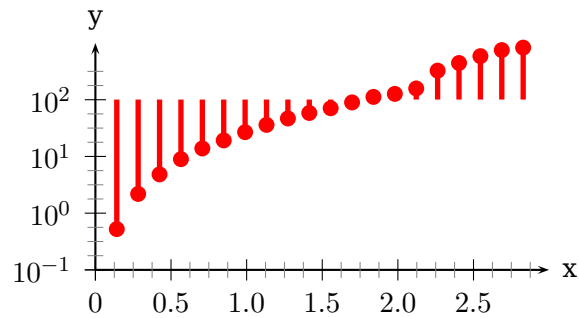
```



```

1 \readdata{\data}{demo0.data}
2 \psset{lly=-0.75cm,ury=0.5cm}
3 \pstScalePoints(1,1){}{log}
4 \begin{psgraph}[arrows=->,Dx=0.5,ylogBase=10,Oy=-1,xsubticks=10,%
5   ysubticks=2](0,-3)(3,1){12cm}{4cm}
6   \psset{Oy=-2}% must be global
7   \listplot[linecolor=red,linewidth=1pt,showpoints=true,
8     plotstyle=LineToXAxis]{\data}
9   \listplot[plotstyle=values,rot=90]{\data}
10 \end{psgraph}

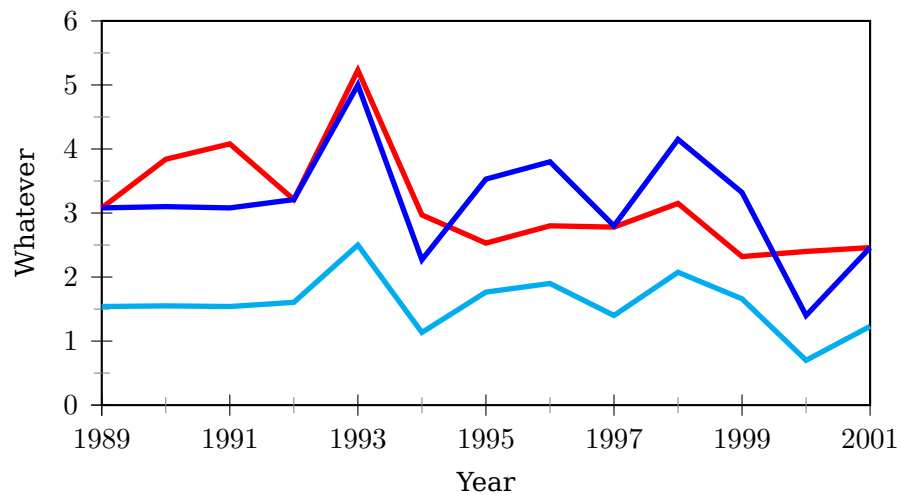
```



```

1 \psset{lly=-0.75cm,ury=0.5cm}
2 \readdata{\data}{demo0.data}
3 \pstScalePoints(1,1){}{log}
4 \psgraph[arrows=->,Dx=0.5,ylogBase=10,Oy=-1,subticks=4](0,-3)(3,1){6cm}{3cm}
5   \listplot[linecolor=red,linewidth=2pt,showpoints=true,plotstyle=LineToXAxis
6     ]{\data}
6 \endpsgraph

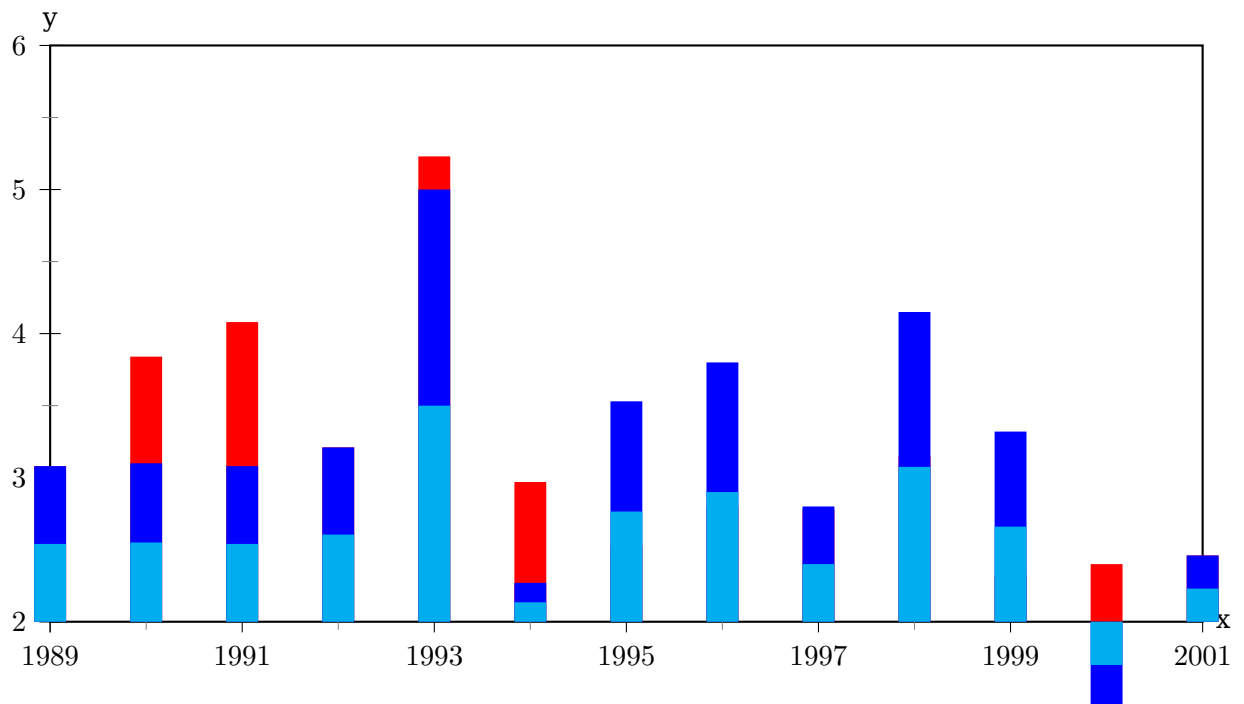
```



```

1 \readdata{\data}{demo2.data}%
2 \readdata{\dataII}{demo3.data}%
3 \pstScalePoints(1,1){1989 sub}{}
4 \psset{llx=-0.5cm,lly=-1cm, xAxisLabel=Year,yAxisLabel=Whatever,%
5   xAxisLabelPos={c,-0.4in},yAxisLabelPos={-0.4in,c}}
6 \psgraph[axesstyle=frame,Dx=2,Ox=1989,subticks=2](0,0)(12,6){4in}{2in}%
7 \listplot[linecolor=red,linewidth=2pt]{\data}
8 \listplot[linecolor=blue,linewidth=2pt]{\dataII}
9 \listplot[linecolor=cyan,linewidth=2pt,yunit=0.5]{\dataII}
10 \endpsgraph

```



```

1 \readdata{\data}{demo2.data}%
2 \readdata{\dataII}{demo3.data}%
3 \psset{llx=-0.5cm,lly=-0.75cm,plotstyle=LineToXAxis}

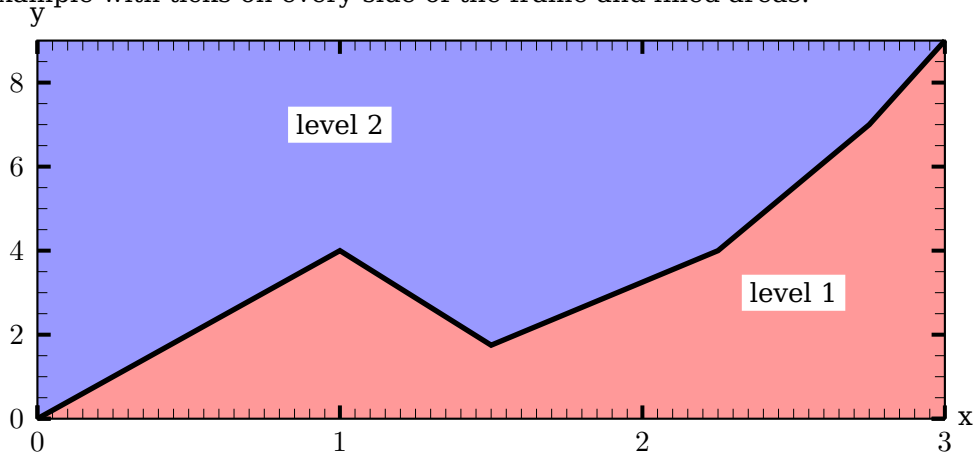
```

```

4 \pstScalePoints(1,1){1989 sub}{2 sub}
5 \begin{psgraph}[axesstyle=frame,Dx=2,0x=1989,0y=2,subticks=2](0,0)(12,4){6in}{3
  in}
6 \listplot[linecolor=red,linewidth=12pt]{\data}
7 \listplot[linecolor=blue,linewidth=12pt]{\dataII}
8 \listplot[linecolor=cyan,linewidth=12pt,yunit=0.5]{\dataII}
9 \end{psgraph}

```

An example with ticks on every side of the frame and filled areas:



```

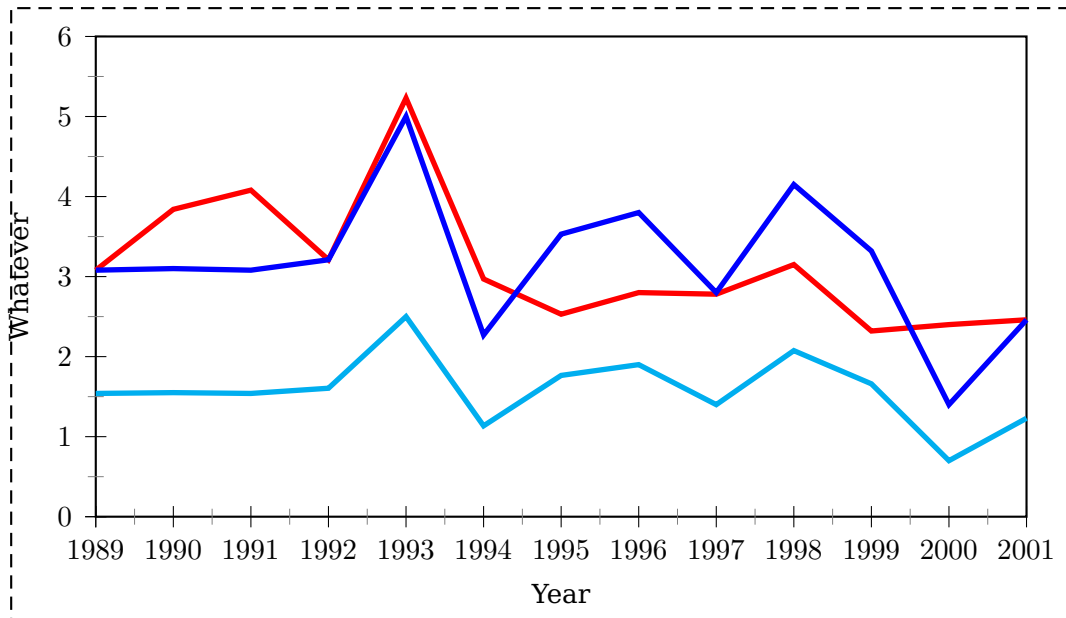
1 \def\data{0 0 1 4 1.5 1.75 2.25 4 2.75 7 3 9}
2 \psset{lly=-0.5cm}
3 \begin{psgraph}[axesstyle=none,ticks=none](0,0)(3.0,9.0){12cm}{5cm}
4 \pscustom[fillstyle=solid,fillcolor=red!40,linestyle=none]{%
5 \listplot{\data}
6 \psline(3,9)(3,0)}
7 \pscustom[fillstyle=solid,fillcolor=blue!40,linestyle=none]{%
8 \listplot{\data}
9 \psline(3,9)(0,9)}
10 \listplot[linewidth=2pt]{\data}
11 \psaxes[axesstyle=frame,ticks=0 5pt,xsubticks=20,ysubticks=4,
12 tickstyle=inner,dy=2,Dy=2,tickwidth=1.5pt,subtickcolor=black](0,0)(3,9)
13 \rput*(2.5,3){level 1}\rput*(1,7){level 2}
14 \end{psgraph}

```

3.1. The new options for nxLenvpsgraph

| name | default | meaning |
|---------------|---------|----------------------------|
| xAxisLabel | x | label for the x-axis |
| yAxisLabel | y | label for the y-axis |
| xAxisLabelPos | {} | where to put the x-label |
| yAxisLabelPos | {} | where to put the y-label |
| llx | 0pt | trim for the lower left x |
| lly | 0pt | trim for the lower left y |
| urx | 0pt | trim for the upper right x |
| ury | 0pt | trim for the upper right y |

There is one restriction in using the trim parameters, they must be set **before** `\psgraph` is called. They are redundant when used as parameters of `\psgraph` itself. The `xAxisLabelPos` and `yAxisLabelPos` options can use the letter `c` for centering an x -axis or y -axis label. The `c` is a replacement for the x or y value. When using values with units, the position is always measured from the origin of the coordinate system, which can be outside of the visible `pspicture` environment.



```

1 \readdata{\data}{demo2.data}%
2 \readdata{\dataII}{demo3.data}%
3 \psset{llx=-1cm, lly=-1.25cm, urx=0.5cm, ury=0.1in, xAxisLabel=Year, %
4   yAxisLabel=Whatever, xAxisLabelPos={c, -0.4in}, %
5   yAxisLabelPos={-0.4in, c}}
6 \pstScalePoints(1,1){1989 sub}{}
7 \psframebox[linestyle=dashed, boxsep=false]{}
8 \begin{psgraph}[axesstyle=frame, 0x=1989, subticks=2](0,0)(12,6){0.8\linewidth
9   }{2.5in}%
10 \listplot[linecolor=red, linewidth=2pt]{\data}%
11 \listplot[linecolor=blue, linewidth=2pt]{\dataII}%
12 \listplot[linecolor=cyan, linewidth=2pt, yunit=0.5]{\dataII}%
13 \end{psgraph}%

```

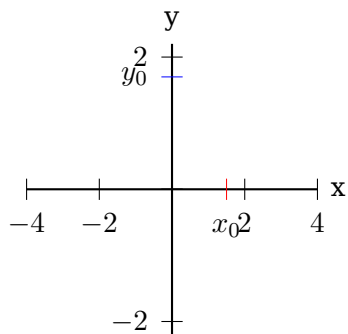
4. \psxTick and \psyTick

Single ticks with labels on an axis can be set with the two macros `\psxTick` and `\psyTick`. The label is set with the macro `\pshlabel`, the setting of `mathLabel` is taken into account.

```

\psxTick [Options] [x value]{label}
\psyTick [Options] [y value]{label}

```



```

1 \begin{psgraph}[Dx=2,Dy=2](0,0)
   (-4,-2.2)(4,2.2){.5\textwidth}{!}
2 \psxTick[linecolor=red](1.5){x_0}
3 \psyTick[linecolor=blue](1.7){y_0}
4 \end{psgraph}

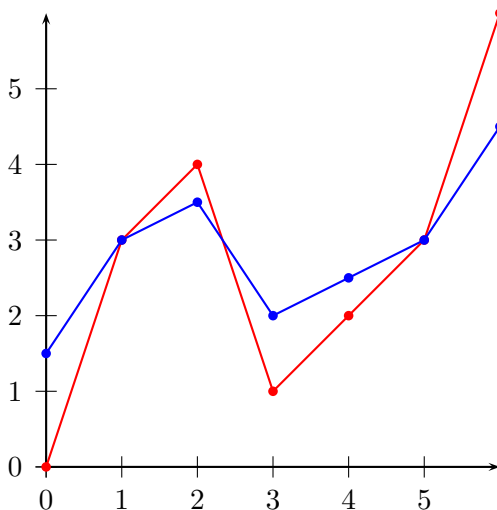
```

5. \pstScalePoints

The syntax is

```
\pstScalePoints(xScale,xScale){xPS}{yPS}
```

$xScale, yScale$ are decimal values used as scaling factors, the xPS and yPS are additional PostScript code applied to the x - and y -values of the data records. This macro is only valid for the `\listplot` macro!



```

1 \def\data{%
2   0 0 1 3 2 4 3 1
3   4 2 5 3 6 6 }
4 \begin{pspicture}(-0.5,-1)(6,6)
5   \psaxes{->}(0,0)(6,6)
6   \listplot[showpoints=true,%
7     linecolor=red]{\data}
8   \pstScalePoints(1,0.5){}{3 add}
9   \listplot[showpoints=true,%
10    linecolor=blue]{\data}
11 \end{pspicture}

```

`\pstScalePoints(1,0.5){}{3 add}` means that **first** the value 3 is added to the y values and **second** this value is scaled with the factor 0.5. As seen for the blue line for $x = 0$ we get $y(0) = (0 + 3) \cdot 0.5 = 1.5$.

Changes with `\pstScalePoints` are always global to all following `\listplot` macros. This is the reason why it is a good idea to reset the values at the end of the `pspicture` environment.

6. New or extended options

6.1. Introduction

The option `tickstyle=full |top|bottom no` no longer works in the usual way. Only the additional value `inner` is valid for `pst-plot`, because everything can be set by the

ticksize option. When using the comma or trigLabels option, the macros `\pshlabel` and `\psvlabel` shouldn't be redefined, because the package does it itself internally in these cases. However, if you need a redefinition, then do it for `\pst@@@hlabel` and `\pst@@@vlabel` with

