MFPIC Quick Reference

(Copyright 2000–2006 by Daniel Luecking)

This information was prepared for version 0.9 of mfpic.

Preamble commands

Load mfpic package (LaTeX)	`\usepackage[⟨options⟩]{mfpic}`
Options	`metafont	metapost, mplabels, overlaylabels,`
	`centeredcaptions, raggedcaptions, clip, truebbox,`
	`draft, final, nowrite, mfpreadlog`
Load mfpic; activate options	`\input mfpic. \usemetafont	\usemetapost,`
(plainTeX)	`\usemplabels, \overlaylabels \usecenteredcaptions,`
	`\useraggedcaptions, \clipmfpic, \usetruebbox,`
	`\mfpicdraft, \mfpicfinal, \mfpicnowrite,`
	`\mfpreadlog`
Turn off some options	`\nomplabels, \nooverlaylabels,`
	`\nocenteredcaptions, \noraggedcaptions,`
	`\noclipmfpic, \notruebbox`
Set up/close the output file	`\opengraphsfile{⟨base name⟩}...\closegraphsfile`

The mfpic environment

Start an mfpic figure	`\mfpic[⟨xscale⟩][⟨yscale⟩]{⟨x_min⟩}{⟨x_max⟩}{⟨y_min⟩}{⟨y_max⟩}`
	`⟨mfpic commands⟩`
	`\endmfpic`
LaTeX (optional)	`\begin{mfpic} ≡ \mfpic, \end{mfpic} ≡ \endmfpic`

Dimensions (lengths)

Purpose; where used:	Name and default value:
Unit of length; `\mfpic`	`\mfpicunit`, 1pt
Size of a symbol; `\point`, `\plot`, and `\plotsymbol`	`\pointsize`, 2pt
Darkness of shading; `\shade`	`\shadespace`, 1pt
Space between dots; `\polkadot`	`\polkadotspace`, 10pt
Space between hatch lines; hatching macros	`\hatchspace`, 3pt
Size of arrowhead; `\arrow`	`\headlen`, 3pt
Size of x-, y-axis arrowhead; xy-axes macros	`\axisheadlen`, 5pt
Size of border axis arrowhead; side axis macros	`\sideheadlen`, 0pt
Size of marks on axes; axis marks	`\hashlen`, 4pt
Size of dashes; `\dashed`	`\dashlen`, 4pt
Space between dashes; `\dashed`	`\dashspace`, 4pt
Size of dots; `\dotted`	`\dotsize`, 0.5pt
Space between dots; `\dotted`	`\dotspace`, 3pt
Space between symbols; `\plot`	`\symbolspace`, 5pt

The following commands are used to change the size of some dimension parameters:

Purpose (default):	Command:
Set diameter of drawing pen (0.5pt)	`\penwd{⟨dimen⟩}`
Set diameter of shading dots (0.5pt)	`\shadewd{⟨dimen⟩}`
Set diameter of polkadot (5pt)	`\polkadotwd{⟨dimen⟩}`
Set diameter of hatching pen (0.5pt)	`\hatchwd{⟨dimen⟩}`
Multiply `\shadespace` by 1.2	`\lightershade`
Divide `\shadespace` by 1.2	`\darkershade`

Colors

Set color for curves	`\drawcolor{⟨color⟩}`
Set color for fills	`\fillcolor{⟨color⟩}`
Set color for points, symbols	`\pointcolor{⟨color⟩}`
Set color for hatching	`\hatchcolor{⟨color⟩}`
Set color for arrowheads	`\headcolor{⟨color⟩}`
Set color for tlabels	`\tlabelcolor{⟨color⟩}`
Set color used by `\gclear`	`\backgroundcolor{⟨color⟩}`
LaTeX syntax	`\drawcolor[⟨model⟩]{⟨clrspec⟩}`, etc.
Define a color name	`\mfpdefinecolor{⟨name⟩}{⟨model⟩}{⟨clrspec⟩}`

Common geometric figures

Drawing commands that operate on a variable length list in braces may be followed by `\datafile{⟨filename⟩}` instead of the list.

