The Ti*k*Z-Extensions Package

Manual for version 0.1

https://github.com/Qrrbrbirlbel/tikz-extensions

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Contents

Part I
Introduction

1 Usage

This package is called `tikz-ext`, however, one can't load it via `\usepackage`. Instead, this package consists of multiple PGF and Ti*k*Z libraries which are loaded by either `\usepgflibrary` or `\usetikzlibrary`.

2 Why do we need it?

Since I have been answering questions on TeX.sx I've noticed that some questions come up again and again, every time with a slightly different approach on how to solve them.

I don't like reinventing the wheel which is why I've gathered the code of my answers in this package.

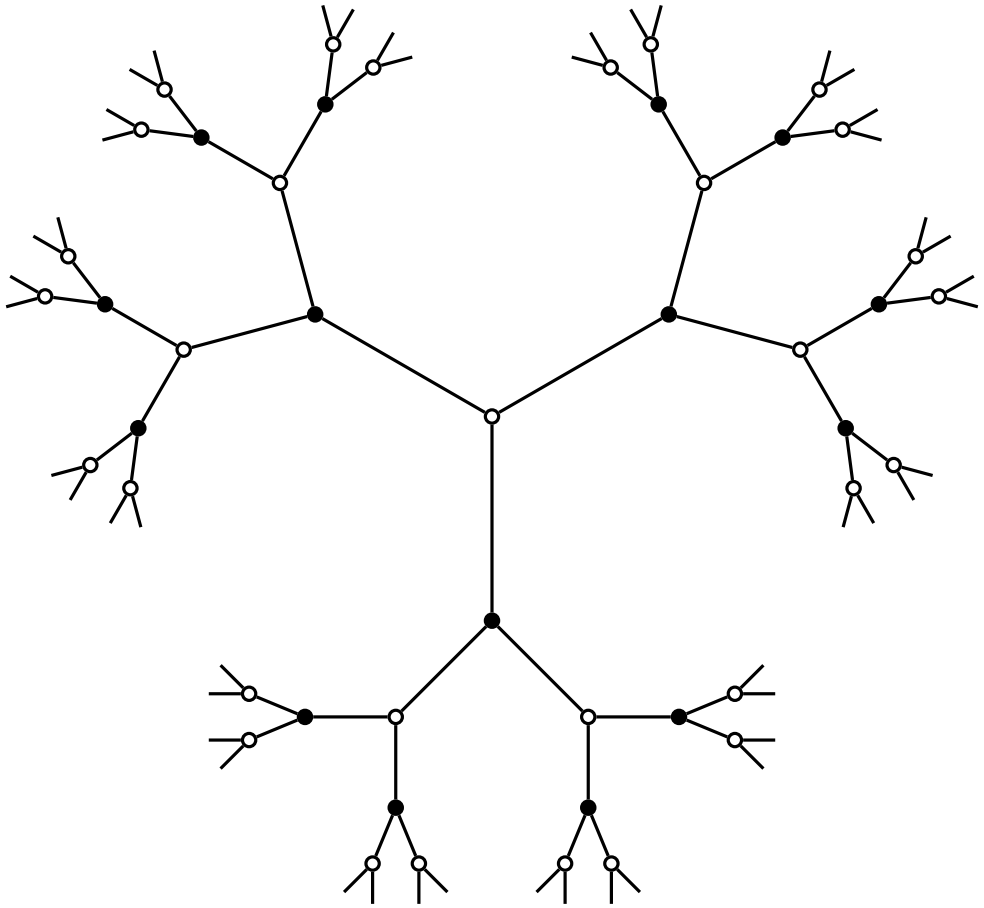
And, yes, I am using them myself, too.

3 Should these libraries be part of Ti*k*Z?

I guess.

Part II
Ti*k*Z Libraries

These libraries only work with Ti*k*Z.