```
\makeatletter
\def\pst@@@hlabel#1{...}
\def\pst@@@vlabel#1{...}
\makeatother
```

Table 1: All new parameters for `pst-plot`

| <i>name</i> | <i>type</i> | <i>default</i> | <i>page</i> |
|-------------------------------|--|------------------------------|-------------|
| <code>axesstyle</code> | <code>none axes frame polar inner</code> | <code>axes</code> | 26 |
| <code>barwidth</code> | <code>length</code> | <code>0.25cm</code> | 66 |
| <code>ChangeOrder</code> | <code>boolean</code> | <code>false</code> | 64 |
| <code>comma</code> | <code>boolean</code> | <code>false</code> | 31 |
| <code>decimals</code> | <code>integer</code> | <code>-1¹</code> | 71 |
| <code>decimalSeparator</code> | <code>char</code> | <code>.</code> | 31 |
| <code>fontscale</code> | <code>real</code> | <code>10</code> | 71 |
| <code>ignoreLines</code> | <code>integer</code> | <code>0</code> | 56 |
| <code>labelFontSize</code> | <code>macro</code> | <code>{}</code> | 29 |
| <code>labels</code> | <code>all x y none</code> | <code>all</code> | 27 |
| <code>llx</code> | <code>length</code> | <code>0pt</code> | 19 |
| <code>lly</code> | <code>length</code> | <code>0pt</code> | 19 |
| <code>logLines</code> | <code>none x y all</code> | <code>none</code> | 45 |
| <code>mathLabel</code> | <code>boolean</code> | <code>false</code> | 29 |
| <code>nEnd</code> | <code>integer or empty</code> | <code>{}</code> | 61 |
| <code>nStart</code> | <code>integer</code> | <code>0</code> | 60 |
| <code>nStep</code> | <code>integer</code> | <code>1</code> | 57 |
| <code>plotNo</code> | <code>integer</code> | <code>1</code> | 62 |
| <code>plotNoMax</code> | <code>integer</code> | <code>1</code> | 62 |
| <code>polarplot</code> | <code>boolean</code> | <code>false</code> | 73 |
| <code>PSfont</code> | <code>PS font</code> | <code>Times-Romasn</code> | 71 |
| <code>subtickcolor</code> | <code>color</code> | <code>darkgray</code> | 44 |
| <code>subticklinestyle</code> | <code>solid dashed dotted none</code> | <code>solid</code> | 45 |
| <code>subticks</code> | <code>integer</code> | <code>0</code> | 43 |
| <code>subticksize</code> | <code>real</code> | <code>0.75</code> | 43 |
| <code>subtickwidth</code> | <code>length</code> | <code>0.5\pslinewidth</code> | 52 |
| <code>tickcolor</code> | <code>color</code> | <code>black</code> | 44 |
| <code>ticklinestyle</code> | <code>solid dashed dotted none</code> | <code>solid</code> | 45 |
| <code>ticks</code> | <code>all x y none</code> | <code>all</code> | 40 |

continued ...

¹ A negative value plots all decimals

... continued

| <i>name</i> | <i>type</i> | <i>default</i> | <i>page</i> |
|-------------------|--------------------------|-----------------|-------------|
| ticksize | length [length] | -4pt 4pt | 41 |
| tickstyle | full top bottom inner | full | 41 |
| tickwidth | length | 0.5\pslinewidth | 52 |
| trigLabelBase | integer | 0 | 32 |
| trigLabels | boolean | false | 32 |
| urx | length | 0pt | 19 |
| ury | length | 0pt | 19 |
| valuewidth | integer | 10 | 71 |
| xAxis | boolean | true | 27 |
| xAxisLabel | literal | {\@empty} | 19 |
| xAxisLabelPos | (x,y) or empty | {\@empty} | 19 |
| xDecimals | integer or empty | {} | 32 |
| xEnd | integer or empty | {} | 61 |
| xlabelFactor | anything | {\@empty} | 30 |
| xlabelPos | bottom,axis,top | bottom | 28 |
| xlogBase | integer or empty | {} | 50 |
| xticklinestyle | solid dashed dotted none | solid | 45 |
| xStart | integer or empty | {} | 60 |
| xStep | integer | 0 | 57 |
| xsubtickcolor | color | darkgray | 44 |
| xsubticklinestyle | solid dashed dotted none | solid | 45 |
| xsubticks | integer | 0 | 43 |
| xsubticksize | real | 0.75 | 43 |
| xtickcolor | color | black | 44 |
| xticksize | length [length] | -4pt 4pt | 41 |
| xtrigLabels | boolean | false | 37 |
| xyAxes | boolean | true | 27 |
| xyDecimals | integer or empty | {} | 32 |
| xylogBase | integer or empty | {} | 47 |
| yAxis | boolean | true | 27 |
| yAxisLabel | literal | {\@empty} | 19 |
| yAxisLabelPos | (x,y) or empty | {\@empty} | 19 |
| yDecimals | integer or empty | {} | 32 |
| yEnd | integer or empty | {} | 62 |
| ylabelFactor | literal | {\@empty} | 30 |
| ylabelPos | left axis right | left | 28 |
| ylogBase | integer or empty | {} | 48 |
| yMaxValue | real | -1 | 24 |
| yStart | integer or empty | {} | 62 |
| yStep | integer | 0 | 57 |
| ysubtickcolor | <color> | darkgray | 44 |

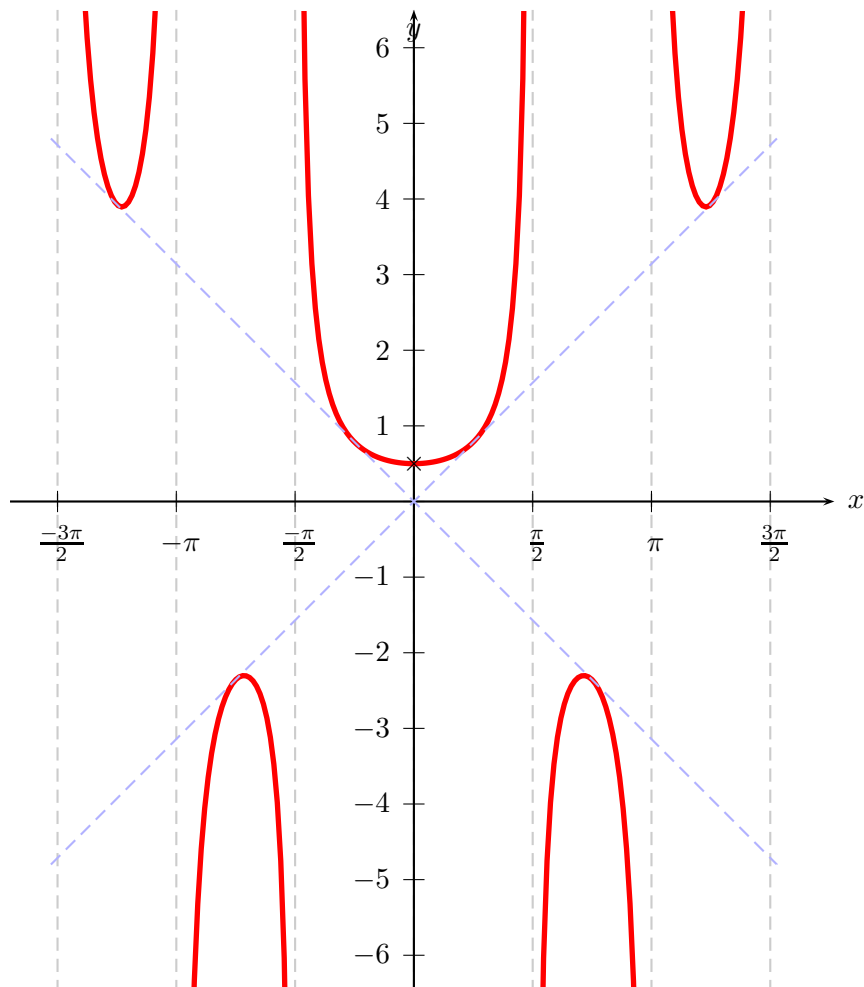
continued ...

... continued

| <i>name</i> | <i>type</i> | <i>default</i> | <i>page</i> |
|-------------------|--------------------------|----------------|-------------|
| ysubticklinestyle | solid dashed dotted none | solid | 45 |
| ysubticks | integer | 0 | 43 |
| ysubticksiz | real | 0.75 | 43 |
| ytickcolor | color> | black | 44 |
| yticklinestyle | solid dashed dotted none | solid | 45 |
| yticksiz | length [length] | -4pt 4pt | 41 |
| ytrigLabels | boolean | false | 37 |

6.2. Option yMaxValue

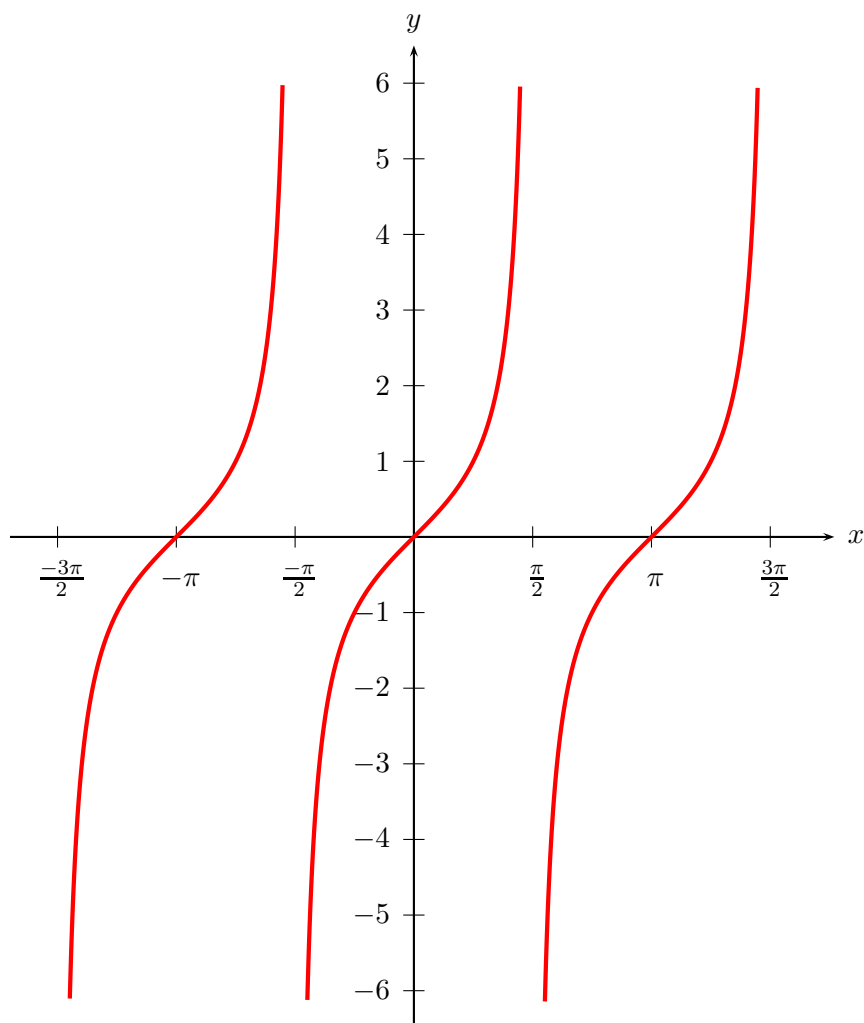
With the new optional argument `yMaxValue` one can control the behaviour of discontinuous functions, like the tangent function. If `yMaxValue` is set to a negative value, then the internal `if` clause is disabled, the function is plotted in the usual way.



```

1 \begin{pspicture}(-6.5,-7)(6.5,7.5)
2 \multido{\rA=-4.71239+\psPiH}{7}{%
3   \psline[linecolor=black!20,linestyle=dashed](\rA,-6.5)(\rA,6.5)}
4 \psset{algebraic=true,plotpoints=200,plotstyle=line}
5 \psaxes[trigLabelBase=2,dx=\psPiH,xunit=\psPi,trigLabels]
6   {->}(0,0)(-1.7,-6.5)(1.77,6.5)[$x$,0][$y$, -90]
7 \psclip{\psframe[linestyle=none](-4.55,-6.5)(5.55,6.5)}
8 \psplot[yMaxValue=10,linewidth=2pt,linecolor=red]{-4.55}{4.55}{(x)/(sin(2*x))
9   }
9 \endpsclip
10 \psplot[linestyle=dashed,linecolor=blue!30]{-4.8}{4.8}{x}
11 \psplot[linestyle=dashed,linecolor=blue!30]{-4.8}{4.8}{-x}
12 \rput(0,0.5){$\times$}
13 \end{pspicture}

```



```

1 \begin{pspicture}(-6.5,-7)(6.5,7.5)
2 \psaxes[trigLabelBase=2,dx=\psPiH,xunit=\psPi,trigLabels]%

```

```

3 | {->}(0,0)(-1.7,-6.5)(1.77,6.5)[x$,0][y$,90]
4 | \psset{algebraic=true}
5 | \psplot[yMaxValue=6,linewidth=1.6pt,plotpoints=2000,
6 |   linecolor=red]{-4.55}{4.55}{tan(x)}
7 | \end{pspicture}

```

6.3. Option axesstyle

There is a new axes style polar which plots a polar coordinate system.

Syntax:

```

\psplot[axesstyle=polar](Rx,Ry)
\psplot[axesstyle=polar](...)(Rx,Ry)
\psplot[axesstyle=polar](...)(...)(Rx,Ry)

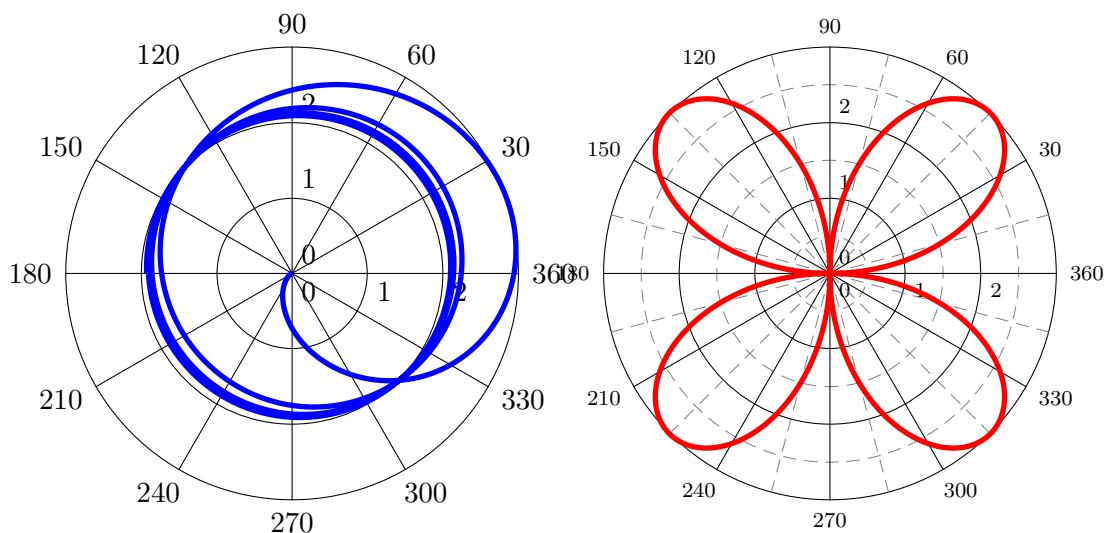
```

Important is the fact, that only one pair of coordinates is taken into account for the radius. It is *always* the last pair in a sequence of allowed coordinates for the `\psaxes` macro. The other ones are ignored; they are not valid for the polar coordinate system.

```

1 | \begin{pspicture}(-3.5,-3.5)(3.5,3.5)
2 | \psaxes[axesstyle=polar](3,3)
3 | \psplot[polarplot,algebraic=true,linecolor=blue,linewidth=2pt,
4 |   plotpoints=2000]{0}{TwoPi 4 mul}{2*(sin(x)-x)/(cos(x)+x)}
5 | \end{pspicture}
6 | %
7 | \begin{pspicture}(-3.5,-3.5)(3.5,3.5)
8 | \psaxes[axesstyle=polar,subticklinestyle=dashed,subticks=2,
9 |   labelFontSize=\scriptstyle](3,3)
10 | \psplot[polarplot,algebraic=true,linecolor=red,linewidth=2pt,
11 |   plotpoints=2000]{0}{TwoPi}{6*sin(x)*cos(x)}
12 | \end{pspicture}

```



All valid optional arguments for the axes are also possible for the polar style, if they make sense ... :-) Important are the `Dy` option, it defines the angle interval and

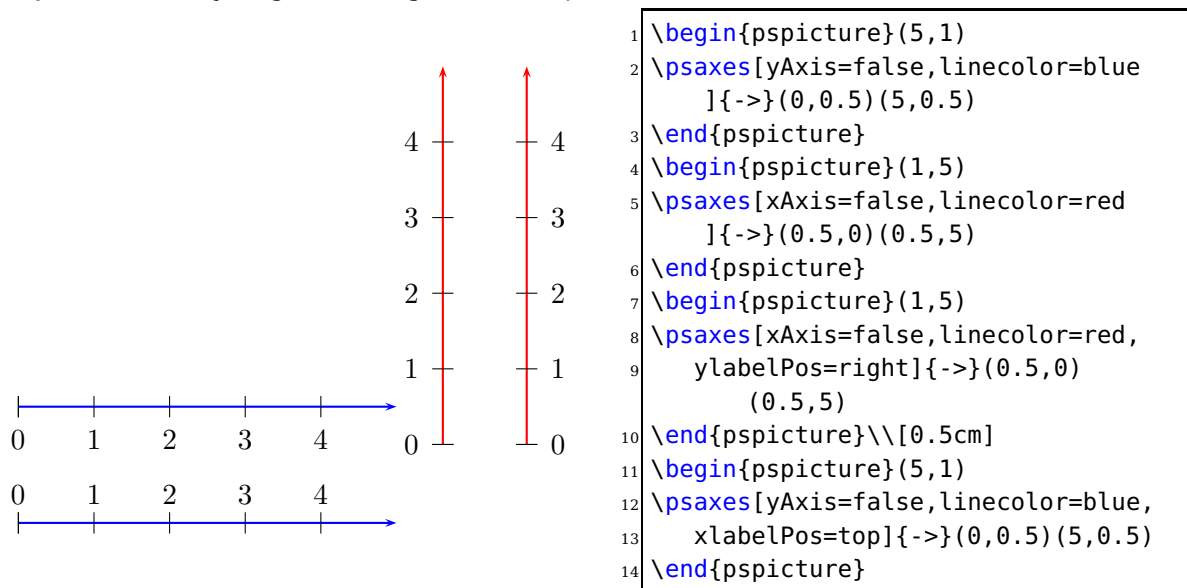
subticks, for the intermediate circles and lines. The number can be different for the circles (ysubticks) and the lines (xsubticks).

6.4. Option xyAxes, xAxis and yAxis

Syntax:

```
xyAxes=true|false
xAxis=true|false
yAxis=true|false
```

Sometimes there is only a need for one axis with ticks. In this case you can set one of the preceding options to false. The xyAxes only makes sense when you want to set both x and y to true with only one command, back to the default, because with xyAxes=false you get nothing with the \psaxes macro.



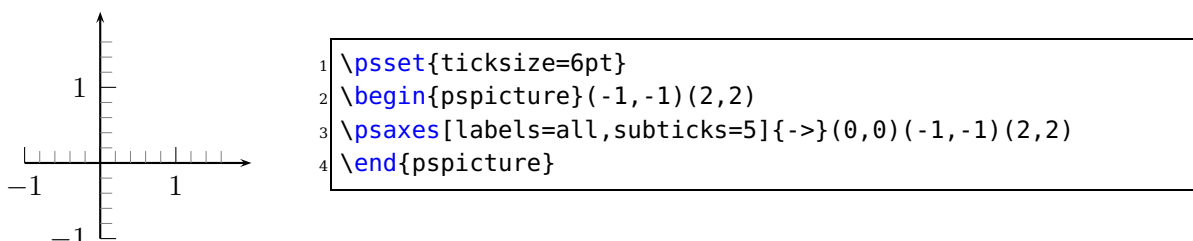
As seen in the example, a single y axis gets the labels on the left side. This can be changed with the option ylabelPos or with xlabelPos for the x-axis.

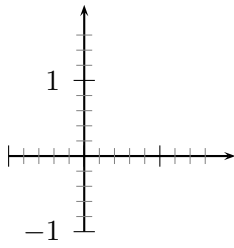
6.5. Option labels

Syntax:

```
labels=all|x|y|none
```

This option was already in the pst-plot package and only mentioned here for completeness.

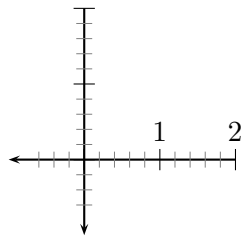




```

1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[labels=y,subticks=5]{->}(0,0)(-1,-1)(2,2)
3 \end{pspicture}

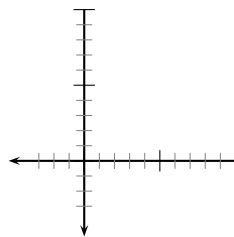
```



```

1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[labels=x,subticks=5]{->}(0,0)(2,2)(-1,-1)
3 \end{pspicture}

```



```

1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[labels=none,subticks=5]{->}(0,0)(2,2)(-1,-1)
3 \end{pspicture}

```

6.6. Options xlabelPos and ylabelPos

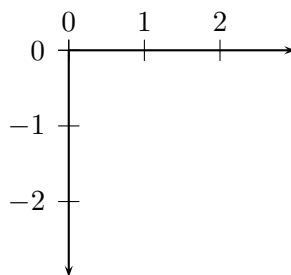
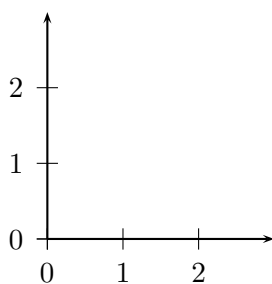
Syntax:

```

xlabelPos=bottom|axis|top
ylabelPos=left|axis|right

```

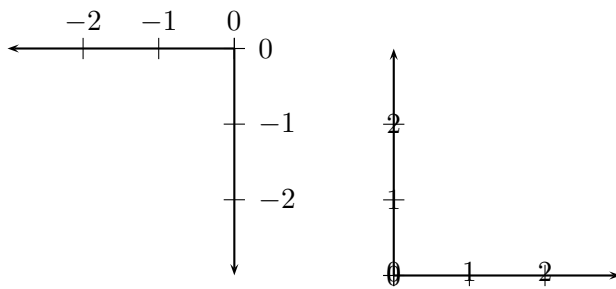
By default the labels for ticks are placed at the bottom (x axis) and left (y-axis). If both axes are drawn in the negative direction the default is top (x axis) and right (y axis). It be changed with the two options `xlabelPos` and `ylabelPos`. With the value `axis` the user can place the labels depending on the value of `labelsep`, which is taken into account for axis.



```

1 \begin{pspicture}(3,3)
2 \psaxes{->}(3,3)
3 \end{pspicture}\hspace{2cm}
4 \begin{pspicture}(3,-3)
5 \psaxes[xlabelPos=top
6 ]{->}(3,-3)

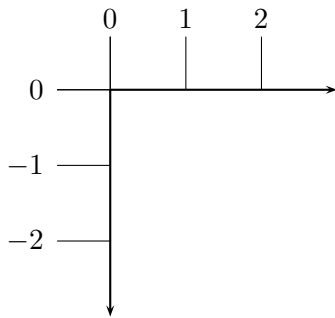
```



```

1 \begin{pspicture}(-3,-3)
2 \psaxes{->}(-3,-3)
3 \end{pspicture}\hspace{2cm}
4 \begin{pspicture}(3,3)
5 \psaxes[labelsep=0pt,
6   ylabelPos=axis,
7   xlabelPos=axis]{->}(3,3)
8 \end{pspicture}

```



```

1 \begin{pspicture}(-1,1)(3,-3)
2 \psaxes[xlabelPos=top,
3   xticksize=0 20pt,
4   yticksize=-20pt 0]{->}(3,-3)
5 \end{pspicture}

```

6.7. Options labelFontSize and mathLabel

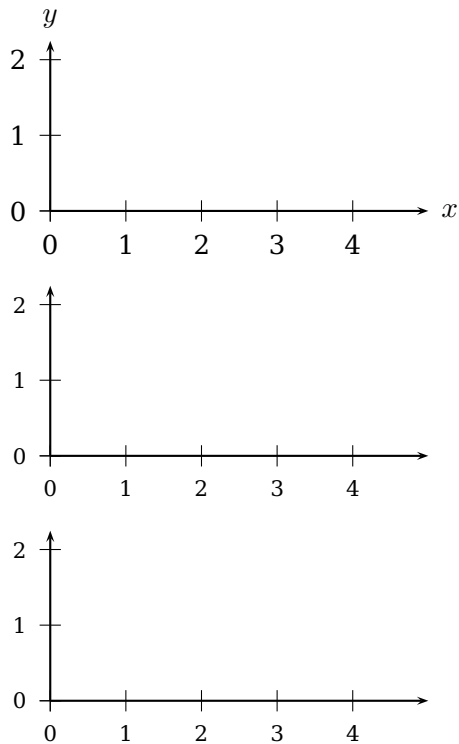
This option sets the horizontal **and** vertical font size for the labels depending on the option `mathLabel` for the text or the math mode. It will be overwritten when another package or a user defines

```

\def\pshlabel#1{\labelFontSize ...}
\def\psvlabel#1{\labelFontSize ...}
\def\pshlabel#1{\labelFontSize ...}$% for mathLabel=true (default)
\def\psvlabel#1{\labelFontSize ...}$% for mathLabel=true (default)

```

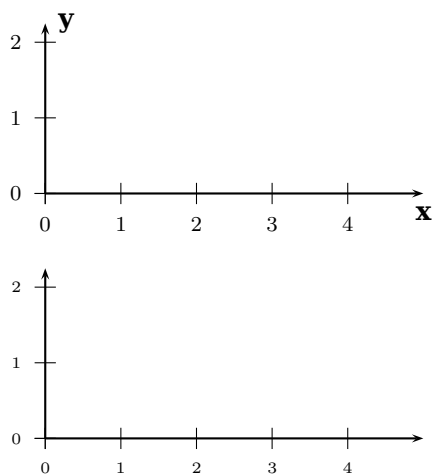
in another way. Note that for `mathLabel=true` the font size must be set by one of the mathematical styles `\textstyle`, `\displaystyle`, `\scriptstyle`, or `\scriptscriptstyle`.