Points

Place a symbol at given point(s)	`\plotsymbol[⟨size⟩]{⟨name⟩}(x_0,y_0),(x_1,y_1),...`
Available symbol names	`Triangle, Square, Circle, Diamond, Star,`
	`SolidTriangle, SolidSquare, SolidCircle,`
	`SolidDiamond, SolidStar, Plus, Cross, Asterisk`
Points (filled or unfilled circles)	`\point[⟨size⟩]{(x_0,y_0),(x_1,y_1),...}`
Force filled/open circles in `\point`:	`\pointfilltrue/\pointfillfalse`

Lines

Connect points with lines	`\polyline(x_0,y_0),(x_1,y_1),...`, or (`\lines`)
Closed polygon	`\polygon{(x_0,y_0),(x_1,y_1),...}`
Concatenate vectors	`\turtle{⟨initialpoint⟩,⟨v_1⟩,⟨v_2⟩,...}`
Rectangle (upright) with given corners	`\rect{(x_0,y_0),(x_1,y_1)}`

Circles, arcs and ellipses

Circles

polar form (default):	`\circle[p]{⟨center⟩,⟨radius⟩}`
three-point form:	`\circle[t]{(x_0,y_0),(x_1,y_1),(x_2,y_2)}`
center-point form:	`\circle[c]{⟨center⟩,⟨point⟩}`
point-sweep form:	`\circle[s]{(x_0,y_0),(x_1,y_1),⟨angle⟩}`

Arcs

polar form:	`\arc[p]{⟨center⟩,⟨θ_1⟩,⟨θ_2⟩,⟨radius⟩}`
three-point form:	`\arc[t]{(x_0,y_0),(x_1,y_1),(x_2,y_2)}`
center-point-angle form:	`\arc[c]{⟨center⟩,⟨point⟩,⟨angle⟩}`
point-sweep form (default):	`\arc[s]{(x_0,y_0),(x_1,y_1),⟨angle⟩}`
Ellipse, center (x_0,y_0), radii $⟨r_x⟩$, $⟨r_y⟩$, angle $⟨θ⟩$	`\ellipse[⟨θ⟩]{(x_0,y_0),⟨r_x⟩,⟨r_y⟩}`

General curves

A ⟨spec⟩ can be p (for polyline) or s (for smooth) followed by a number for the tension.

Smooth curve through points	`\curve[⟨tension⟩]{(x_0,y_0),(x_1,y_1),...}`
Graph of $y = f(x)$	`\function[⟨spec⟩]{x_min,x_max,Δx}{f(x)}`
Graph of parametric curve $(x(t),y(t))$	`\parafcn[⟨spec⟩]{t_min,t_max,Δt}{(x(t), y(t))}`
Graph of $r = f(θ)$	`\plrfcn[⟨spec⟩]{θ_min,θ_max,Δθ}{f(t)}`
Interpolate with a smooth *function*	`\fcncurve[⟨tension⟩]{(x_0,y_0),(x_1,y_1),...}`
Curve from data in a file	`\datafile[⟨spec⟩]{⟨file⟩}`
Set how `\datafile` processes a line	`\using{⟨read_pattern⟩}{⟨write_pattern⟩}`
	Default is `\using{#1 #2 #3}{(#1,#2)}`

Regions

Curves are not necessarily 'closed' even if the start and end are the same. The following are closed (may be filled), as are `\rect`, `\polygon`, `\circle`, and `\ellipse`.

Closed curve through given points	`\cyclic[`$\langle tension\rangle$`]{`$(x_1,y_1),(x_2,y_2),\ldots$`}`
Circular sector (pie slice)	`\sector{`$\langle center\rangle$`,`$\langle radius\rangle$`,`$\langle\theta_1\rangle$`,`$\langle\theta_2\rangle$`}`
Region between two functions	`\btwnfcn[`$\langle spec\rangle$`]{`$x_{\min},x_{\max},\Delta x$`}{`$f(x)$`}{`$g(x)$`}`
Region in polar coordinates	`\plrregion[`$\langle spec\rangle$`]{`$\theta_{\min},\theta_{\max},\Delta\theta$`}{`$f(t)$`}`
Curves surrounding text	`\tlabelrect[`$\langle radius\rangle$`](`$\langle x\rangle$`,`$\langle y\rangle$`){`$\langle text\rangle$`}`
	`\tlabeloval[`$\langle mult\rangle$`](`$\langle x\rangle$`,`$\langle y\rangle$`){`$\langle text\rangle$`}`
	`\tlabelellipse[`$\langle ratio\rangle$`](`$\langle x\rangle$`,`$\langle y\rangle$`){`$\langle text\rangle$`}`
	$\langle radius\rangle$: round corners. $\langle mult\rangle$: stretch horizontally. $\langle ratio\rangle$: width/height of ellipse