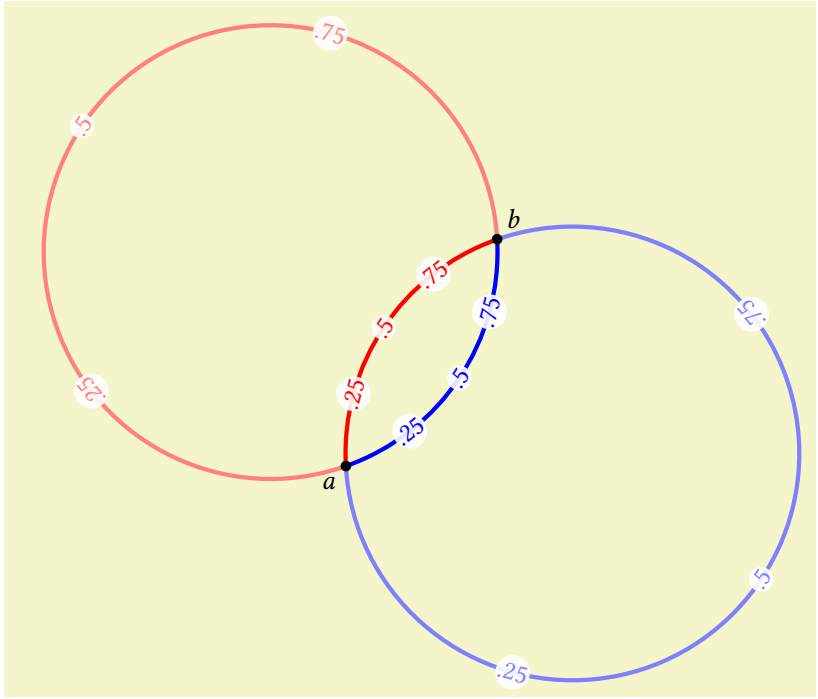


4 Arc *to* a point

TikZ Library paths.arcto

```
\usetikzlibrary{paths.arcto} % LaTeX and plain TeX
\usetikzlibrary[paths.arcto] % ConTeXt
```

This library adds new path specifications `arc to` that specifies an arc *to* a point – without the user having to specify any angles.




```
\usetikzlibrary {paths.arcto}
\begin{tikzpicture}[ultra thick,dot/.style={label={#1}}]
\coordinate[dot=below left:$a$] (a) at (0,0);
\coordinate[dot=above right:$b$] (b) at (2,3);
\begin{scope}[
  radius=3,
  nodes={
    shape=circle,
    fill=white,
    fill opacity=.9,
    text opacity=1,
    inner sep=+0pt,
    sloped,
    allow upside down
  }]
\draw[blue]    (a) arc to[]
  node[near start] {.25} node {.5} node[near end] {.75} (b);
\draw[red]     (a) arc to[clockwise]
  node[near start] {.25} node {.5} node[near end] {.75} (b);
\draw[blue!50] (a) arc to[large]
  node[near start] {.25} node {.5} node[near end] {.75} (b);
\draw[red!50]  (a) arc to[large, clockwise]
  node[near start] {.25} node {.5} node[near end] {.75} (b);
\end{scope}

\fill[radius=2pt] (a) circle[] (b) circle[];
\end{tikzpicture}
```

`\path` ... `arc to[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ ...;

When this operation is used, the path gets extended by an arc that goes through the current point and ⟨*coordinate*⟩.

For two points there exist two circles or four arcs that go through or connect these two points. Which one of these is constructed is determined by the following options that can be used inside of ⟨*options*⟩.

`/tikz/arc to/clockwise` (style, no value)

This constructs an arc that goes clockwise.

`/tikz/arc to/counter clockwise` (style, no value)

This constructs an arc that goes counter clockwise.

This is the default.

`/tikz/arc to/large` (style, no value)

This constructs an arc whose angle is larger than 180°.

`/tikz/arc to/small` (style, no value)

This constructs an arc whose angle is smaller than 180°.

`/tikz/arc to/rotate`=⟨*degree*⟩ (no default)

Rotates the arc by ⟨*degree*⟩. This only takes effect when `x radius` and `y radius` is different.

`/tikz/arc to/x radius`=⟨*value*⟩ (no default)

This forwards the ⟨*value*⟩ to `/tikz/x radius`.

`/tikz/arc to/y radius`=⟨*value*⟩ (no default)

This forwards the ⟨*value*⟩ to `/tikz/y radius`.

`/tikz/arc to/radius`=⟨*value*⟩ (no default)

This forwards the ⟨*value*⟩ to both `/tikz/x radius` and `/tikz/y radius`.

`/tikz/every arc to` (style, no value)

After `/tikz/every arc` this will also be applied before any ⟨*options*⟩ are set.

It should be noted that this uses `\pgfpatharcto` where the Ti*k*Z manual warns of:

> *The internal computations necessary for this command are numerically very unstable. In particular, the arc will not always really end at the ⟨target coordinate⟩, but may be off by up to several points. A more precise positioning is currently infeasible due to TEX's numerical weaknesses. The only case it works quite nicely is when the resulting angle is a multiple of* 90°.

The `arc to` path operation will also work only in the `canvas` coordinate system. The lengths of the vectors $(1, 0)$ and $(0, 1)$ will be used for the calculation of the radii but no further consideration is done.