```

1 \psset{mathLabel=false}
2 \begin{pspicture}(-0.25,-0.25)(5,2.25)
3 \psaxes{->}(5,2.25)[$x$,0][$y$,90]
4 \end{pspicture}\[20pt]
5 \begin{pspicture}(-0.25,-0.25)(5,2.25)
6 \psaxes[labelFontSize=\footnotesize
7   ]{->}(5,2.25)
8 \end{pspicture}\[20pt]
9 \begin{pspicture}(-0.25,-0.25)(5,2.25)
10 \psaxes[labelFontSize=\footnotesize
11   ]{->}(5,2.25)
12 \end{pspicture}\[20pt]

```



```

1 \begin{pspicture}(-0.25,-0.25)(5,2.25)
2 \psaxes[labelFontSize=\scriptstyle
3   ]{->}(5,2.25)[\textbf{x},-90][\textbf{y}
4   ],0]
5 \end{pspicture}\[20pt]
6 \psset{mathLabel=true}
7 \begin{pspicture}(-0.25,-0.25)(5,2.25)
8 \psaxes[labelFontSize=\scriptscriptstyle
9   ]{->}(5,2.25)
10 \end{pspicture}\[20pt]

```

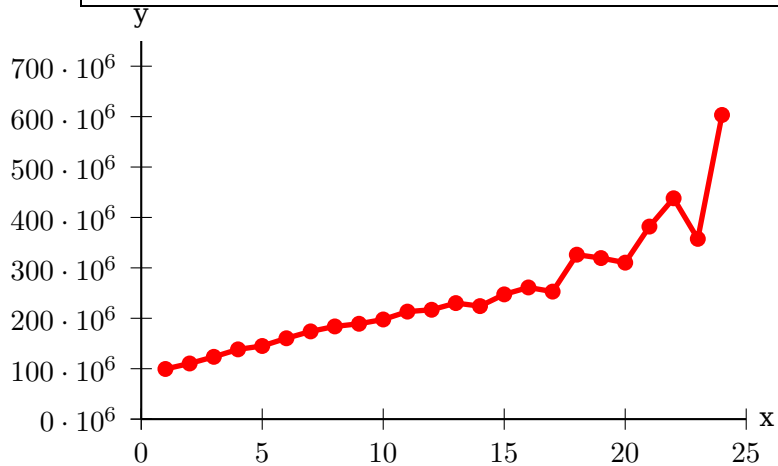
6.8. Options xlabelFactor and ylabelFactor

When having big numbers as data records then it makes sense to write the values as $\langle number \rangle \cdot 10^{\langle exp \rangle}$. These new options allow you to define the additional part of the value, but it must be set in math mode when using math operators or macros like `\cdot!`


```

1 \readdata{\data}{demo1.data}
2 \pstScalePoints(1,0.000001){}{% (x,y){additional x operator}{y op}
3 \psset{llx=-1cm, lly=-1cm}
4 \psgraph[ylabelFactor=\cdot 10^6, Dx=5, Dy=100](0,0)(25,750){8cm}{5cm}
5   \listplot[linecolor=red, linewidth=2pt, showpoints=true]{\data}
6 \endpsgraph
7 \pstScalePoints(1,1){}{% reset

```



6.9. Options decimalSeparator and comma

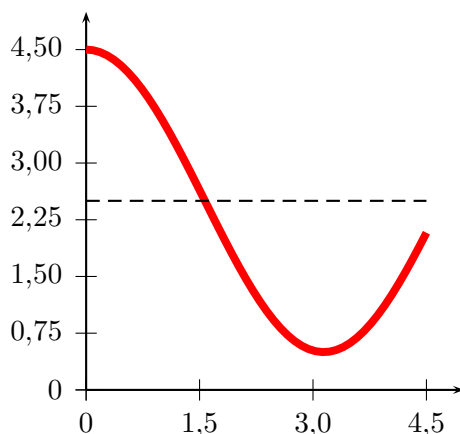
Syntax:

```

comma=false|true
decimalSeparator=<character>

```

Setting the option `comma` to `true` gives labels with a comma as a decimal separator instead of the default dot. `comma` and `comma=true` is the same. The optional argument `decimalSeparator` allows an individual setting for languages with a different character than a dot or a comma. The character has to be set into braces, if it is an active one, e.g. `decimalSeparator={,}`.



```

1 \begin{pspicture}(-0.5,-0.5)(5,5.5)
2 \psaxes[Dx=1.5,comma,Dy=0.75,dy=0.75]{->}(5,5)
3 \psplot[linecolor=red,linewidth=3pt]{0}{4.5}%
4   {x RadtoDeg cos 2 mul 2.5 add}
5 \psline[linestyle=dashed](0,2.5)(4.5,2.5)
6 \end{pspicture}

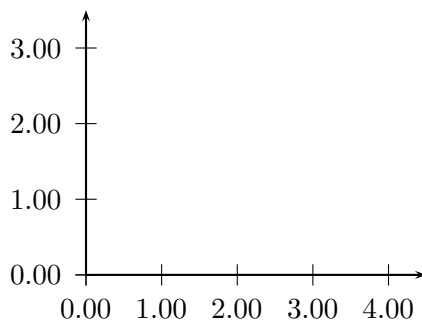
```

6.10. Options xyDecimals, xDecimals and yDecimals

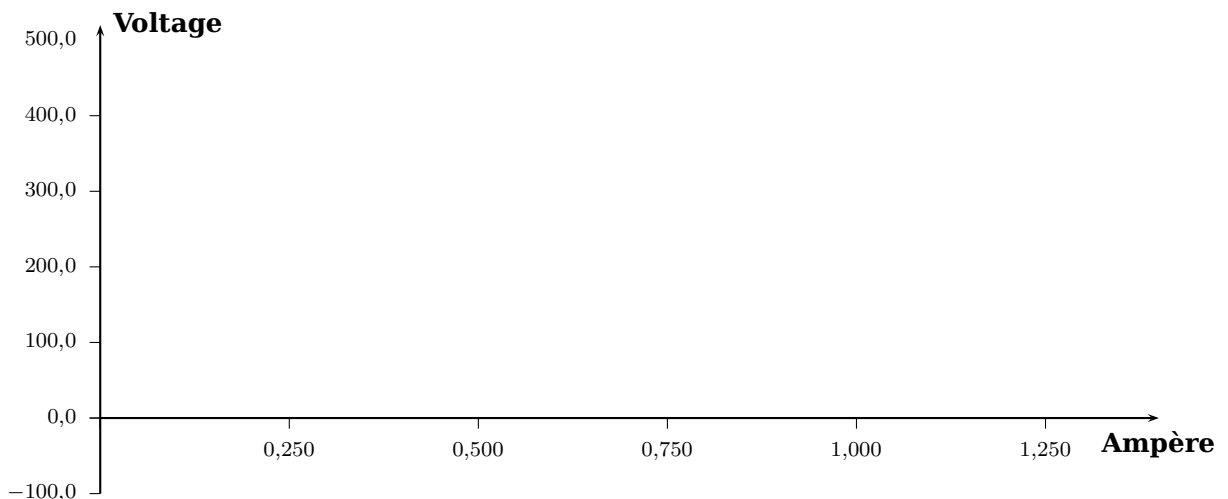
Syntax:

```
xyDecimals=<number>
xDecimals=<any>
yDecimals=<any>
```

By default the labels of the axes get numbers with or without decimals, depending on the numbers itself. With these options it is possible to determine the decimals, where the option `xyDecimals` sets this identical for both axes. `xDecimals` only for the x and `yDecimals` only for the y axis. The default setting `{}` means, that you'll get the standard behaviour.



```
1 \begin{pspicture}(-1.5,-0.5)(5,3.75)
2   \psaxes[xyDecimals=2]{->}(0,0)(4.5,3.5)
3 \end{pspicture}
```



```
1 \psset{xunit=10cm,yunit=0.01cm,labelFontSize=\scriptstyle}
2 \begin{pspicture}(-0.1,-150)(1.5,550.0)
3   \psaxes[Dx=0.25,Dy=100,ticks=-4pt 0,comma,xDecimals=3,yDecimals=1]{->}%
4     (0,0)(0,-100)(1.4,520)[\textbf{Amp\`ere},-90][\textbf{Voltage},0]
5 \end{pspicture}
```

6.11. Options trigLabels, xtrigLabels, ytrigLabels, and trigLabelBase for an axis with trigonometrical units

With the option `trigLabels=true` *only* the labels on the x axis are trigonometrical ones. It is the same than setting `xtrigLabels=true`. The option `trigLabelBase` sets

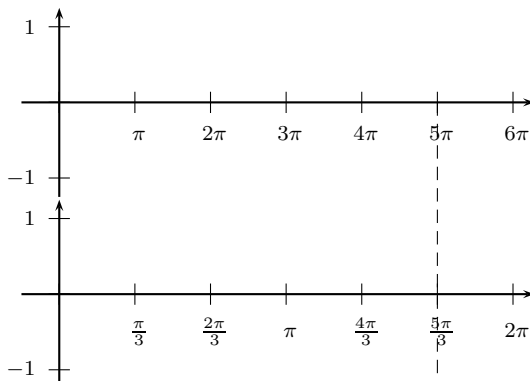
the denominator of fraction. The default value of 0 is the same as no fraction. The following constants are defined in the package:

```
\def\psPiFour{12.566371}
\def\psPiTwo{6.283185}
\def\psPi{3.14159265}
\def\psPiH{1.570796327}
\newdimen\pstRadUnit
\newdimen\pstRadUnitInv
\pstRadUnit=1.047198cm % this is pi/3
\pstRadUnitInv=0.95493cm % this is 3/pi
```

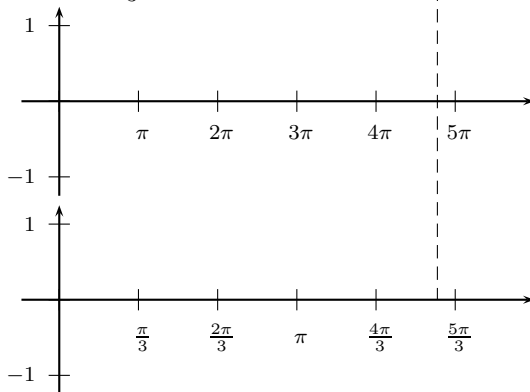
Because it is a bit complicated to set the right values, we show some more examples here. For **all** following examples in this section we did a global

```
\psset{trigLabels,labelFontSize=\scriptstyle}
```

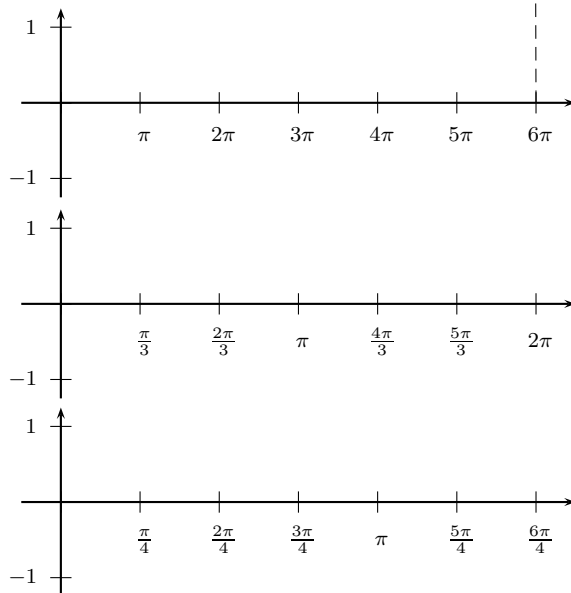
Translating the decimal ticks to trigonometrical ones makes no real sense, because every 1 xunit (1cm) is a tick and the last one is at 6cm.



Modifying the ticks to have the last one exactly at the end is possible with a different dx value ($\frac{\pi}{3} \approx 1.047$):



Set everything globally in radian units. Now 6 units on the x -axis are 6π . Using `trigLabelBase=3` reduces this value to 2π , a.s.o.



```
1 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)%
2   \nnode(5,0){A}%
3   \psaxes{->}(0,0)(-.5,-1.25)(\psPiTwo,1.25)
4 \end{pspicture}
```

```
1 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)%
2   \psaxes[trigLabelBase=3]{->}(0,0)(-.5,-1.25)(\psPiTwo,1.25)
3 \end{pspicture}
```

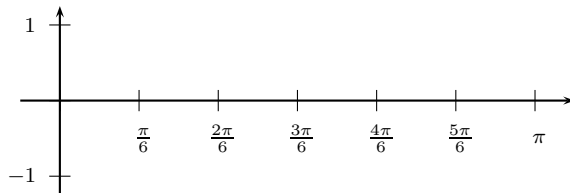
```
1 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)\nnode(\psPiTwo,0){C}%
2   \psaxes[dx=\pstRadUnit]{->}(0,0)(-.5,-1.25)(\psPiTwo,1.25)
3 \end{pspicture}%
```

```
1 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)\nnode(5,0){B}%
2   \psaxes[dx=\pstRadUnit,trigLabelBase=3]{->}(0,0)(-.5,-1.25)(\psPiTwo,1.25)
3 \end{pspicture}%
```

```
1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)\nnode(6,0){D}%
3   \psaxes{->}(0,0)(-.5,-1.25)(6.5,1.25)%
4 \end{pspicture}%
```

```
1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[trigLabelBase=3]{->}(0,0)(-.5,-1.25)(6.5,1.25)
4 \end{pspicture}%
```

```
1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[trigLabelBase=4]{->}(0,0)(-.5,-1.25)(6.5,1.25)
4 \end{pspicture}%
```

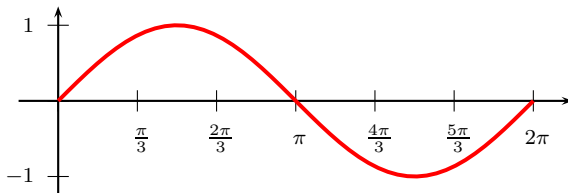


```

1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[trigLabelBase=6]{->}(0,0)(-0.5,-1.25)
4   (6.5,1.25)
5 \end{pspicture}%

```

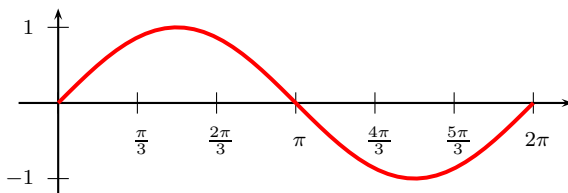
The best way seems to be to set the x -unit to `\pstRadUnit`. Plotting a function doesn't consider the value for `trigLabelBase`, it has to be done by the user. The first example sets the unit locally for the `\psplot` back to 1cm, which is needed, because we use this unit on the PostScript side.



```

1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[trigLabelBase=3]{->}(0,0)(-0.5,-1.25)
4   (6.5,1.25)
5   \psplot[xunit=1cm,linewidth=1.5pt]{0}{\psPiTwo}{x RadtoDeg sin}
6 \end{pspicture}

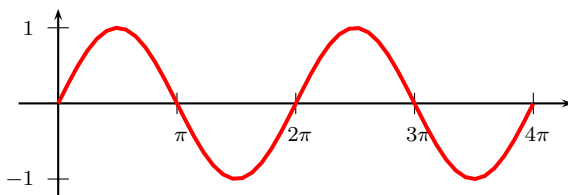
```



```

1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[trigLabelBase=3]{->}(0,0)(-0.5,-1.25)
4   (6.5,1.25)
5   \psplot[linewidth=1.5pt]{0}{6}{x
6   Pi 3 div mul RadtoDeg sin}
7 \end{pspicture}

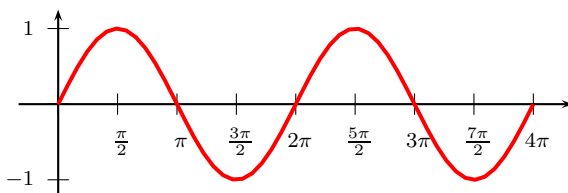
```



```

1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[dx=1.5]{->}(0,0)(-0.5,-1.25)(6.5,1.25)
4   \psplot[xunit=0.5cm,linewidth=1.5pt]{0}{\psPiFour}{x RadtoDeg sin}
5 \end{pspicture}

```

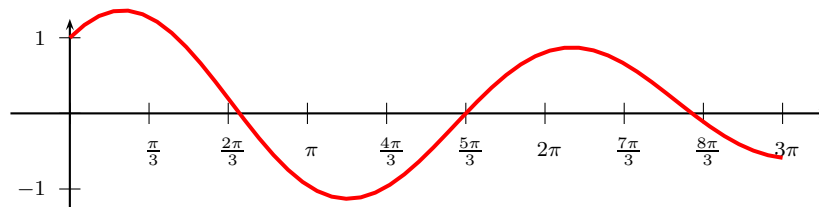


```

1 \psset{xunit=\pstRadUnit}%
2 \begin{pspicture}(-0.5,-1.25)(6.5,1.25)
3   \psaxes[dx=0.75, trigLabelBase=2]{->}(0,0)
4   (-0.5,-1.25)(6.5,1.25)
5   \psplot[xunit=0.5cm,linewidth=1.5pt]{0}{\psPiFour}{x RadtoDeg sin}
6 \end{pspicture}

```

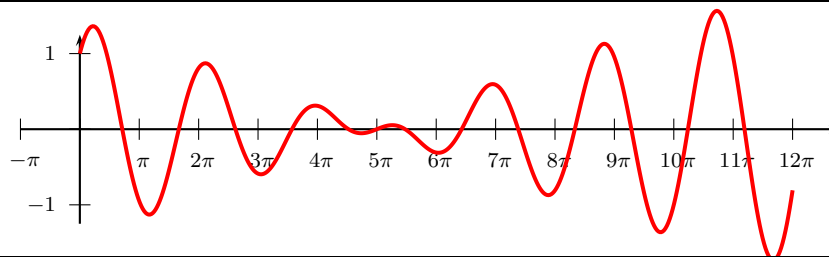
It is also possible to set the x unit and dx value to get the labels right. But this needs some more understanding as to how it really works. A `xunit=1.570796327` sets the unit to $\pi/2$ and a `dx=0.666667` then puts at every $2/3$ of the unit a tick mark and a label. The length of the x -axis is 6.4 units which is $6.4 \cdot 1.570796327 \text{ cm} \approx 10 \text{ cm}$. The function then is plotted from 0 to $3\pi = 9.424777961$.



```

1 \begin{pspicture}(-0.5,-1.25)(10,1.25)
2   \psaxes[xunit=\psPiH,trigLabelBase=3,dx=0.666667]{->}(0,0)(-0.5,-1.25)
   (6.4,1.25)
3   \psplot[linecolor=red,linewidth=1.5pt]{0}{9.424777961}{%
4     x RadtoDeg dup sin exch 1.1 mul cos add}
5 \end{pspicture}

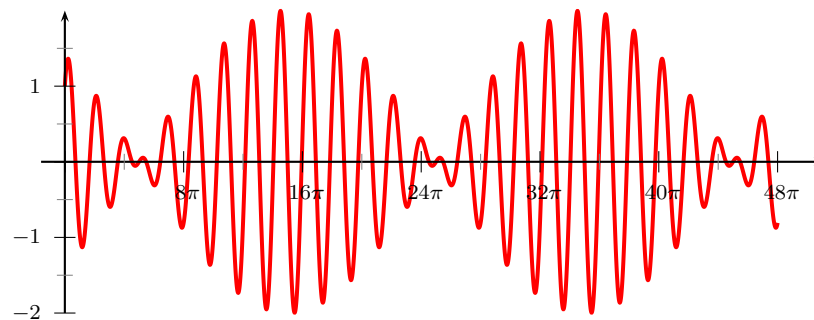
```



```

1 \psset{unit=1cm}
2 \psplot[xunit=0.25,plotpoints=500,linecolor=red,linewidth=1.5pt]{0}{37.70}{%
3   x RadtoDeg dup sin exch 1.1 mul cos add}
4 \end{pspicture}

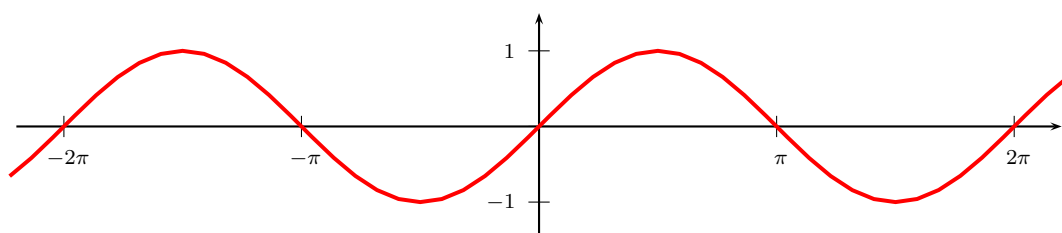
```



```

1 \psset{unit=1cm}
2 \begin{pspicture}(-0.5,-1.25)(10,1.25)
3   \psplot[xunit=0.0625,linecolor=red,linewidth=1.5pt,%
4     plotpoints=5000]{0}{150.80}{%
5     {x RadtoDeg dup sin exch 1.1 mul cos add}
6   \psaxes[xunit=\psPi,dx=0.5,Dx=8]{->}(0,0)(-0.25,-1.25)(3.2,1.25)
7 \end{pspicture}