Prefix macros

Drawing curves

Dashed path	`\dashed[`$\langle length\rangle$`,`$\langle gap\rangle$`]`$\ldots$
Dotted path	`\dotted[`$\langle size\rangle$`,`$\langle gap\rangle$`]`$\ldots$
Trace a path with symbols	`\plot[`$\langle size\rangle$`,`$\langle gap\rangle$`]{`$\langle symbol\rangle$`}`$\ldots$
Generalized dashes	`\gendashed{`$\langle patname\rangle$`}`$\ldots$
Define a named dash pattern	`\dashpattern{`$\langle patname\rangle$`}{`$\langle len_1\rangle$`,`$\langle len_2\rangle$`,`$\ldots$`,`$\langle len_{2n}\rangle$`}`
Place a symbol at all nodes	`\plotnodes[`$\langle size\rangle$`]{`$\langle symbol\rangle$`}`$\ldots$
Solid curve	`\draw[`$\langle color\rangle$`]`$\ldots$

Closing a curve

These turn any path into a 'closed' path (result may be filled).

Close with a straight line,	`\lclosed`$\ldots$
Close with a smooth join, like `\cycle`,	`\sclosed`$\ldots$
Close letting METAFONT choose	`\bclosed`$\ldots$

Filling closed curves

These filling prefixes turn off drawing of the curve.

Solid fill	`\gfill[`$\langle color\rangle$`]`$\ldots$
Unfill	`\gclear`$\ldots$
Hatched fills	`\thatch[`$\langle space\rangle$`,`$\langle angle\rangle$`][`$\langle color\rangle$`]`$\ldots$
$\langle angle\rangle = 45\deg$	`\rhatch[`$\langle space\rangle$`][`$\langle color\rangle$`]`$\ldots$
$\langle angle\rangle = -45\deg$	`\lhatch[`$\langle space\rangle$`][`$\langle color\rangle$`]`$\ldots$
crosshatching	`\xhatch[`$\langle space\rangle$`][`$\langle color\rangle$`]`$\ldots$
	`\hatch = \xhatch`
Shading	`\shade[`$\langle space\rangle$`]`$\ldots$
Polkadot fill	`\polkadot[`$\langle space\rangle$`]`$\ldots$
Fill with copies of a tile	`\tess{`$\langle tile\rangle$`}`$\ldots$
Define a tile*	`\tile{`$\langle name\rangle$`,`$\langle unit\rangle$`,`$\langle width\rangle$`,`$\langle height\rangle$`,`$\langle clip\rangle$`}`
	$\langle drawing\ commands\rangle$ `\endtile`

* Creates a mini-mfpic, clipped if $\langle clip\rangle$ = `true`.

Storing and reusing a path

Store a path	`\store{`$\langle name\rangle$`}`$\ldots$
reusing a stored path	`\mfobj{`$\langle name\rangle$`}`

Subpaths

Subpath by fraction of length	`\partpath{`$\langle frac1\rangle$`,`$\langle frac2\rangle$`}`$\ldots$
Subpath by node number	`\subpath{`$\langle m\rangle$`,`$\langle n\rangle$`}`$\ldots$

Cutting by another path	`\cutoffafter{`$\langle obj\rangle$`}`$\ldots$, `\cutoffbefore{`$\langle obj\rangle$`}`$\ldots$
	$\langle obj\rangle$ is a name created with `\store`
Trim the ends of a path	`\trimpath{`$\langle dim1\rangle$`,`$\langle dim2\rangle$`}`$\ldots$