5 More Horizontal and Vertical Lines

TikZ Library `paths.ortho`

```
\usetikzlibrary{paths.ortho} % LaTeX and plain TeX
\usetikzlibrary[paths.ortho] % ConTeXt
```

This library adds new path specifications `|-|`, `-|-` as well as `r-ud`, `r-du`, `r-lr` and `r-rl`.

5.1 Zig-Zag

Similar to the path operations `|-` and `-|` this library adds the path operations `|-|` and `-|-`.

`\path` ... `|-|[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ ...;

This operation means "first vertical, then horizontal and then vertical again".

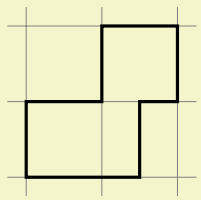
`\path` ... `-|-[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ ...;

This operation means "first horizontal, then vertical and then horizontal again".

`/tikz/hvvh/ratio`=⟨*ratio*⟩ (no default, initially `0.5`)

This sets the ratio for the middle part of the Zig-Zag connection.

For values ⟨*ratio*⟩ < 0 and ⟨*ratio*⟩ > 1 the Zig-Zag lines will look more like Zig-Zig lines.

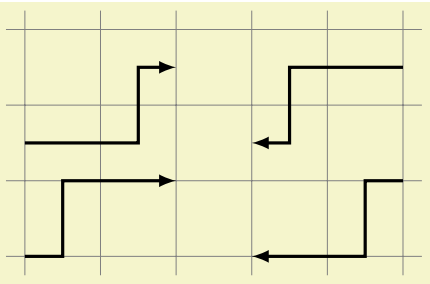


```
\usetikzlibrary {paths.ortho}
\begin{tikzpicture}[very thick]
\draw[help lines] (-.25, -1.25) grid (2.25, 1.25);
\draw (0, 0) -|-            (2, 1) --
      (2, 0) -|-[ratio=.25] (0,-1) -- cycle;
\end{tikzpicture}
```

`/tikz/hvvh/distance`=⟨*distance*⟩ (no default)

This sets the distance between the start point and the middle part of the Zig-Zag connection.

For values ⟨*distance*⟩ < 0 the distance will be used for the target coordinate.

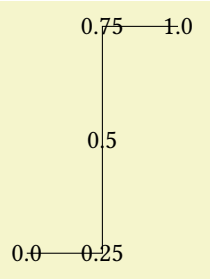


```
\usetikzlibrary {paths.ortho}
\begin{tikzpicture}[very thick,-latex]
\draw[help lines,-] (-.25, -.25) grid (5.25, 3.25);
\draw (0, 0)   -|-[distance= .5cm] ++(2, 1);
\draw (0, 1.5) -|-[distance=-.5cm] ++(2, 1);

\tikzset{xshift=3cm}
\draw (2, 1)   -|-[distance= .5cm] ++(-2, -1);
\draw (2, 2.5) -|-[distance=-.5cm] ++(-2, -1);
\end{tikzpicture}
```

`/tikz/hvvh/from center`=⟨*true or false*⟩ (no default, initially `false, default true`)

When nodes get connected the placement of the middle part of the Zig-Zag and the Zig-Zig (see below) connections will be calculated from the border of these nodes. The middle part of the connections can be calculated from the nodes' center if this key is set to `true`.

New timers are setup for both the Zig-Zag and the Zig-Zig connections, these can be configured through the following keys.




```
\usetikzlibrary {paths.ortho}
\tikz \draw (0,0) -|- (2,3)
  foreach \p in {0.0, 0.25, 0.5, 0.75, 1.0}{
    node [pos=\p] {\p}};
```

`/tikz/hvvh/spacing`=⟨*number*⟩ (no default, initially 4)

Unless ⟨*number*⟩ = 0 is set

- `pos = 0` will be at the start,
- `pos = 1` will be at the end,
- `pos =` $\frac{1}{\langle number \rangle}$ will be at the first kink,
- `pos =` $\frac{\langle number \rangle - 1}{\langle number \rangle}$ will be at the second kink and
- `pos = .5` will be in the middle of the middle part of the connection.

If ⟨*number*⟩ = 0 then

- `pos = -1` will be at the start,
- `pos = 2` will be at the end,
- `pos = 0` will be at the first kink,
- `pos = 1` will be at the second kink and
- `pos = .5` will still be in the middle of the middle part of the connection.

`/tikz/hvvh/middle 0 to 1` (no value)

This is an alias for `spacing = 0`.

5.2 Zig-Zig

`\path ... r-ud[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ `...;`

This operation means "first up, then horizontal and then down".

`/tikz/udlr/ud distance=`⟨*length*⟩ (no default, initially `.5cm`)

This sets the distance between the start and the horizontal line to ⟨*length*⟩.