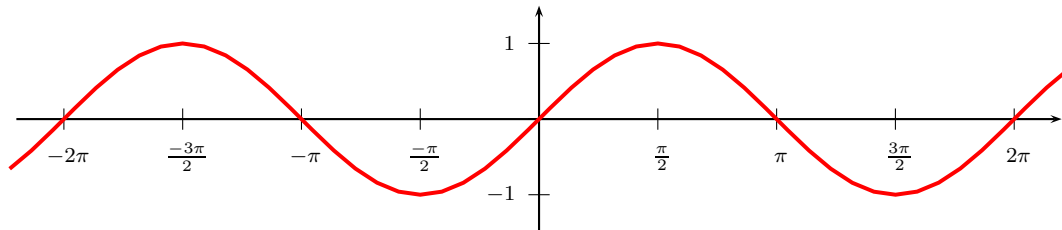
```



```

1 \begin{pspicture}(-7,-1.5)(7,1.5)
2   \psaxes[trigLabels=true,xunit=\psPi]{->}(0,0)(-2.2,-1.5)(2.2,1.5)
3   \psplot[linecolor=red,linewidth=1.5pt]{-7}{7}{x RadtoDeg sin}
4 \end{pspicture}

```

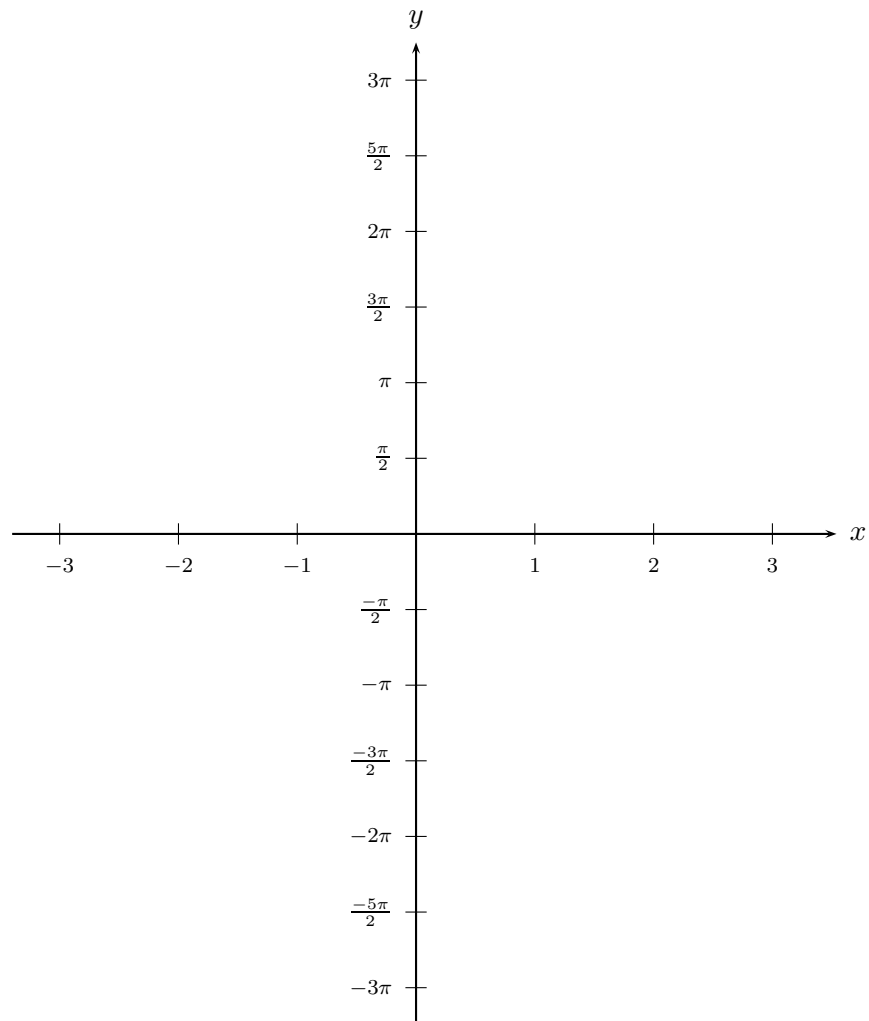


```

1 \begin{pspicture}(-7,-1.5)(7,1.5)
2   \psaxes[trigLabels=true,
3   trigLabelBase=2,dx=\psPiH,xunit=\psPi]{->}(0,0)(-2.2,-1.5)(2.2,1.5)
4   \psplot[linecolor=red,linewidth=1.5pt]{-7}{7}{x RadtoDeg sin}
5 \end{pspicture}

```

The setting of trigonometrical labels with `ytriglabels=true` for the y axis is the same as for the x axis.

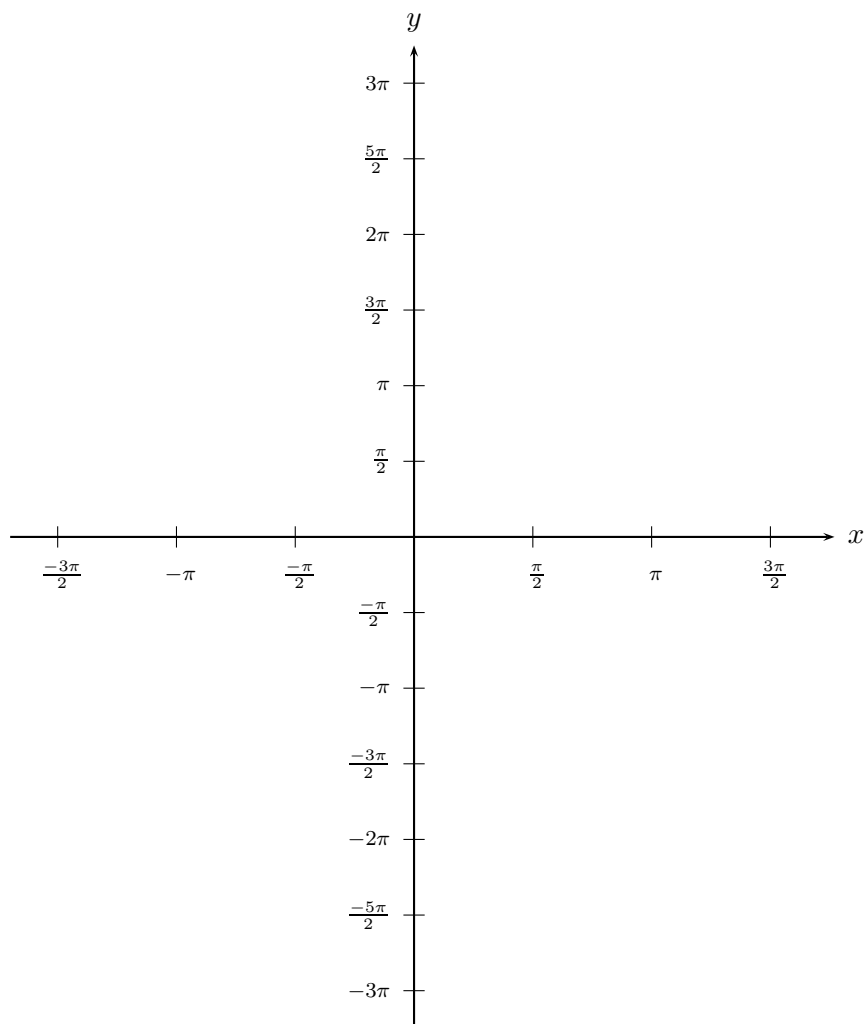


```

1 \psset{unit=1cm}
2 \begin{pspicture}(-6.5,-7)(6.5,7.5)
3 \psaxes[trigLabelBase=2,dx=\psPiH,xunit=\psPi,ytrigLabels]
4   {->}(0,0)(-1.7,-6.5)(1.77,6.5)[$x$,0][$y$,90]
5 \end{pspicture}

```

Also setting labels for the x axis is possible with `trigLabels=true` or alternatively with `ytrigLabels=true`.



```

1 \psset{unit=1cm}
2 \begin{pspicture}(-6.5,-7)(6.5,7.5)
3 \psaxes[trigLabelBase=2,dx=\psPiH,xunit=\psPi,xtrigLabels,ytrigLabels]
4   {->}(0,0)(-1.7,-6.5)(1.77,6.5)[$x$,0][$y$,90]
5 \end{pspicture}

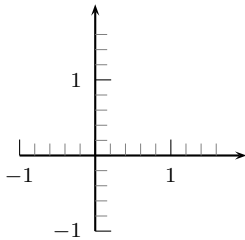
```

6.12. Option ticks

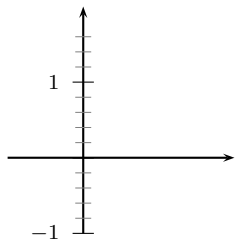
Syntax:

```
ticks=all|x|y|none
```

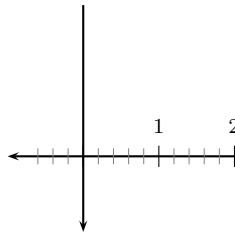
This option was already in the `pst-plot` package and only mentioned here for some completeness.



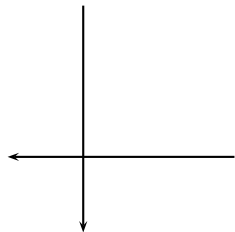
```
1 \psset{ticksize=6pt}
2 \begin{pspicture}(-1,-1)(2,2)
3 \psaxes[ticks=all,subticks=5]{->}(0,0)(-1,-1)(2,2)
4 \end{pspicture}
```



```
1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[ticks=y,subticks=5]{->}(0,0)(-1,-1)(2,2)
3 \end{pspicture}
```



```
1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[ticks=x,subticks=5]{->}(0,0)(2,2)(-1,-1)
3 \end{pspicture}
```



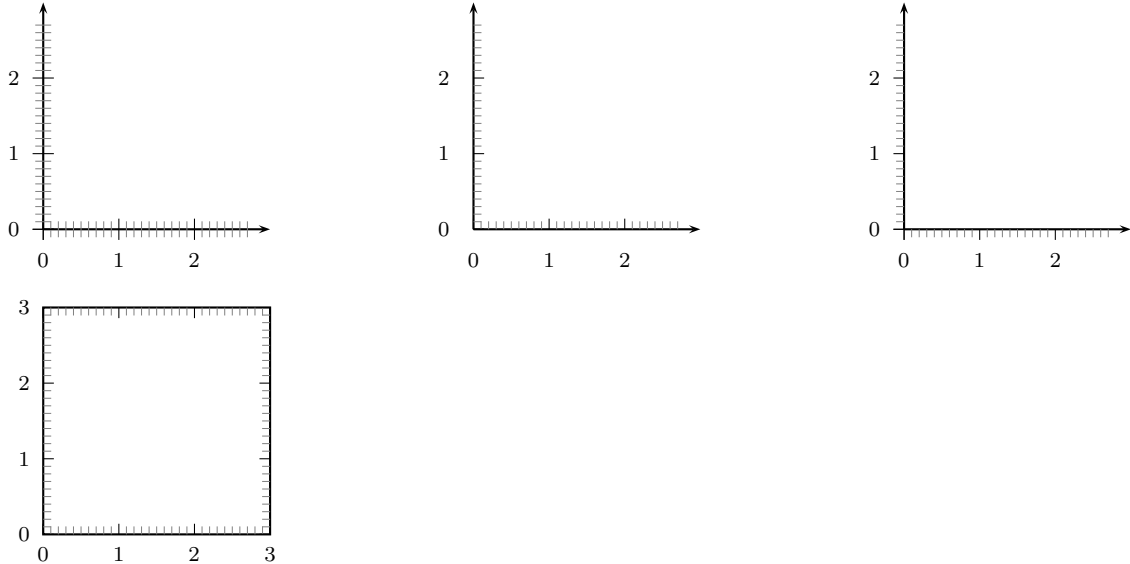
```
1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[ticks=none,subticks=5]{->}(0,0)(2,2)(-1,-1)
3 \end{pspicture}
```

6.13. Option tickstyle

Syntax:

```
tickstyle=full|top|bottom|inner
```

The value `inner` is only possible for the `axes style frame`.



```

1 \psset{subticks=10}
2 \begin{pspicture}(-1,-1)(3,3) \psaxes[tickstyle=full]{->}(3,3) \end{pspicture}
3 \begin{pspicture}(-1,-1)(3,3) \psaxes[tickstyle=top]{->}(3,3) \end{pspicture}
4 \begin{pspicture}(-1,-1)(3,3) \psaxes[tickstyle=bottom]{->}(3,3)\end{pspicture}
5 \begin{pspicture}(-1,-1)(3,3)
6   \psaxes[axesstyle=frame, tickstyle=inner, ticksize=0 4pt]{->}(3,3)
7 \end{pspicture}

```

6.14. Options ticksize, xticksize, yticksize

With this new option the recent `tickstyle` option of `pst-plot` is obsolete and no longer supported by `pstricks-add`.

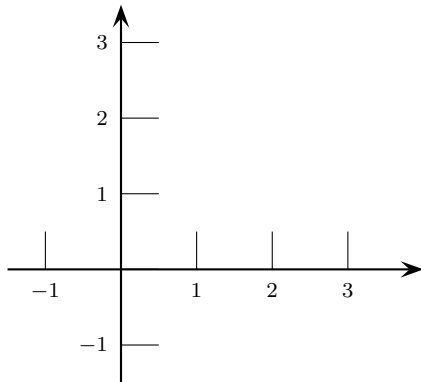
Syntax:

```

ticksize=value[unit]
ticksize=value[unit] value[unit]
xticksize=value[unit]
xticksize=value[unit] value[unit]
yticksize=value[unit]
yticksize=value[unit] value[unit]

```

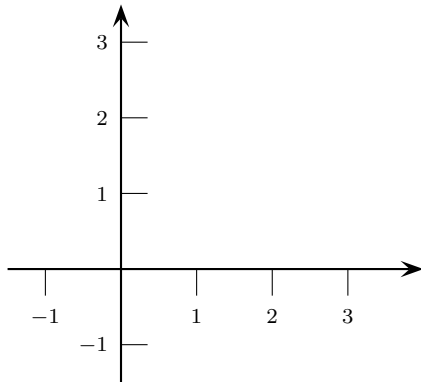
`ticksize` sets both values. The first one is left/below and the optional second one is right/above of the coordinate axis. The old setting `tickstyle=bottom` is now easy to realize, e.g.: `ticksize=-6pt 0`, or vice versa, if the coordinates are set from positive to negative values.



```

1 \psset{arrowscale=2}
2 \begin{pspicture}(-1.5,-1.5)(4,3.5)
3   \psaxes[ticksize=0.5cm]{->}(0,0)(-1.5,-1.5)
4     (4,3.5)
5 \end{pspicture}

```

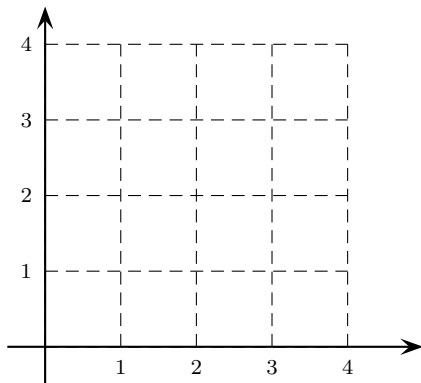


```

1 \psset{arrowscale=2}
2 \begin{pspicture}(-1.5,-1.5)(4,3.5)
3   \psaxes[xticksize=-10pt 0,yticksize=0 10pt]{%
4     {->}(0,0)(-1.5,-1.5)(4,3.5)
5 \end{pspicture}

```

A grid is also possible by setting the values to the max/min coordinates.



```

1 \psset{arrowscale=2}
2 \begin{pspicture}(-.5,-.5)(5,4.5)
3   \psaxes[ticklinestyle=dashed,
4     ticksize=0 4cm]{->}(0,0)(-.5,-.5)(5,4.5)
5 \end{pspicture}

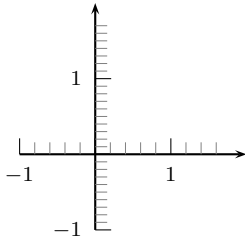
```

6.15. Options subticks, xsubticks, and ysubticks

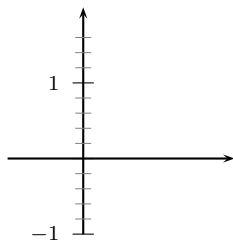
Syntax:

```
subticks=<number>
xsubticks=<number>
ysubticks=<number>
```

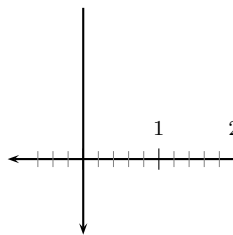
By default subticks cannot have labels.



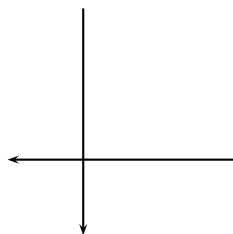
```
1 \psset{ticks=6pt}
2 \begin{pspicture}(-1,-1)(2,2)
3 \psaxes[ticks=all,xsubticks=5,
4   ysubticks=10]{->}(0,0)(-1,-1)(2,2)
5 \end{pspicture}
```



```
1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[ticks=y,subticks=5]{->}(0,0)(-1,-1)(2,2)
3 \end{pspicture}
```



```
1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[ticks=x,subticks=5]{->}(0,0)(2,2)(-1,-1)
3 \end{pspicture}
```



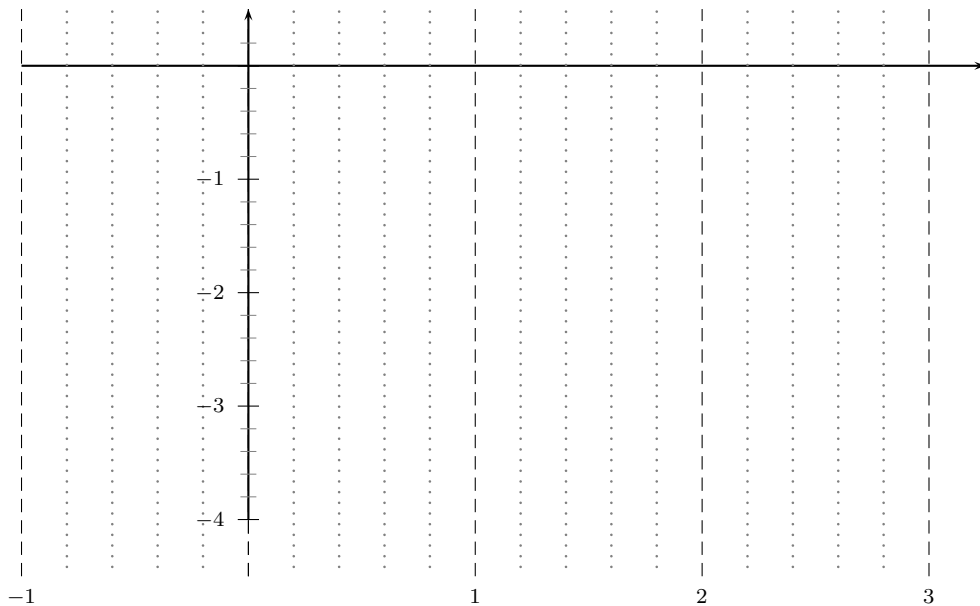
```
1 \begin{pspicture}(-1,-1)(2,2)
2 \psaxes[ticks=none,subticks=5]{->}(0,0)(2,2)(-1,-1)
3 \end{pspicture}
```

6.16. Options subticksize, xsubticksize, ysubticksize

subticksize sets both values, xsubticksize only for the x -axis and ysubticksize only for the y -axis, which must be relative to the ticksize length and can have any number. 1 sets it to the same length as the main ticks.

Syntax:

```
subticksize=value
xsubticksize=value
ysubticksize=value
```



```

1 \psset{yunit=1.5cm,xunit=3cm}
2 \begin{pspicture}(-1.25,-4.75)(3.25,.75)
3   \psaxes[xticks=-4.5 0.5,ticklinestyle=dashed,subticks=5,xsubticks=1,%
4     ysubticks=0.75,xsubticklinestyle=dotted,xsubtickwidth=1pt,
5     subtickcolor=gray]{->}(0,0)(-1,-4)(3.25,0.5)
6 \end{pspicture}

```

6.17. Options tickcolor, xtickcolor, ytickcolor, subtickcolor, xsubtickcolor, and ysubtickcolor

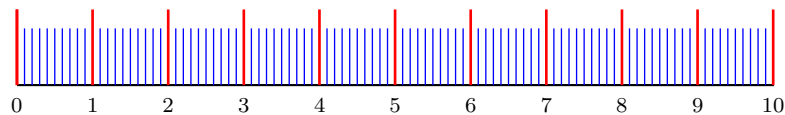
Syntax:

```

tickcolor=<color>
xtickcolor=<color>
ytickcolor=<color>
subtickcolor=<color>
xsubtickcolor=<color>
ysubtickcolor=<color>

```

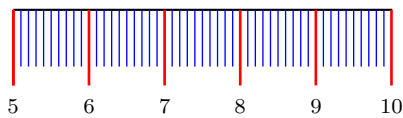
tickcolor and subtickcolor set both for the x - and the y -Axis.