Modifying a curve

Add arrowhead to the end	`\arrow[l`$\langle length\rangle$`][r`$\langle angle\rangle$`][b`$\langle backset\rangle$`][c`$\langle color\rangle$`]`$\ldots$
Define arrowhead shape	`\headshape{`$\langle ratio\rangle$`}{`$\langle tension\rangle$`}{`$\langle filled\rangle$`}`
Reverse a curve	`\reverse`$\ldots$
Double arrow	`\arrow\reverse\arrow`$\ldots$
Rotate around a point	`\rotatepath{(`x_0,y_0`),`$\langle angle\rangle$`}`$\ldots$
Reflect about a line	`\reflectpath{(`x_0,y_0`),(`x_1,y_1`)}`$\ldots$
Shift	`\shiftpath{(`dx,dy`)}`$\ldots$
Scale around a point	`\scalepath{(`x_0,y_0`),`$\langle scale\rangle$`}`$\ldots$
xscale about line $x = x_0$	`\xscalepath{`x_0`,`$\langle scale\rangle$`}`$\ldots$
yscale about line $y = y_0$	`\yscalepath{`y_0`,`$\langle scale\rangle$`}`$\ldots$
slant, pivoting on line $y = y_0$	`\slantpath{`y_0`,`$\langle slant\rangle$`}`$\ldots$
yslant, pivoting on line $x = x_0$	`\yslantpath{`x_0`,`$\langle slant\rangle$`}`$\ldots$
Swap x and y	`\xyswappath`$\ldots$

Axes

Draw x- and/or y-axes	`\axes[`$\langle headlen\rangle$`]`, `\xaxis[`$\langle headlen\rangle$`]`, `\yaxis[`$\langle headlen\rangle$`]`
Draw various axes	`\axis[`$\langle headlen\rangle$`]{`$\langle axis\rangle$`}`, $\langle axis\rangle$ is one of x, y, l, b, r, or t.
Draw many axes	`\doaxes[`$\langle headlen\rangle$`]{`$\langle list\rangle$`}`, $\langle list\rangle$ of letters, no commas.
Shift border axis inward	`\axismargin{`$\langle axis\rangle$`}{`$\langle amt\rangle$`}`, $\langle amt\rangle$ is in graph units.
Add hashmarks to axes	`\axismarks{`$\langle axis\rangle$`}[`$\langle len\rangle$`]{`$c_1,c_2,\ldots$`}`, c_j are positions.
	Abbrev. by `\xmarks` for `\axismarks{x}`, etc.
Change position of hash marks	`\setaxismarks{`$\langle axis\rangle$`}{`$\langle pos\rangle$`}` $\langle pos\rangle$ is one of `inside`, `outside`, `centered`, `ontop`, `onbottom`, `onleft`, or `onright`.

Miscellaneous

Text labels	`\tlabel[`$\langle pos\rangle\langle\theta\rangle$`](`$\langle x\rangle$`,`$\langle y\rangle$`){`$\langle$TeX $text\rangle$`}`
	`\tlabels{`$\langle args_1\rangle\langle args_2\rangle$`}`$\ldots$`}`
	`\axislabels{`$\langle axis\rangle$`}[`$\langle pos\rangle\langle\theta\rangle$`]{{`$\langle txt_1\rangle$`}`$\langle n_1\rangle$`},{`$\langle txt_2\rangle$`}`$\langle n_2\rangle$`},`$\ldots$`}`
	$\langle pos\rangle$ is a two-letter sequence, $\langle\theta\rangle$ the angle* of rotation in degrees; $\langle args_j\rangle$ is an entire set of arguments as in `\tlabel`; $\langle axis\rangle$ is a letter, $\langle txt_j\rangle$ is label, $\langle n_j\rangle$ is coordinate on axis
Clipping to a path	`\gclip`$\ldots$
Polar conversion	`\plr{(`r_0,θ_0`),(`r_1,θ_1`),`$\ldots$`}`
Connect paths	`\connect` $\langle path1\rangle$ $\langle path2\rangle$ $\ldots$ `\endconnect`
Draw many curves from one datafile	`\plotdata[`$\langle spec\rangle$`]{`$\langle file\rangle$`}`, $\langle spec\rangle$ is p or s$\langle num\rangle$ where $\langle num\rangle$ is the (optional) tension in the smooth curve
Set how `\plotdata` draws curves[†]	`\dashedlines` (different dash patterns)
	`\coloredlines` (different colors, METAPOST only)
	`\pointedlines` (different symbols, like `\plot`)
	`\datapointsonly` (different symbols, like `\plotnodes`)

* The angle is optional, and ignored unless option `mplabels` is in effect.

[†] `\plotdata` also respects the `\using` setting (see `\datafile` in section **General curves**).