```

1 \begin{pspicture}(0,-0.75)(10,1)
2 \psaxes[yAxis=false,labelFontSize=\scriptstyle,ticks=0 10mm,subticks=10,
3   subticks=0.75,
4   tickcolor=red,subtickcolor=blue,tickwidth=1pt,subtickwidth=0.5pt](10.01,0)
5 \end{pspicture}

```



```

1 \begin{pspicture}(5, -0.75)(10,1)
2 \psaxes[yAxis=false,labelFontSize=\scriptstyle,
3   ticksize=0 -10mm,subticks=10,subticksize=0.75,
4   tickcolor=red,subtickcolor=blue,tickwidth=1pt,
   subtickwidth=0.5pt,0x=5](5,0)(5,0)(10.01,0)
\end{pspicture}

```

6.18. Options ticklinestyle, xticklinestyle, yticklinestyle, subticklinestyle, xsubticklinestyle, and ysubticklinestyle

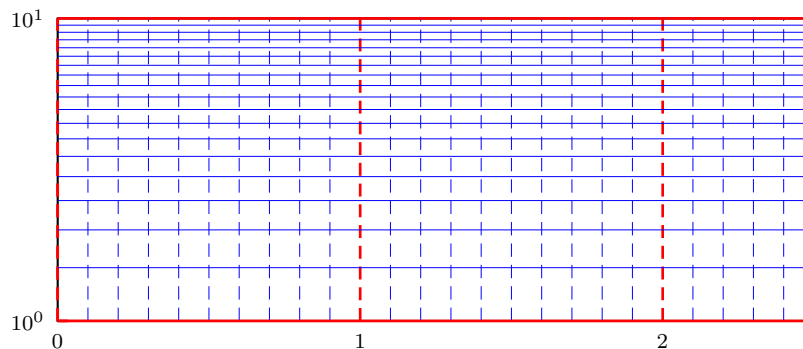
Syntax:

```

ticklinestyle=solid|dashed|dotted|none
xticklinestyle=solid|dashed|dotted|none
yticklinestyle=solid|dashed|dotted|none
subticklinestyle=solid|dashed|dotted|none
xsubticklinestyle=solid|dashed|dotted|none
ysubticklinestyle=solid|dashed|dotted|none

```

ticklinestyle and subticklinestyle set both values for the x and y axis. The value none doesn't really makes sense, because it is the same as [sub]ticklines=0



```

1 \psset{unit=4cm}
2 \pspicture(-0.15, -0.15)(2.5,1)
3 \psaxes[axesstyle=frame,logLines=y,xticks=0 1,xsubticks=1,ylogBase=10,
4   tickcolor=red,subtickcolor=blue,tickwidth=1pt,subticks=20,xsubticks=10,
5   xticklinestyle=dashed,xsubticklinestyle=dashed](2.5,1)
6 \endpspicture

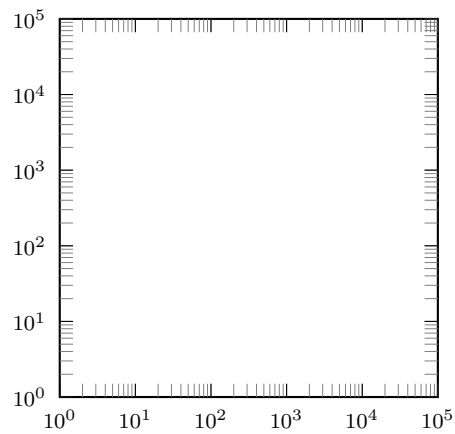
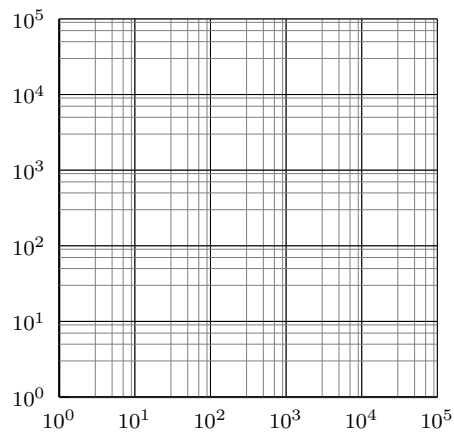
```

6.19. logLines

Syntax:

```
logLines=all|x|y
```

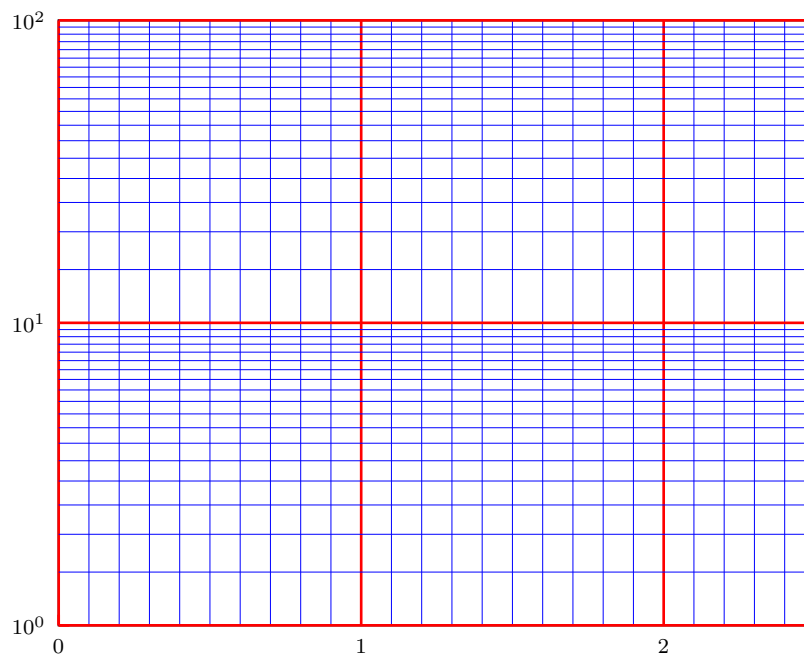
By default the option logLines sets the ticksize to the maximal length for x, y, or both. It can be changed, when *after* the option logLines the ticksize is set.



```

1 \pspicture(-1,-1)(5,5)
2   \psaxes[subticks=5,xylogBase=10,logLines=all](5,5)
3 \endpspicture\hspace{1cm}
4 \pspicture(-1,-1)(5,5)
5   \psaxes[subticks=10,axesstyle=frame,xylogBase=10,logLines=all,
6     ticksize=0.5pt,tickstyle=inner](5,5)
7 \endpspicture

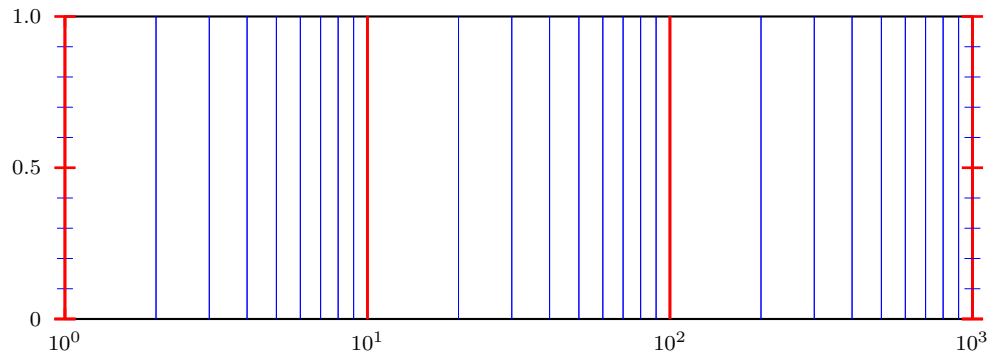
```



```

1 \psset{unit=4cm}
2 \pspicture(-0.15,-0.15)(2.5,2)
3   \psaxes[axesstyle=frame,logLines=y,xticks=max,xsubticks=1,ylogBase=10,
4     tickcolor=red,subtickcolor=blue,tickwidth=1pt,subticks=20,xsubticks
5     =10](2.5,2)
6 \endpspicture

```

```

1 \psset{unit=4}
2 \pspicture(-0.5,-0.3)(3,1.2)
3   \psaxes[axesstyle=frame,tickstyle=inner,logLines=x,xlogBase=10,Dy=0.5,
4     tickcolor=red,
5     subtickcolor=blue,tickwidth=1pt,ysubticks=5,xsubticks=10](3,1)
6 \endpspicture

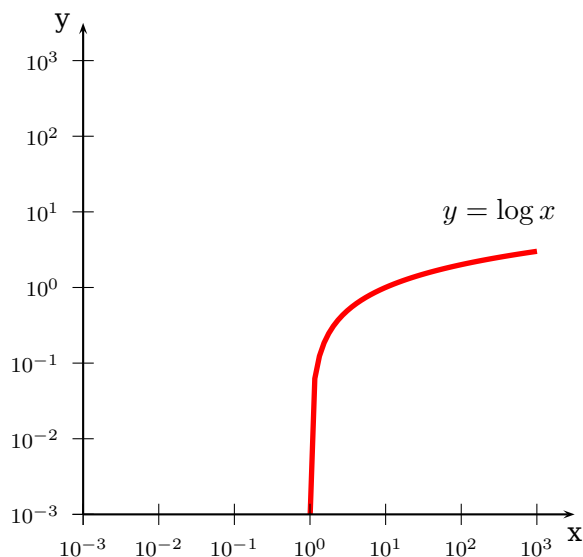
```

6.20. xylogBase, xlogBase and ylogBase

There are additional options `xylogBase`, `xlogBase`, `ylogBase` to get one or both axes with logarithmic labels. For an interval of $[10^{-3} \dots 10^2]$ choose a PSTricks interval of $[-3, 2]$. PSTricks takes 0 as the origin of this axes, which is wrong if we want to have a logarithmic axes. With the options `0y` and `0x` we can set the origin to -3 , so that the first label gets 10^{-3} . If this is not done by the user then `pst-plot` does it by default. An alternative is to set these parameters to empty values `0x={}`, `0y={}`, in this case the package does nothing.

6.21. xylogBase

This mode in math is also called double logarithmic. It is a combination of the two foregoing modes and the function is now $y = \log x$ and is shown in the following example.



```

1 \begin{pspicture}(-3.5,-3.5)(3.5,3.5)
2 \psplot[linewidth=2pt,linecolor=red
3 ]{0.001}{3}{x log}
4 \psaxes[xylogBase=10,0y=-3,0x
5 =-3]{->}(-3,-3)(3.5,3.5)
6 \uput[-90](3.5,-3){x}
7 \uput[180](-3,3.5){y}
8 \rput(2.5,1){$y=\log x$}
9 \end{pspicture}

```

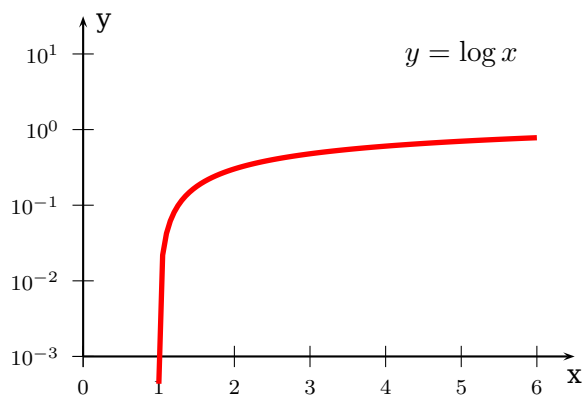
6.22. ylogBase

The values for the `\psaxes` y-coordinate are now the exponents to the base 10 and for the right function to the base e : $10^{-3} \dots 10^1$ which corresponds to the given y-interval $-3 \dots 1.5$, where only integers as exponents are possible. These logarithmic labels have no effect on the internally used units. To draw the logarithm function we have to use the math function

$$y = \log\{\log x\}$$

$$y = \ln\{\ln x\}$$

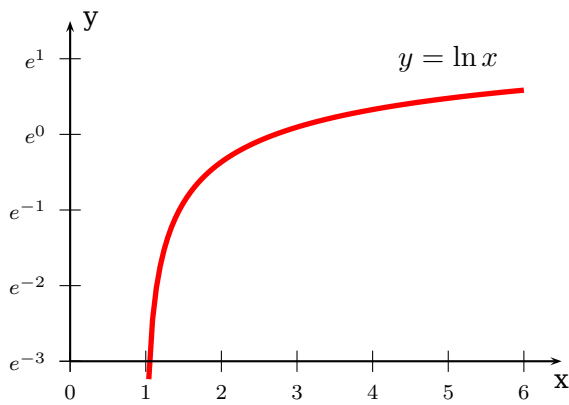
with an drawing interval of $1.001 \dots 6$.



```

1 \begin{pspicture}(-0.5,-3.5)(6.5,1.5)
2 \psaxes[ylogBase=10,0y=-3]{->}(0,-3)
3 (6.5,1.5)
4 \uput[-90](6.5,-3){x}
5 \uput[0](0,1.4){y}
6 \rput(5,1){$y=\log x$}
7 \psplot[linewidth=2pt,%
8 plotpoints=100,linecolor=red
9 ]{1.001}{6}{x log log} % log(log(x))
10 \end{pspicture}

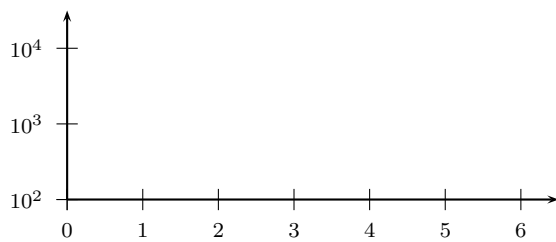
```



```

1 \begin{pspicture}(-0.5,-3.5)(6.5,1.5)
2 \psplot[linewidth=2pt,plotpoints=100,
3   linecolor=red]%
4   {1.04}{6}[ /ln {log 0.4343 div} def
5   ]{x ln ln} % log(x)
6 \psaxes[ylogBase=e,0y=-3]{->}(0,-3)
7   (6.5,1.5)
8 \uput[-90](6.5,-3){x}
9 \uput[0](0,1.5){y}
10 \rput(5,1){$y=\ln x$}
11 \end{pspicture}

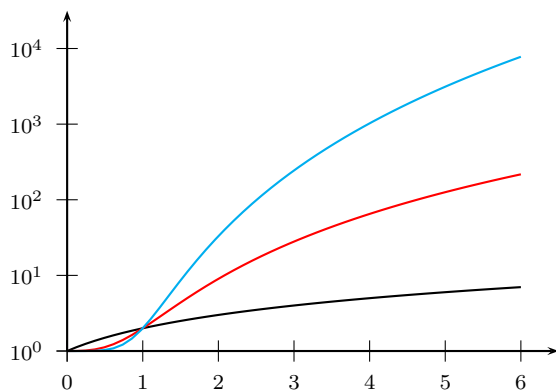
```



```

1 \begin{pspicture}(-0.5,1.75)(6.5,4.5)
2 \psaxes[ylogBase=10,0y=2]{->}(0,2)
3   (0,2)(6.5,4.5)
4 \end{pspicture}

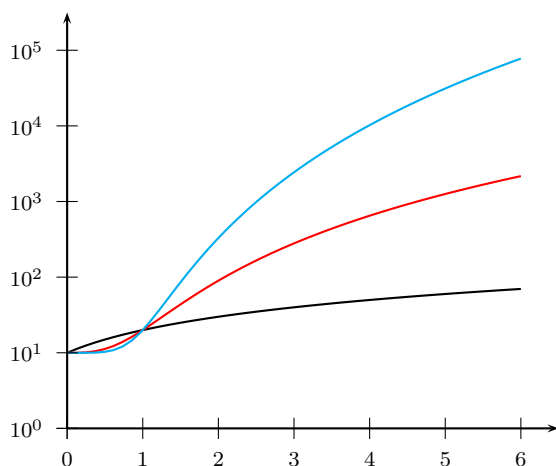
```



```

1 \begin{pspicture}(-0.5,-0.25)(6.5,4.5)
2 \psplot{0}{6}{x x cos add log}
3   % x + cos(x)
4 \psplot[linewidth=red]{0}{6}{x 3 exp
5   x cos add log} % x^3 + cos(x)
6 \psplot[linewidth=cyan]{0}{6}{x 5 exp
7   x cos add log} % x^5 + cos(x)
8 \psaxes[ylogBase=10]{->}(6.5,4.5)
9 \end{pspicture}

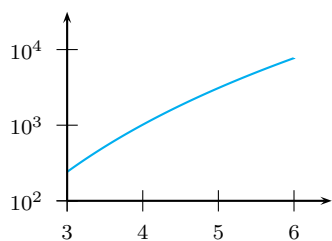
```



```

1 \begin{pspicture}(-0.5,-1.25)(6.5,4.5)
2 \psplot{0}{6}{x x cos add log}
3   % x + cos(x)
4 \psplot[linewidth=red]{0}{6}{x 3 exp x
5   cos add log} % x^3 + cos(x)
6 \psplot[linewidth=cyan]{0}{6}{x 5 exp x
7   cos add log} % x^5 + cos(x)
8 \psaxes[ylogBase=10]{->}(0,-1)(0,-1)
9   (6.5,4.5)
10 \end{pspicture}

```



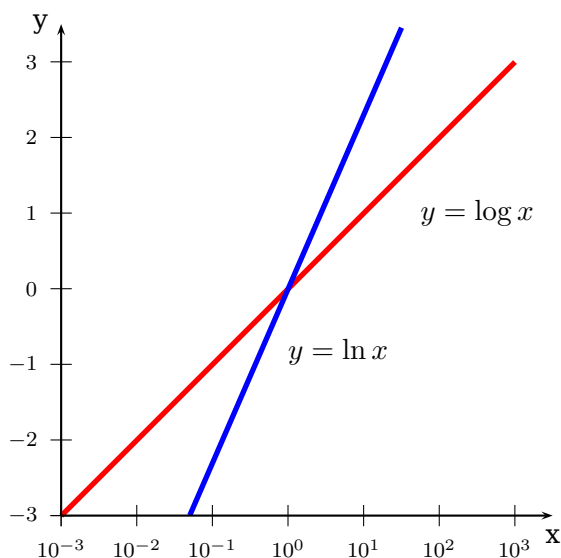
```

1 \begin{pspicture}(2.5,1.75)(6.5,4.5)
2 \psplot[linecolor=cyan]{3}{6}{x 5 exp x cos add log} %
3   x^5 + cos(x)
4 \psaxes[ylogBase=10,0x=3,0y=2]{->}(3,2)(3,2)(6.5,4.5)
5 \end{pspicture}

```

6.23. xlogBase

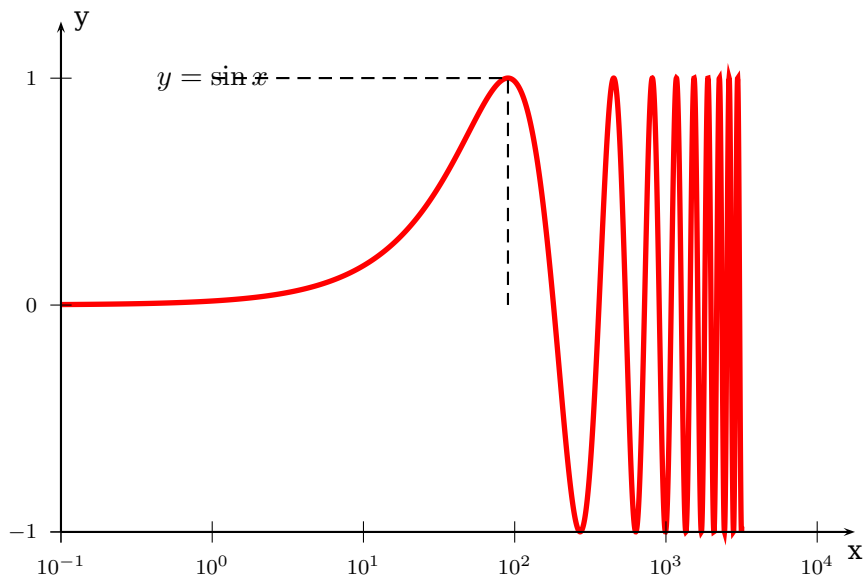
Now we have to use the easy math function $y = x$ because the x axis is still $\log x$.



```

1 \begin{pspicture}(-3.5,-3.5)(3.5,3.5)
2 \psplot[linewidth=2pt,linecolor=red]
3   {-3}{3}{x} % log(x)
4 \psplot[linewidth=2pt,linecolor=blue]
5   {-1.3}{1.5}{x 0.4343 div} % ln(x)
6 \psaxes[xlogBase=10,0y=-3,0x
7   =-3]{->}(-3,-3)(3.5,3.5)
8 \uput[-90](3.5,-3){x}
9 \uput[180](-3,3.5){y}
10 \rput(2.5,1){$y=\log x$}
11 \rput[lb](0,-1){$y=\ln x$}
12 \end{pspicture}

```



```

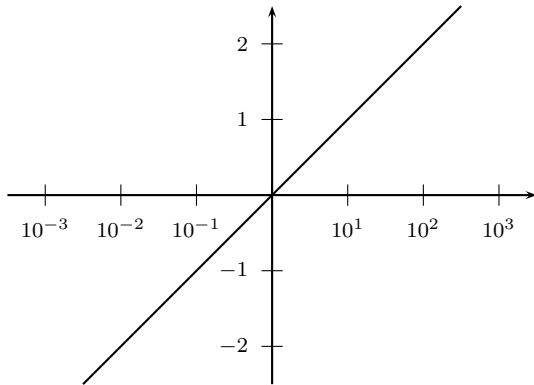
1 \psset{yunit=3cm,xunit=2cm}
2 \begin{pspicture}(-1.25,-1.25)(4.25,1.5)
3 \uput[-90](4.25,-1){x}

```

```

4 \uput[0](-1,1.25){y}
5 \rput(0,1){$y=\sin x$}
6 \psplot[linewidth=2pt,plotpoints=5000,linecolor=red]{-1}{3.5}{10 x exp sin }
7 \psaxes[xlogBase=10,0x=-1,0y=-1]{->}(-1,-1)(4.25,1.25)
8 \psline[linestyle=dashed](-1,0)(4,0)
9 \psline[linestyle=dashed](!-1 1)(!90 log 1)(!90 log -1)
10 \psline[linestyle=dashed](!90 log 1)(!180 log 1)(!180 log -1)
11 \end{pspicture}

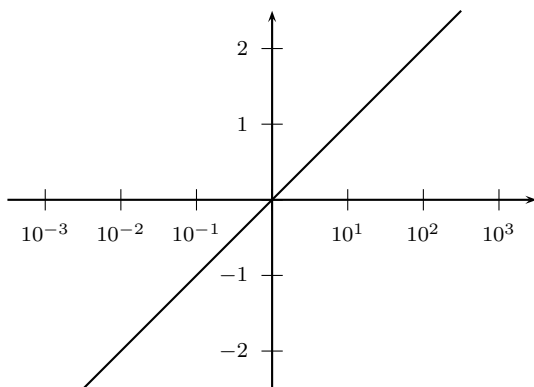
```



```

1 \begin{pspicture}(-3.5,-2.5)(3.5,2.5)
2 \psaxes[xlogBase=10]{->}(0,0)
   (-3.5,-2.5)(3.5,2.5)
3 \psplot{-2.5}{2.5}{10 x exp log}
4 \end{pspicture}

```



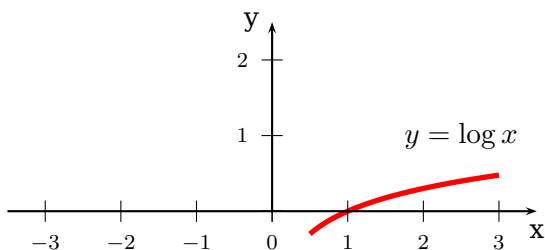
```

1 \begin{pspicture}(-3.5,-2.5)(3.5,2.5)
2 \psaxes[xlogBase=10,0x={},0y
   ={}]{->}(0,0)(-3.5,-2.5)(3.5,2.5)
3 \psplot{-2.5}{2.5}{10 x exp log}
4 \end{pspicture}

```

6.24. No logstyle (xylogBase={})

This is only a demonstration that the default option `={}` still works ... :-)

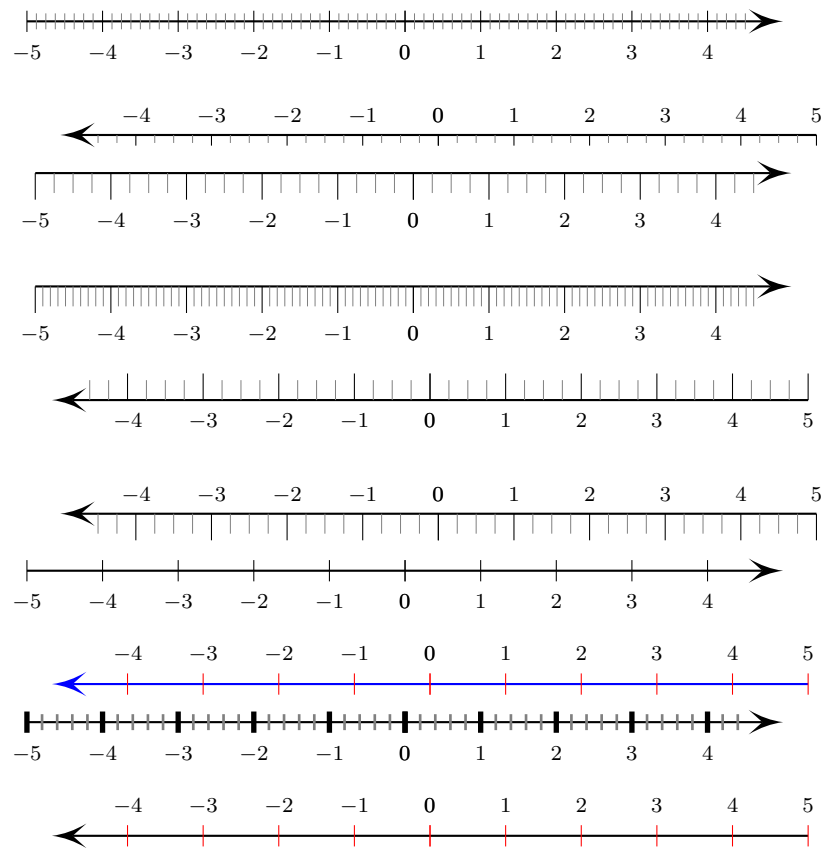


```

1 \begin{pspicture}(-3.5,-0.5)(3.5,2.5)
2 \psplot[linewidth=2pt,linecolor=red,
   xylogBase={}]{0.5}{3}{x log} % log(
   x)
3 \psaxes{->}(0,0)(-3.5,0)(3.5,2.5)
4 \uput[-90](3.5,0){x}
5 \uput[180](0,2.5){y}
6 \rput(2.5,1){$y=\log x$}
7 \end{pspicture}

```

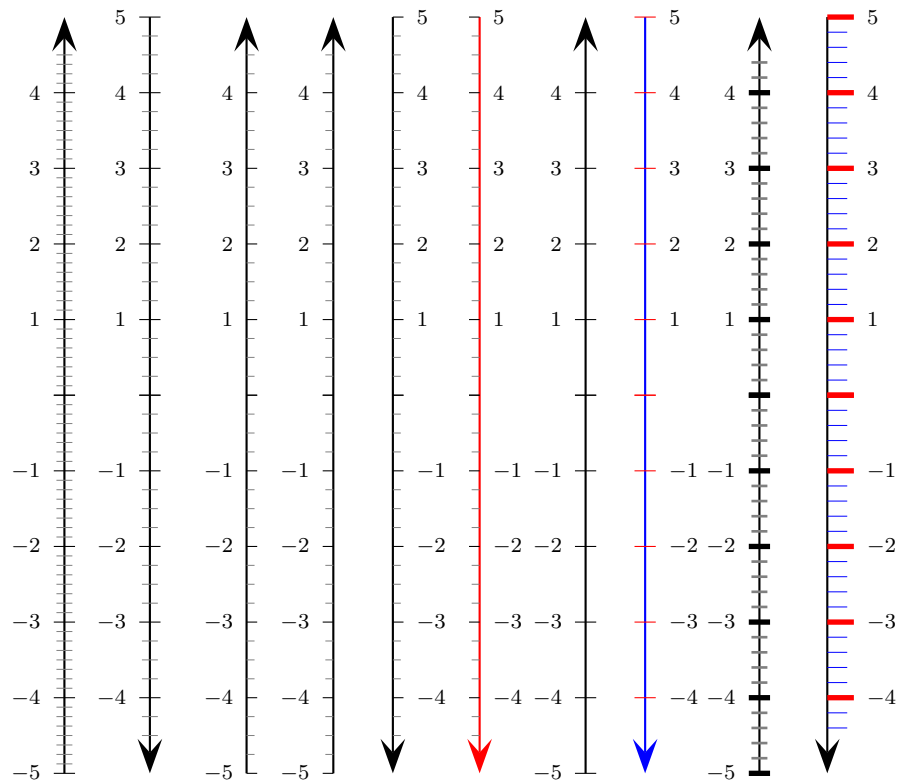
6.25. Option tickwidth and subtickwidth



```

1 \psset{arrowscale=3,arrows=-D>,yAxis=false}
2 \psaxes[subticks=8](0,0)(-5,-1)(5,1)\[1cm]
3 \psaxes[subticks=4,ticks=-4pt 0,xlabelPos=top](0,0)(5,1)(-5,-1)\[1cm]
4 \psaxes[subticks=4,ticks=-10pt 0](0,0)(-5,-5)(5,5)\[1cm]
5 \psaxes[subticks=10,ticks=0 -10pt](0,0)(-5,-5)(5,5)\[1cm]
6 \psaxes[subticks=4,ticks=0 10pt,xlabelPos=bottom](0,0)(5,5)(-5,-5)\[1cm]
7 \psaxes[subticks=4,ticks=0 -10pt,xlabelPos=top](0,0)(5,5)(-5,-5)\[0.25cm]
8 \psaxes[subticks=0](0,0)(-5,-5)(5,5)\[1cm]
9 \psaxes[subticks=0,tickcolor=red,linecolor=blue,xlabelPos=top](0,0)(5,5)(-5,-5)\[1cm]
10 \psaxes[subticks=5,tickwidth=2pt,subtickwidth=1pt](0,0)(-5,-5)(5,5)\[1cm]
11 \psaxes[subticks=0,tickcolor=red,xlabelPos=top](0,0)(5,5)(-5,-5)

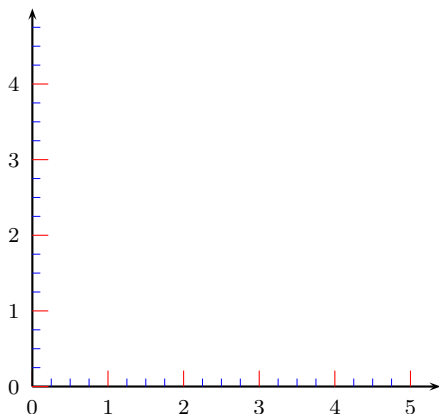
```



```

1 \psset{arrowscale=3,xAxis=false}
2 \psaxes[subticks=8]{->}(0,0)(-5,-5)(5,5)\hspace{2em}
3 \psaxes[subticks=4,ylabelPos=right,ylabelPos=left]{->}(0,0)(5,5)(-5,-5)\hspace{4em}
4 \psaxes[subticks=4,ticks=0 4pt]{->}(0,0)(-5,-5)(5,5)\hspace{3em}
5 \psaxes[subticks=4,ticks=-4pt 0]{->}(0,0)(-5,-5)(5,5)\hspace{1em}
6 \psaxes[subticks=4,ticks=0 4pt,ylabelPos=right]{->}(0,0)(5,5)(-5,-5)\hspace{3em}
7 \psaxes[subticks=4,ticks=-4pt 0,linecolor=red,ylabelPos=right]{->}(0,0)(5,5)(-5,-5)\hspace{5em}
8 \psaxes[subticks=0]{->}(0,0)(-5,-5)(5,5)\hspace{1em}
9 \psaxes[subticks=0,tickcolor=red,linecolor=blue,ylabelPos=right]{->}(0,0)(5,5)(-5,-5)\hspace{5em}
10 \psaxes[subticks=5,tickwidth=2pt,subtckwidth=1pt]{->}(0,0)(-5,-5)(5,5)\hspace{1em}
11 \psaxes[subticks=5,tickcolor=red,tickwidth=2pt,%
12 ticksize=10pt,subtckcolor=blue,subtcksize=0.75,ylabelPos=right]{->}(0,0)(5,5)(-5,-5)

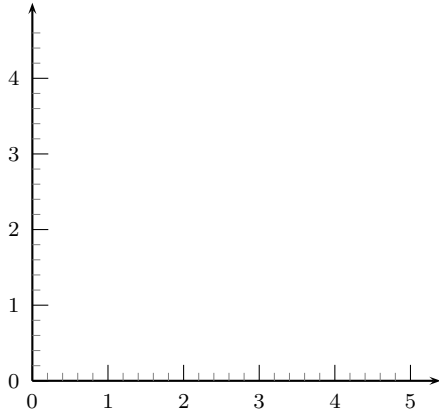
```



```

1 \pspicture(5,5.5)
2 \psaxes[subticks=4,ticks=6pt,subtcksize=0.5,%
3 tickcolor=red,subtckcolor=blue]{->}(5.4,5)
4 \endpspicture

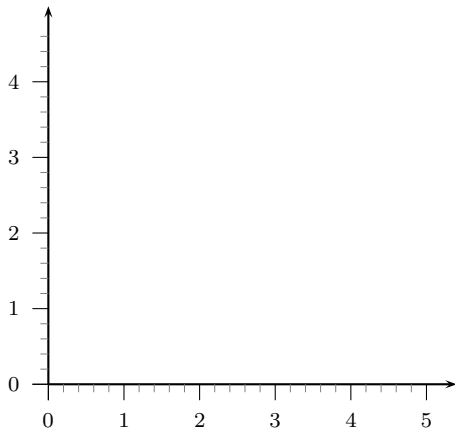
```



```

1 \pspicture(5,5.5)
2   \psaxes[subticks=5,ticksize=0 6pt,subticksize
   =0.5]{->}(5.4,5)
3 \endpspicture

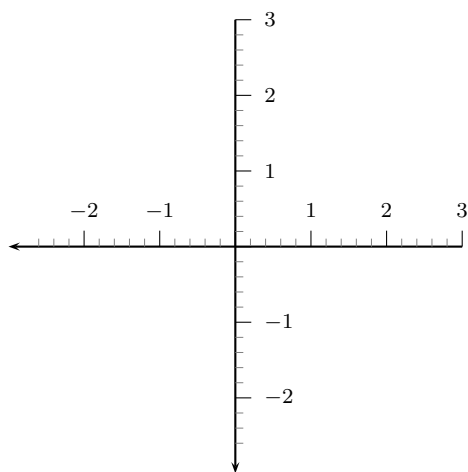
```



```

1 \pspicture(5,5.5)
2   \psaxes[subticks=5,ticksize=-6pt 0,subticksize
   =0.5]{->}(5.4,5)
3 \endpspicture

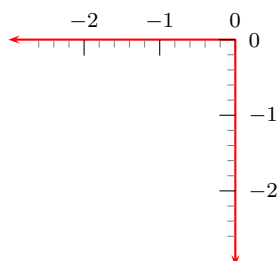
```



```

1 \pspicture(-3,-3)(3,3.5)
2   \psaxes[subticks=5,ticksize=0 6pt,
   subticksize=0.5]{->}(0,0)(3,3)(-3,-3)
3 \endpspicture

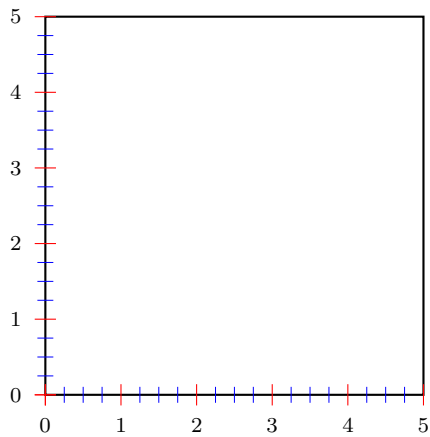
```



```

1 \pspicture(0,0.5)(-3,-3)
2   \psaxes[subticks=5,ticksize=-6pt 0,
   subticksize=0.5,linecolor=red
   ]{->}(-3,-3)
3 \endpspicture

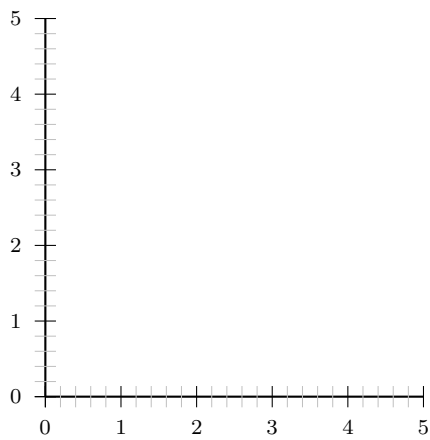
```

```

1 \psset{axesstyle=frame}
2 \pspicture(5,5.5)
3   \psaxes[subticks=4,tickcolor=red,subtickcolor=
4     blue](5,5)
5 \endpspicture

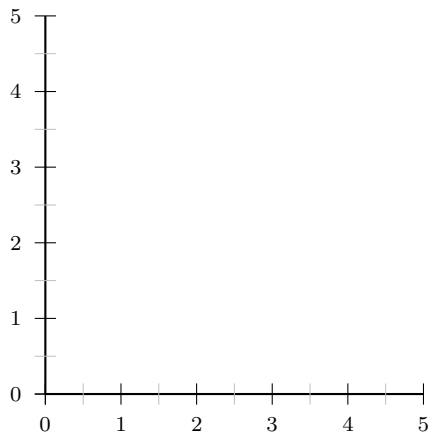
```



```

1 \pspicture(5,5.5)
2   \psaxes[subticks=5,subticks=1,subtickcolor=
3     lightgray](5,5)
4 \endpspicture

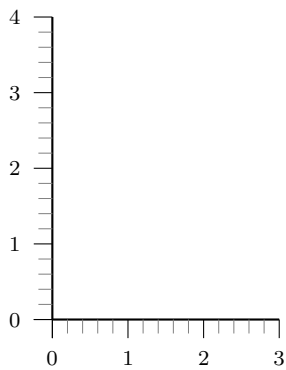
```



```

1 \pspicture(5,5.5)
2   \psaxes[subticks=2,subticks=1,subtickcolor=
3     lightgray](5,5)
4 \endpspicture

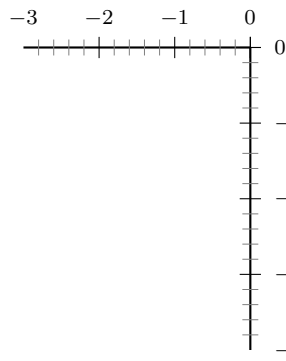
```



```

1 \pspicture(3,4.5)
2   \psaxes[subticks=5,ticks=-7pt 0](3,4)
3 \endpspicture

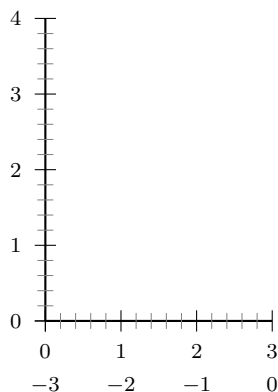
```



```

1 \pspicture(0,1)(-3,-4)
2   \psaxes[subticks=5](-3,-4)
3 \endpspicture

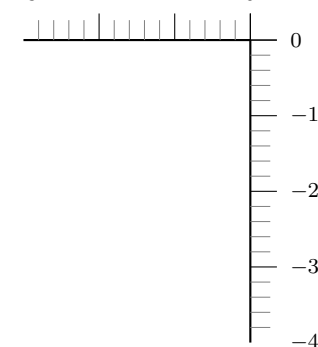
```



```

1 \pspicture(3,4.5)
2   \psaxes[axesstyle=axes,subticks=5](3,4)
3 \endpspicture

```



```

1 \pspicture(0,1)(-3,-4)
2   \psaxes[axesstyle=axes,subticks=5,%
3     ticksize=0 10pt](-3,-4)
4 \endpspicture

```

7. New options for \readdata

By default the macro `\readdata` reads every data record, which could be annoying when you have some text lines at top of your data files or when there are more than 10000 records to read.

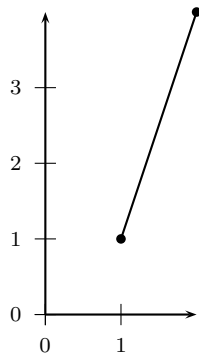
`pst-plot` defines two additional keys `ignoreLines` and `nStep`, which allows you to ignore preceding lines, e.g. `ignoreLines=2`, or to read only a selected part of the data records, e.g. `nStep=10`, only every 10th record is saved.

```

1 \readdata[ignoreLines=2]{\dataA}{stressrawdata.data}
2 \readdata[nStep=10]{\dataA}{stressrawdata.data}

```

The default value for `ignoreLines` is 0 and for `nStep` is 1. the following data file has two text lines which shall be ignored by the `\readdata` macro:



```

1 \begin{filecontents*}{pstricks-add-data9.data}
2 some nonsense in this line ---time forcex forcey
3 0 0.2
4 1 1
5 2 4
6 \end{filecontents*}
7 \readdata[ignoreLines=2]{\data}{pstricks-add-data9.data}
8 \pspicture(2,4)
9   \listplot[showpoints]{\data}
10  \psaxes{->}(2,4)
11 \endpspicture

```

8. New options for \listplot

By default the plot macros `\dataplot`, `\fileplot` and `\listplot` plot every data record. There are now additional keys `nStep`, `nStart`, `nEnd`, and `xStep`, `xStart`, `xEnd`, which allows to plot only a selected part of the data records, e.g. `nStep=10`. These "n" options mark the number of the record to be plotted (0, 1, 2, ...) and the "x" ones the x-values of the data records.

The new options are only available for the `\listplot` macro, which is not a real limitation, because all data records can be read from a file with the `\readdata` macro (see example files or [?]):

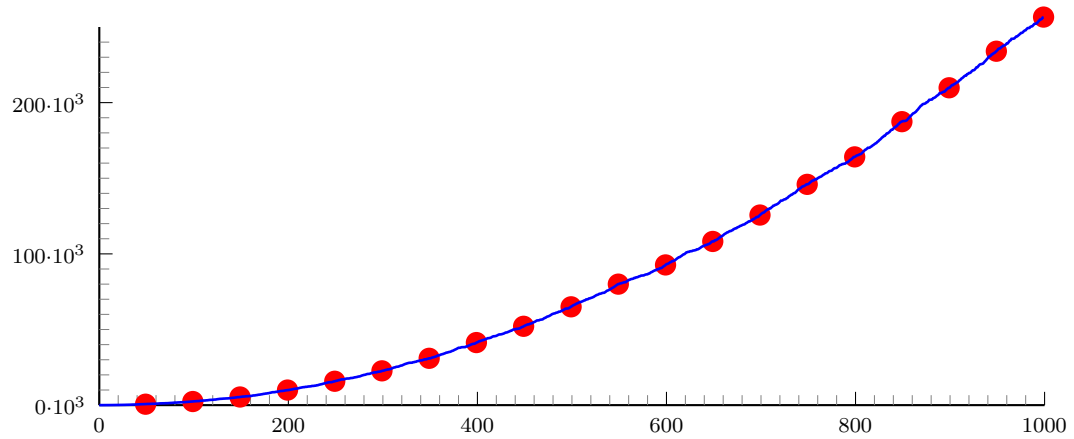
```
\readdata[nStep=10]{\data}{/home/voss/data/data1.data}
```

The use `nStep` and `xStep` options only make real sense when also using the option `plotstyle=dots`. Otherwise the coordinates are connected by a line as usual. Also the `xStep` option needs increasing x values. Note that `nStep` can be used for `\readdata` and for `\listplot`. If used in both macros then the effect is multiplied, e.g. `\readdata` with `nStep=5` and `\listplot` with `nStep=10` means, that only every 50th data record is read and plotted.

When both, `x/yStart/End` are defined then the values are also compared with both values.

8.1. Options `nStep`, `xStep`, and `yStep`

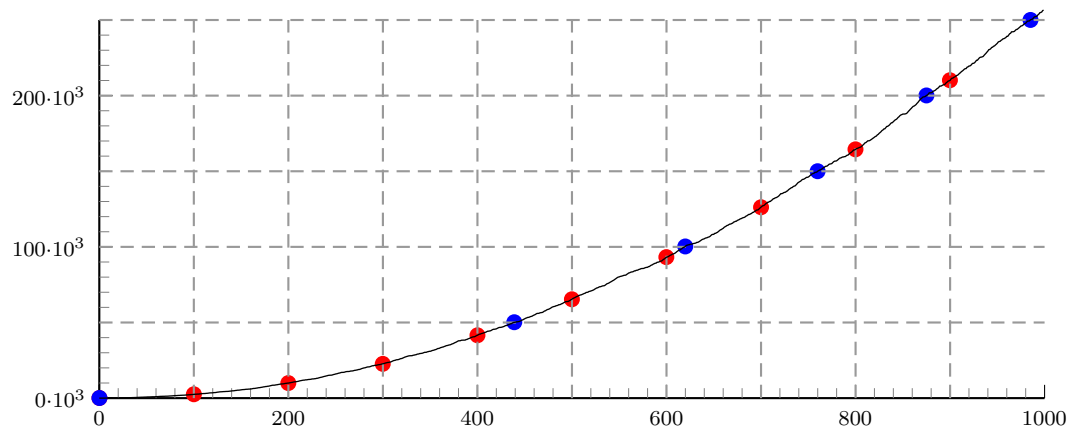
The datafile `data.data` contains 1000 data records. The thin blue line is the plot of all records with the `plotstyle curve` option.



```

1 \readdata{\data}{data.data}
2 \psset{xunit=12.5cm,yunit=0.2mm}
3 \begin{pspicture}(-0.080,-30)(1,270)
4 \pstScalePoints(1,1){1000 div}{1000 div}
5 \psaxes[Dx=200,dx=2.5cm,Dy=100,ticksiz=0 5pt,tickstyle=inner,
6   subticks=10,ylabelFactor=\cdot 10^3,dy=2cm](0,0)(1,250)
7 \listplot[nStep=50,linewidth=3pt,linecolor=red,plotstyle=dots]{\data}
8 \listplot[linewidth=1pt,linecolor=blue]{\data}
9 \end{pspicture}

```

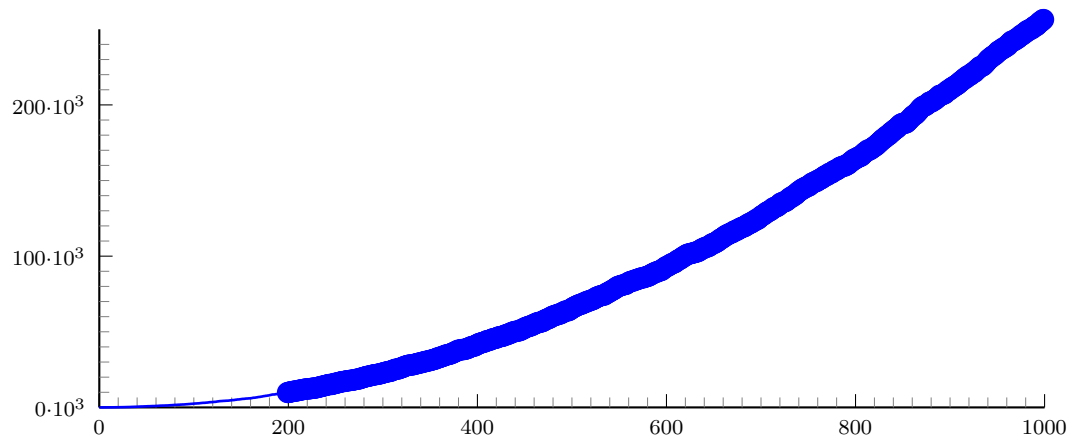


```

1 \readdata{\data}{data.data}
2 \psset{xunit=12.5cm,yunit=0.2mm}
3 \begin{pspicture}(-0.080,-30)(1,270)
4 \pstScalePoints(1,1){1000 div}{1000 div}
5 \psaxes[Dx=200,dx=2.5cm,Dy=100,ticksiz=0 5pt,tickstyle=inner,
6   subticks=10,ylabelFactor=\cdot 10^3,dy=2cm](0,0)(1,250)
7 \listplot[xStep=100,linewidth=2pt,linecolor=red,plotstyle=dots]{\data}
8 \multido{\rA=0.1+0.1}{9}{%
9   \psline[linecolor=black!40,linestyle=dashed](\rA,0)(\rA,250)}
10 \listplot[yStep=50000,linewidth=2pt,linecolor=blue,plotstyle=dots]{\data}
11 \multido{\nA=50+50}{5}{%
12   \psline[linecolor=black!40,linestyle=dashed](0,\nA)(1,\nA)}
13 \listplot[linewidth=0.5pt]{\data}
14 \end{pspicture}

```

8.2. Options nStart and xStart

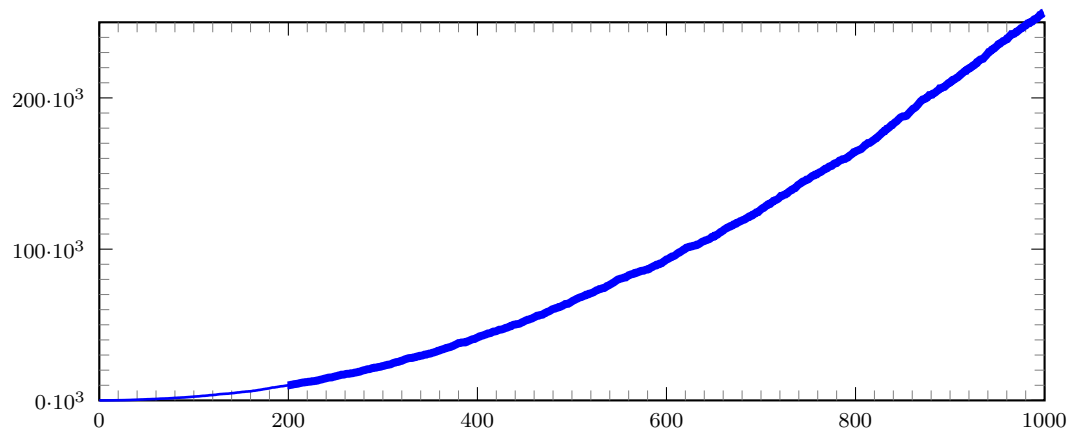


```

1 \readdata{\data}{data.data}
2 \psset{xunit=12.5cm,yunit=0.2mm}
3 \begin{pspicture}(-0.080,-30)(1,270)
4 \pstScalePoints(1,1){1000 div}{1000 div}
5 \psaxes[Dx=200,dx=2.5cm,Dy=100,ticks=0 5pt,tickstyle=inner,
6   subticks=10,ylabelFactor=\cdot 10^3,dy=2cm](0,0)(1,250)
7 \listplot[nStart=200,linewidth=3pt,
8   linecolor=blue,plotstyle=dots]{\data}
9 \listplot[linewidth=1pt,linecolor=blue]{\data}
10 \end{pspicture}

```

8.3. Options nEnd and xEnd

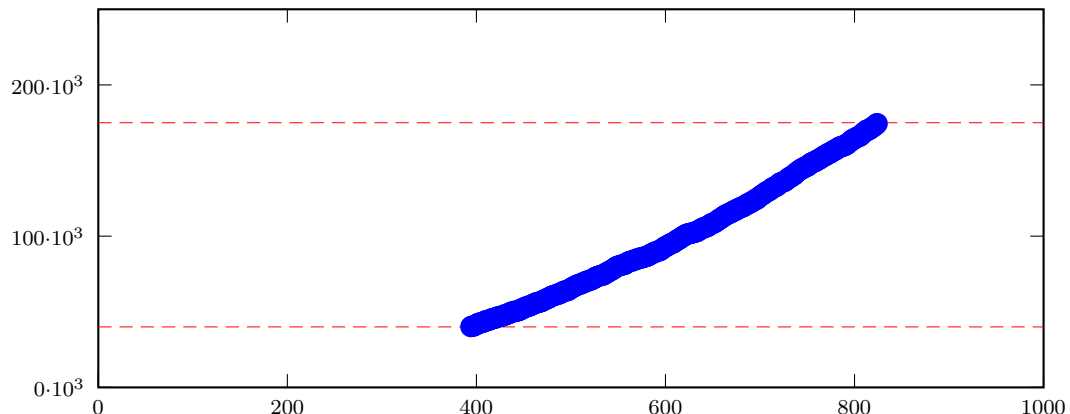


```

1 \readdata{\data}{data.data}
2 \psset{xunit=12.5cm,yunit=0.2mm}
3 \begin{pspicture}(-0.080,-30)(1,270)
4 \pstScalePoints(1,1){1000 div}{1000 div}
5 \psaxes[axesstyle=frame,Dx=200,dx=2.5cm,Dy=100,ticksiz=0 5pt,tickstyle=inner,
6   subticks=10,ylabelFactor=\cdot 10^3,dy=2cm](0,0)(1,250)
7 \listplot[nStart=200,linewidth=3pt,
8   linecolor=blue]{\data}
9 \listplot[linewidth=1pt,linecolor=blue]{\data}
10 \end{pspicture}

```

8.4. Options yStart and yEnd



```

1 \readdata{\data}{data.data}
2 \psset{xunit=12.5cm,yunit=0.2mm}
3 \begin{pspicture}(-0.080,-30)(1,270)
4 \pstScalePoints(1,1){1000 div}{1000 div}
5 \psaxes[axesstyle=frame,Dx=200,dx=2.5cm,Dy=100,ticksiz=0 5pt,tickstyle=inner,
6   ylabelFactor=\cdot 10^3,dy=2cm](0,0)(1,250)
7 \psset{linewidth=0.1pt,linestyle=dashed,linecolor=red}
8 \psline(0,40)(1,40)
9 \psline(0,175)(1,175)
10 \listplot[yStart=40000,yEnd=175000,linewidth=3pt,linecolor=blue,plotstyle=
   dots]{\data}
11 \end{pspicture}

```

8.5. Options plotNo and plotNoMax

By default the plot macros expect $x|y$ data records, but when having data files with multiple values for y , like:

```

x y1 y2 y3 y4 ... yMax
x y1 y2 y3 y4 ... yMax
...

```

you can select the y value which should be plotted. The option `plotNo` marks the plotted value (default 1) and the option `plotNoMax` tells `pst-plot` how many y values are present. There are no real restrictions in the maximum number for `plotNoMax`.

We have the following data file:

```

[% file data.data
0 0 3.375 0.0625
10 5.375 7.1875 4.5
20 7.1875 8.375 6.25
30 5.75 7.75 6.6875
40 2.1875 5.75 5.9375
50 -1.9375 2.1875 4.3125
60 -5.125 -1.8125 0.875

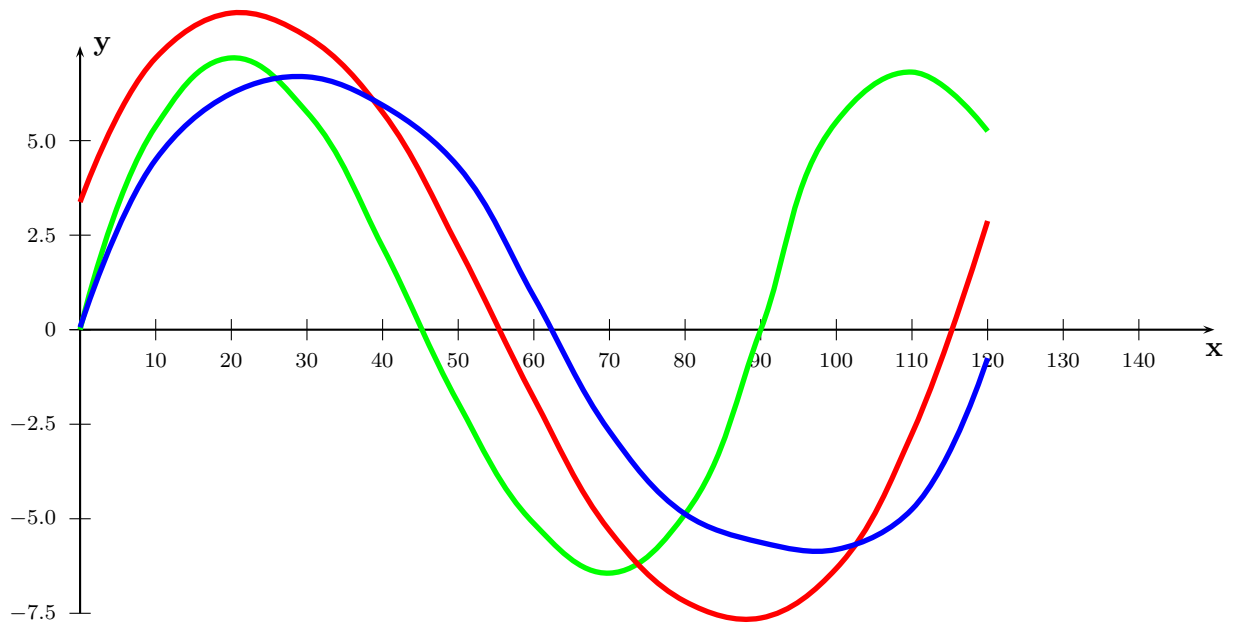
```



```

70 -6.4375 -5.3125 -2.6875
80 -4.875 -7.1875 -4.875
90 0 -7.625 -5.625
100 5.5 -6.3125 -5.8125
110 6.8125 -2.75 -4.75
120 5.25 2.875 -0.75
]%
```

which holds data records for multiple plots (x y1 y2 y3). This can be plotted without any modification to the data file:

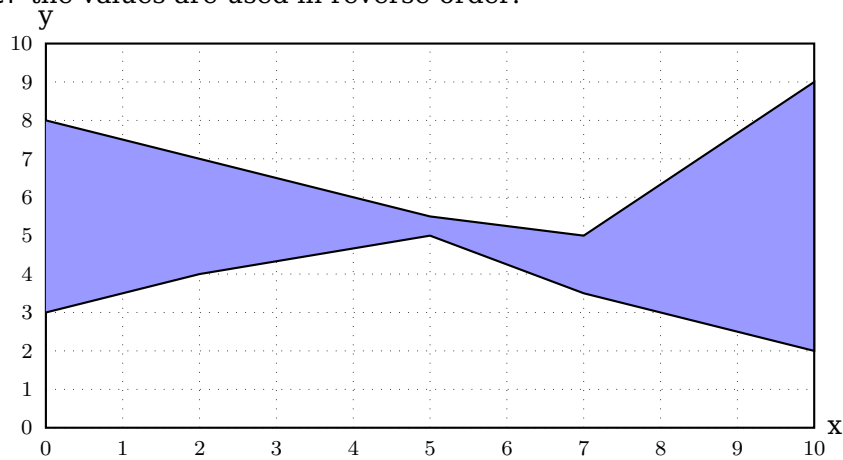


```

1 \readdata\Data{dataMul.data}
2 \psset{xunit=0.1cm, yunit=0.5cm, lly=-0.5cm}
3 \begin{pspicture}(0, -7.5)(150, 10)
4 \psaxes[Dx=10, Dy=2.5]{->}(0, 0)(0, -7.5)(150, 7.5)[$\mathbf{x}$, -90][$\mathbf{y}$, 0]
5 \psset{linewidth=2pt, plotstyle=curve}
6 \listplot[linecolor=green, plotNo=1, plotNoMax=3]{\Data}
7 \listplot[linecolor=red, plotNo=2, plotNoMax=3]{\Data}
8 \listplot[linecolor=blue, plotNo=3, plotNoMax=3]{\Data}
9 \end{pspicture}
```

8.6. Option changeOrder

It is only possible to fill the region between two listplots with `\pscustom` if one of them has the values in reverse order. Otherwise we do not get a closed path. With the option `ChangeOrder` the values are used in reverse order:



```

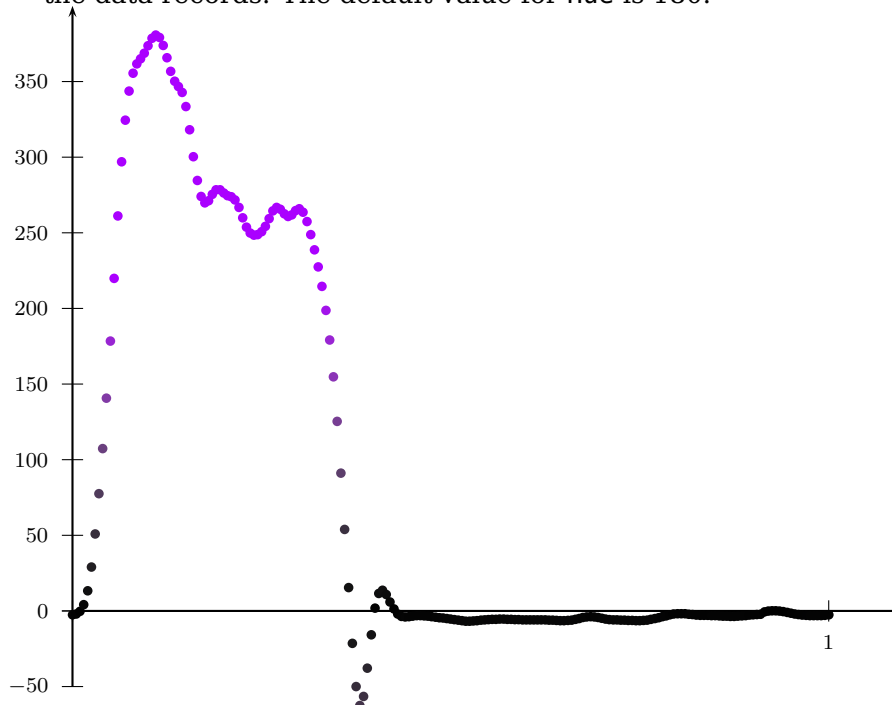
1 \begin{filecontents*}{test.data}
2   0 3 8
3   2 4 7
4   5 5 5.5
5   7 3.5 5
6   10 2 9
7 \end{filecontents*}
8 \psset{lly=-.5cm}
9 \begin{psgraph}[axesstyle=frame,ticklinestyle=dotted,ticks=0 10](0,0)(10,10)
10   {4in}{2in}%
11 \readdata{\data}{test.data}%
12 \pscustom[fillstyle=solid,fillcolor=blue!40]{%
13   \listplot[plotNo=2,plotNoMax=2]{\data}%
14   \listplot[plotNo=1,plotNoMax=2,ChangeOrder]{\data}}
15 \end{psgraph}

```

9. New plot styles

9.1. Plot style `colordot` and option `Hue`

The plotted dots can be colored with the HSB color model, where Hue is set by an angle (0...360) and the values of Saturation and Brightness are set by the relative y value of the data records. The default value for Hue is 180.



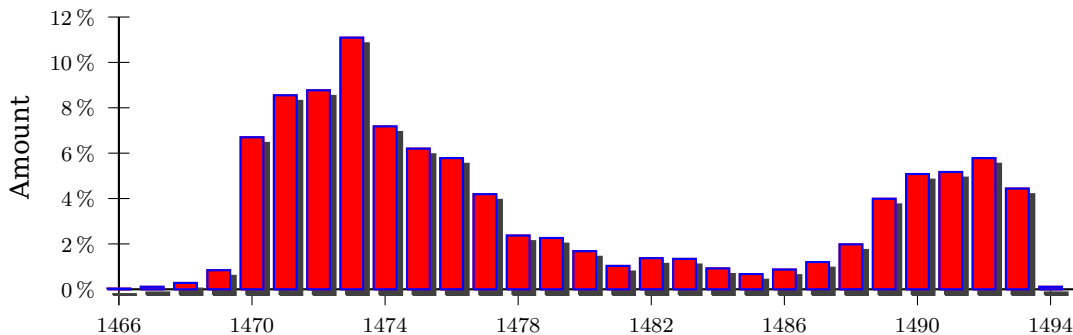
```

1 \readdata{\data}{data3.data}
2 \psset{xunit=10,yunit=0.02}
3 \begin{pspicture}(0,-50)(1.1,400)
4   \psaxes[dy=1cm,Dy=50]{->}(0,0)(0,-50)(1.1,400)
5   \listplot[Hue=280,plotstyle=colordots]{\data}
6 \end{pspicture}

```

9.2. Plot style bar and option barwidth

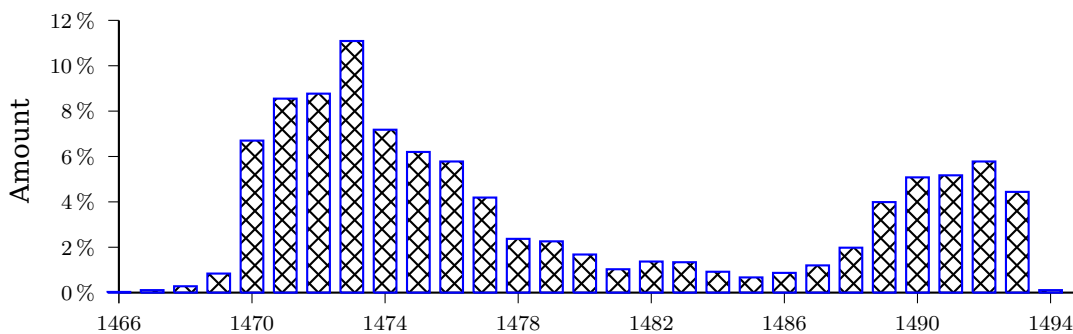
This option allows you to draw bars for the data records. The width of the bars is controlled by the option `barwidth`, which is set by default to value of `0.25cm`, which is the total width.



```

1 \psset{xunit=.44cm,yunit=.3cm}
2 \begin{pspicture}(-2,-3)(29,13)
3   \psaxes[axesstyle=axes,0x=1466,0y=0,Dx=4,Dy=2,xticks=-6pt 0,
4     ylabelFactor={\,%}](-)(29,12)
5   \listplot[shadow=true,linecolor=blue,plotstyle=bar,barwidth=0.3cm,
6     fillcolor=red,fillstyle=solid]{\barData}
7   \rput{90}(-3,6.25){Amount}
8 \end{pspicture}

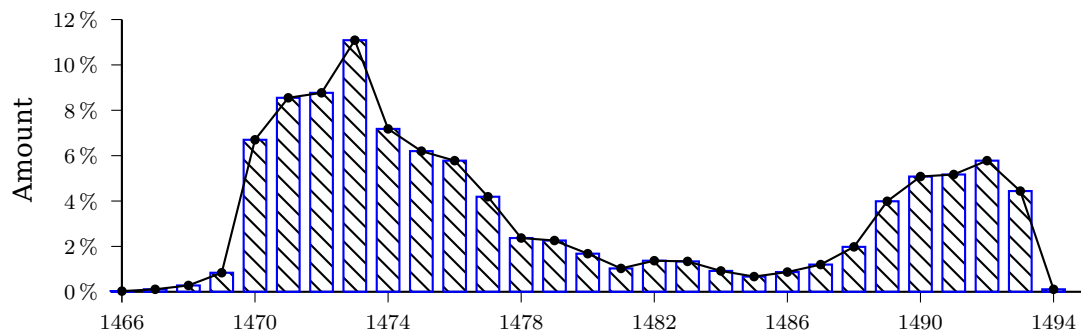
```



```

1 \psset{xunit=.44cm,yunit=.3cm}
2 \begin{pspicture}(-2,-3)(29,13)
3   \psaxes[axesstyle=axes,0x=1466,0y=0,Dx=4,Dy=2,ticks=-4pt 0,
4     ylabelFactor={\,%}](-)(29,12)
5   \listplot[linecolor=blue,plotstyle=bar,barwidth=0.3cm,
6     fillcolor=red,fillstyle=crosshatch]{\barData}
7   \rput{90}(-3,6.25){Amount}
8 \end{pspicture}

```



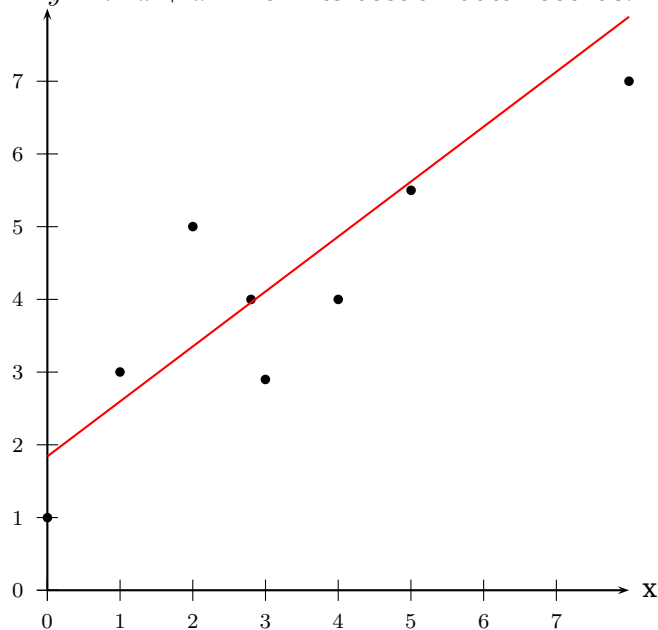
```

1 \psset{xunit=.44cm,yunit=.3cm}
2 \begin{pspicture}(-2,-3)(29,13)
3   \psaxes[axesstyle=axes,0x=1466,0y=0,Dx=4,Dy=2,ticks=-4pt 0,
4     ylabelFactor={\,%}]{-}(29,12)
5   \listplot[linecolor=blue,plotstyle=bar,barwidth=0.3cm,
6     fillcolor=red,fillstyle=vlines]{\barData}
7   \listplot[showpoints=true]{\barData}
8   \rput{90}(-3,6.25){Amount}
9 \end{pspicture}

```

9.3. Plotstyle LSM

With the setting `plotstyle=LSM` (**L**east **S**quare **M**ethod) the data records are not printed in the usual way as dots or a line, the `\listplot` macro calculates the values for a line $y = v \cdot x + u$ which fits best all data records.

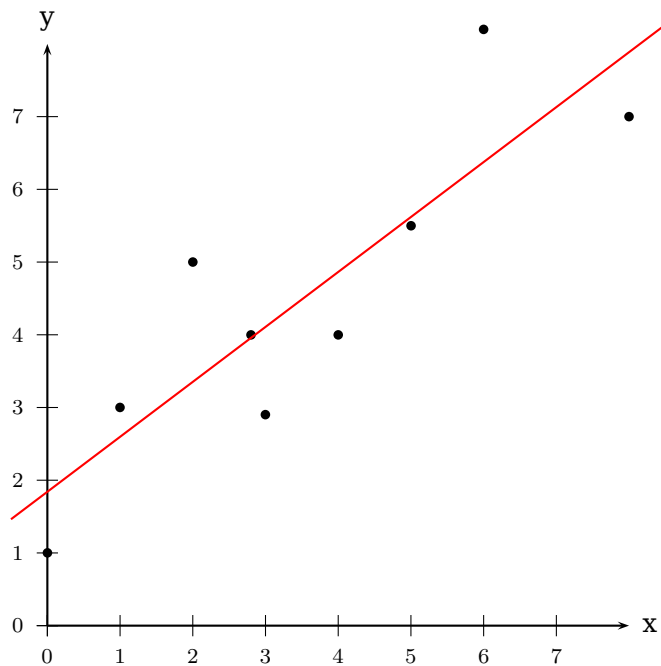


```

1 \begin{filecontents*}{LSM.data}
2 0 1 1 3 2.8 4 3 2.9 2 5 4 4 5 5.5 6 8.2 8 7
3 \end{filecontents*}
4 \psset{lly=-.5cm}
5 \readdata{\data}{LSM.data}
6 \begin{psgraph}[arrows=->](0,0)(0,0)(8,8){.5\textwidth}{!}
7   \listplot[plotstyle=dots]{\data}
8   \listplot[plotstyle=LSM,linecolor=red]{\data}
9 \end{psgraph}

```

The macro looks for the lowest and biggest x-value and draws the line for this interval. It is possible to pass other values to the macro by setting the `xStart` and/or `xEnd` options. They are preset with an empty value `{}`.



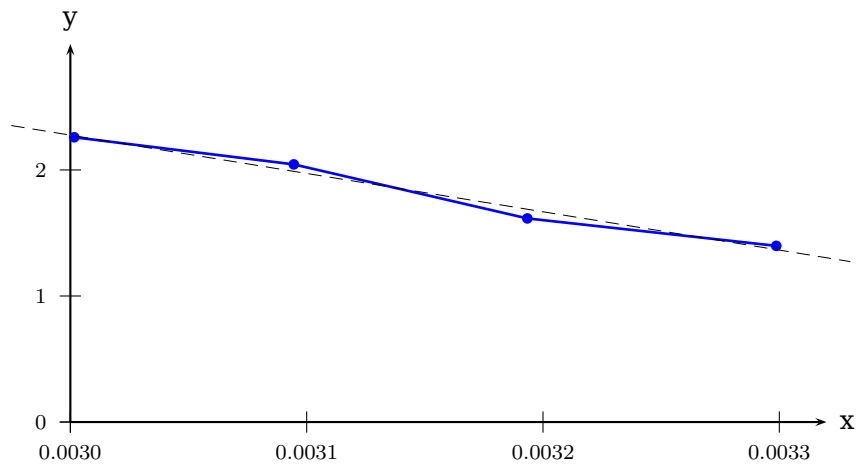
$$y = 0.755679x + 1.84105$$

```

1 \begin{filecontents*}{LSM.data}
2 0 1 1 3 2.8 4 3 2.9 2 5 4 4 5 5.5 6 8.2 8 7
3 \end{filecontents*}
4 \readdata{\data}{LSM.data}
5 \psset{lly=-1.75cm}
6 \begin{psgraph}[arrows=->](0,0)(0,0)(8,8){.5\textwidth}{!}
7   \listplot[plotstyle=dots]{\data}
8   \listplot[PstDebug,plotstyle=LSM,xStart=-0.5,xEnd=8.5,linecolor=red]{\data}
9 \end{psgraph}

```

With PstDebug one gets the equation $y = v \cdot x + u$ printed, beginning at the position (0|-50pt). This cannot be changed, because it is only for some kind of debugging. Pay attention for the correct xStart and xEnd values, when you use the \pstScalePoints Macro. In the following example we use an x-interval from 0 to 3 to plot the values; first we subtract 0.003 from all x-values and then scale them with 10000. This is not taken into account for the xStart and xEnd values.



$$y = -0.162184x + 2.27634$$

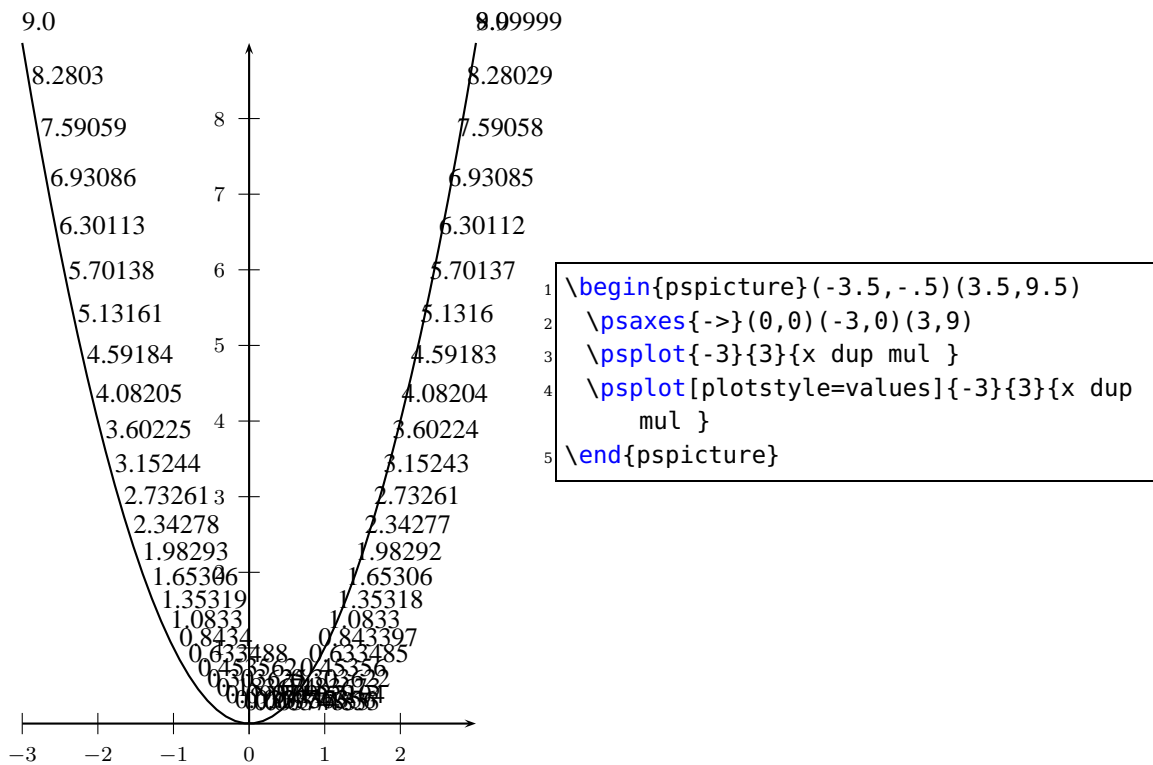
```

1 \begin{filecontents*}{LSM.data}
2 0.003298697 1.397785583
3 0.003193358 1.615489564
4 0.003094538 2.044019006
5 0.003001651 2.259240127
6 \end{filecontents*}
7 \readdata{\data}{LSM.data}
8 \pstScalePoints(10000,1){ 0.003 sub }{}
9 \psset{lly=-1.75cm}
10 \psgraph[arrows=->,Ox=0.0030,Dx=0.0001,dx=\psxunit](0,0)(3.2,3){10cm}{5cm}
11 \listplot[showpoints=true,linewidth=1pt,linecolor=blue]{\data}
12 \listplot[PstDebug=1,plotstyle=LSM,linewidth=0.1pt,linestyle=dashed,%
13 xStart=-0.25,xEnd=3.3]{\data}
14 \endpsgraph

```


9.4. Plotstyles values and values*

Instead of plotting the curve with the setting `plotstyle=values` the y -values are printed at the current point.



The possible optional arguments are `PSfont`, `valuewidth`, `fontscale`, and `decimals`. The default setting is:

```
\psset[pst-plot]{PSfont=Times-Roman,fontscale=10,valuewidth=10,decimals=-1}
```

The optional argument `rot` from the base package `pstricks` is also taken into account. With the star version `plotstyle=values*` the box of the printed value isn't transparent, everything behind this box is not seen.

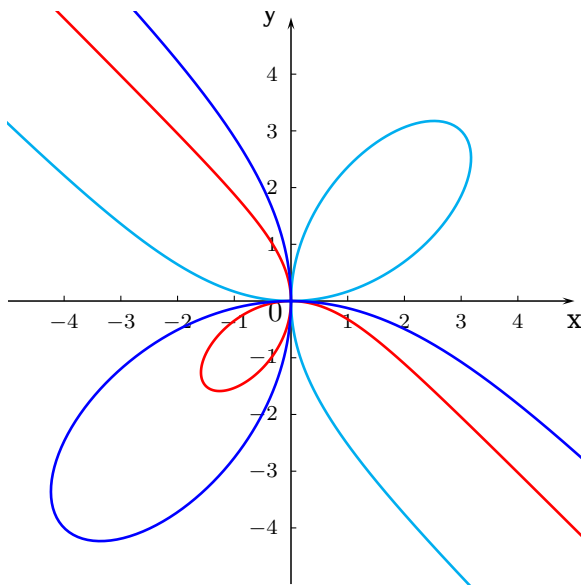
10. Polar plots

With the option `polarplot=false|true` it is possible to use `\psplot` in polar mode:

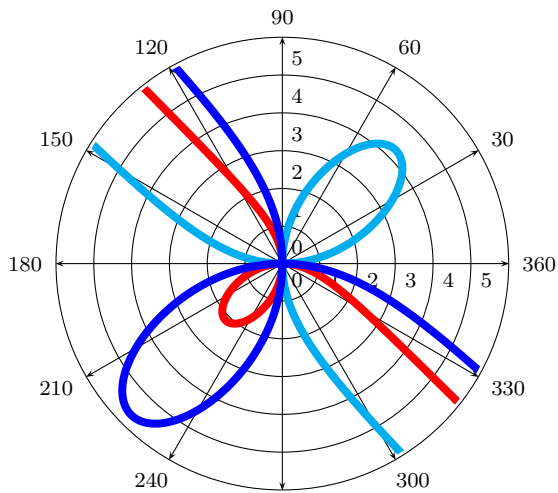
```
\psplot [polarplot=true, ...] {<start angle>}{<end angle>}%
  [PS command] {<r(alpha)>}
```

The equation in PostScript code is interpreted as a function $r = f(\alpha)$, e.g. for the circle with radius 1 as $r = \sqrt{\sin^2 x + \cos^2 x}$, or $r = a * \frac{\sin(x) * \cos(x)}{(\sin(x)^3 + \cos(x)^3)}$ for the following examples:

```
x sin dup mul x cos dup mul add sqrt
```



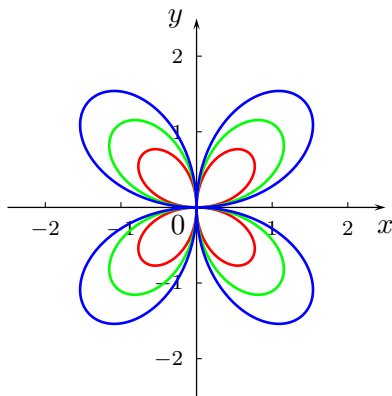
```
1 \psset{plotpoints=200,unit=0.75}
2 \begin{pspicture*(-5,-5)(5.1,5.1)}
3   \psaxes[arrowlength=1.75,ticks=2pt,labelFontSize=\scriptstyle,
4     linewidth=0.2mm]{->}(0,0)(-4.99,-4.99)(5,5)[x,-90][y,180]
5   \rput[Br](-.15,-.35){$$} \psset{linewidth=.35mm,polarplot}
6   \psplot[linecolor=red]{140}{310}{3 neg x sin mul x cos mul x sin 3 exp x cos
7     3 exp add div}
8   \psplot[linecolor=cyan]{140}{310}{6 x sin mul x cos mul x sin 3 exp x cos 3
9     exp add div}
10  \psplot[linecolor=blue,algebraic=true]{2.44}{5.41}{-8*sin(x)*cos(x)/(sin(x)
11    ^3+cos(x)^3)}
12 \end{pspicture}
```



```

1 \psset{unit=0.5cm}
2 \begin{pspicture}(-6,-6)(6,6)
3 \psaxes[axesstyle=polar,labelFontSize=\scriptstyle,linewidth=0.2mm]{->}(6,6)
4 \psset{linewidth=3pt,polarplot,plotpoints=500,plotstyle=curve}
5 \psclip{\pscircle[linestyle=none]{6}}
6 \psplot[linecolor=red]{140}{310}{3 neg x sin mul x cos mul x sin 3 exp x cos
7   3 exp add div}
8 \psplot[linecolor=cyan]{140}{310}{6 x sin mul x cos mul x sin 3 exp x cos 3
9   exp add div}
10 \psplot[linecolor=blue,algebraic=true]{2.44}{5.41}{-8*sin(x)*cos(x)/(sin(x)
11   ^3+cos(x)^3)}
12 \endpsclip
13 \end{pspicture}

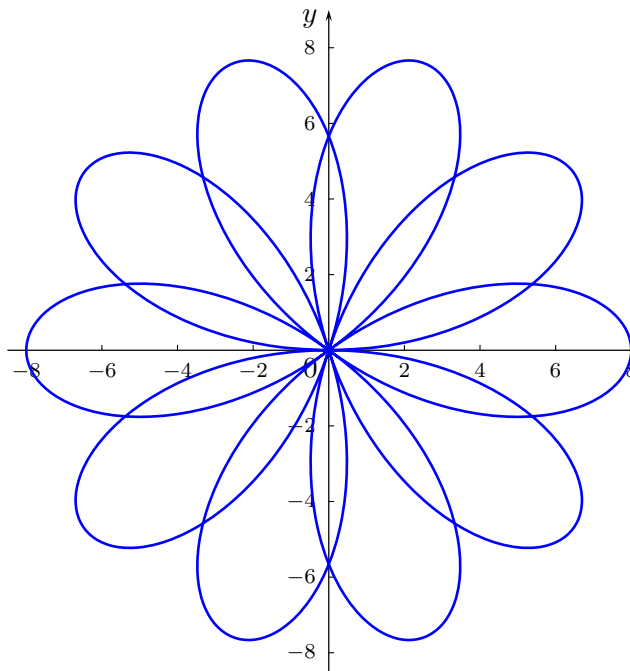
```



```

1 \psset{plotpoints=200,unit=1}
2 \begin{pspicture}(-2.5,-2.5)(2.5,2.5)% Ulrich Dirr
3 \psaxes[arrowlength=1.75,%
4   ticksize=2pt,linewidth=0.17mm]{->}%
5   (0,0)(-2.5,-2.5)(2.5,2.5)[$x$,-90][$y$,180]
6 \rput[Br]{-.15,-.35}{$0$}
7 \psset{linewidth=.35mm,plotstyle=curve,polarplot=
8   true}
9 \psplot[linecolor=red]{0}{360}{x cos 2 mul x sin
10   mul}
11 \psplot[linecolor=green]{0}{360}{x cos 3 mul x
12   sin mul}
13 \psplot[linecolor=blue]{0}{360}{x cos 4 mul x sin
14   mul}
15 \end{pspicture}

```



```

1 \psset{plotpoints=200,unit=0.5}
2 \begin{pspicture}(-8.5,-8.5)(9,9)%
   Ulrich Dirr
3 \psaxes[Dx=2,dx=2,Dy=2,dy=2,
   arrowlength=1.75,
4   ticksize=2pt,linewidth=0.17mm
   ]{->}(0,0)(-8.5,-8.5)(9,9)
5 \rput[Br](9,-.7){$x$}
6 \rput[tr](-.3,9){$y$}
7 \rput[Br](-.3,-.7){$0$}
8 %
9 \psset{linewidth=.35mm,plotstyle=
   curve,polarplot=true}
10 \psplot[linecolor=blue]{0}{720}{8
   2.5 x mul sin mul}
11 \end{pspicture}

```

11. List of all optional arguments for pst-plot

| Key | Type | Default |
|----------------|----------|-------------|
| ignoreLines | ordinary | 0 |
| Hue | ordinary | 180 |
| barwidth | ordinary | 0.25cm |
| IQLfactor | ordinary | [none] |
| plotstyle | ordinary | line |
| plotpoints | ordinary | 50 |
| yMaxValue | ordinary | -1.0 |
| PSfont | ordinary | Times-Roman |
| valuewidth | ordinary | 10 |
| fontscale | ordinary | 10 |
| decimals | ordinary | -1 |
| xyValues | boolean | true |
| ChangeOrder | boolean | true |
| polarplot | boolean | true |
| VarStep | boolean | true |
| PlotDerivative | ordinary | [none] |
| VarStepEpsilon | ordinary | [none] |
| ticks | ordinary | all |
| labels | ordinary | all |
| Ox | ordinary | 0 |
| Dx | ordinary | 1 |
| dx | ordinary | 0 |
| Oy | ordinary | 0 |

Continued on next page

Continued from previous page

| Key | Type | Default |
|------------------|----------|------------------|
| Dy | ordinary | 1 |
| dy | ordinary | 0 |
| showorigin | boolean | true |
| labelFontSize | ordinary | |
| mathLabel | boolean | true |
| decimalSeparator | ordinary | . |
| comma | boolean | true |
| xAxis | boolean | true |
| yAxis | boolean | true |
| xyAxes | boolean | true |
| xlabelPos | ordinary | b |
| ylabelPos | ordinary | l |
| xyDecimals | ordinary | |
| xDecimals | ordinary | |
| yDecimals | ordinary | |
| xlogBase | ordinary | |
| ylogBase | ordinary | |
| xylogBase | ordinary | |
| trigLabelBase | ordinary | 0 |
| xtrigLabels | boolean | true |
| ytrigLabels | boolean | true |
| trigLabels | boolean | true |
| logLines | ordinary | none |
| ylabelFactor | ordinary | \relax |
| xlabelFactor | ordinary | \relax |
| showOriginTick | boolean | true |
| ticksize | ordinary | -4pt 4pt |
| xticksize | ordinary | [none] |
| yticksize | ordinary | [none] |
| tickstyle | ordinary | full |
| subticks | ordinary | 1 |
| xsubticks | ordinary | 1 |
| ysubticks | ordinary | 1 |
| subticksize | ordinary | 0.75 |
| xsubticksize | ordinary | 0.75 |
| ysubticksize | ordinary | 0.75 |
| tickwidth | ordinary | 0.5\pslinewidth |
| xtickwidth | ordinary | 0.5\pslinewidth |
| ytickwidth | ordinary | 0.5\pslinewidth |
| subtickwidth | ordinary | 0.25\pslinewidth |
| xsubtickwidth | ordinary | 0.25\pslinewidth |
| ysubtickwidth | ordinary | 0.25\pslinewidth |
| labelOffset | ordinary | 0pt |

Continued on next page

Continued from previous page

| Key | Type | Default |
|-------------------|----------|---------|
| xlabelOffset | ordinary | 0pt |
| ylabelOffset | ordinary | 0pt |
| tickcolor | ordinary | black |
| xtickcolor | ordinary | black |
| ytickcolor | ordinary | black |
| subtickcolor | ordinary | gray |
| xsubtickcolor | ordinary | gray |
| ysubtickcolor | ordinary | gray |
| xticklinestyle | ordinary | solid |
| xsubticklinestyle | ordinary | solid |
| yticklinestyle | ordinary | solid |
| ysubticklinestyle | ordinary | solid |
| ticklinestyle | ordinary | solid |
| subticklinestyle | ordinary | solid |
| nStep | ordinary | 1 |
| nStart | ordinary | 0 |
| nEnd | ordinary | |
| xStep | ordinary | 0 |
| yStep | ordinary | 0 |
| xStart | ordinary | |
| xEnd | ordinary | |
| yStart | ordinary | |
| yEnd | ordinary | |
| plotNo | ordinary | 1 |
| plotNoMax | ordinary | 1 |
| axesstyle | ordinary | axes |
| xAxisLabel | ordinary | [none] |
| yAxisLabel | ordinary | [none] |
| xAxisLabelPos | ordinary | |
| yAxisLabelPos | ordinary | |
| llx | ordinary | \z@ |
| lly | ordinary | \z@ |
| urx | ordinary | \z@ |
| ury | ordinary | \z@ |

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