`\path ... r-du[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ `...;`

This operation means "first down, then horizontal and then up".

`/tikz/udlr/du distance=`⟨*length*⟩ (no default, initially `.5cm`)

This sets the distance between the start and the horizontal line to ⟨*length*⟩.

`\path ... r-lr[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ `...;`

This operation means "left down, then vertical and then right".

`/tikz/udlr/lr distance=`⟨*length*⟩ (no default, initially `.5cm`)

This sets the distance between the start and the vertical line to ⟨*length*⟩.

`\path ... r-rl[`⟨*options*⟩`]`⟨*coordinate or cycle*⟩ `...;`

This operation means "first right, then vertical and then down".

`/tikz/udlr/rl distance=`⟨*length*⟩ (no default, initially `.5cm`)

This sets the distance between the start and the vertical line to ⟨*length*⟩.

All distances can be set with on key.

`/tikz/udlr/distance`=⟨*length*⟩ (no default)

Sets all distances in the `/tikz/udlr` namespace.

`/tikz/udlr/from center`=⟨*true or false*⟩ (no default, initially `false, default true`)

This is an alias for `/tikz/hvvh/from center`.

6 Extending the Path Timers

Ti*k*Z Library `paths.timer`

```
\usetikzlibrary{paths.timer} % LaTeX and plain TeX
\usetikzlibrary[paths.timer] % ConTeXt
```

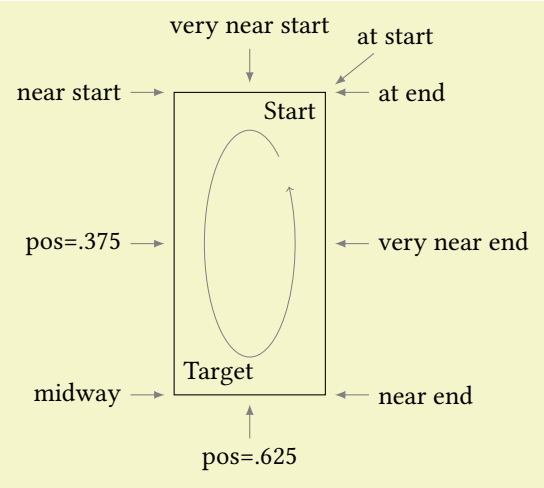
This library adds timers to the path specifications `rectangle`, `parabola`, `sin` and `cos`.

In Ti*k*Z, the path specification `rectangle`, `parabola`, `sin` and `cos` do not provide their own timer, i. e. a node placing algorithm that is dependent on the actual path. For `rectangle` the timer of the straight line between the rectangle's corners is used, for the other paths, nodes, coordinates, pics, etc. are placed on the last coordinate.

This library allows this.

6.1 Rectangle

For the `rectangle` path operator, the timer starts with `pos = 0` (= `at start`) from the starting coordinate in a counter-clockwise direction along the rectangle. The corners will be at positions 0.0, 0.25, 0.5, 0.75 and 1.0.

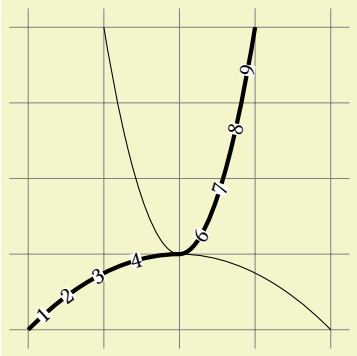



```
\usetikzlibrary {paths.timer}
\begin{tikzpicture}[scale=2, every pin edge/.style={latex-, gray}]
\coordinate [label=above right:Target] (A) at (0,0);
\coordinate [label=below left:Start]   (B) at (1,2);
\draw[->, help lines] ([shift=(50:.3 and .75)] .5,1)
  arc[start angle=50, delta angle=340, x radius=.3, y radius=.75];
\draw (B) rectangle (A)
  foreach \pos/\ang in {at start/60, very near start/90, near start/180, pos=.375/180,
                        midway/180, pos=.625/270, near end/0, very near end/0, at end/0}{
    node[pin=\ang:\pos, style/.expanded=\pos]{}};
\end{tikzpicture}
```

6.2 Parabola

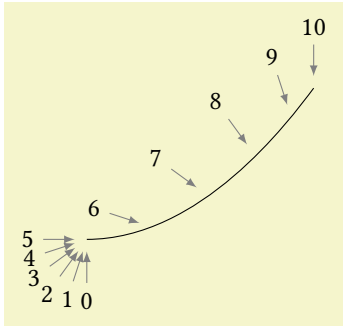
For the `parabola` path operator the timer is similar to the `.. controls ..` operator.

The position 0.5 will lie at the bend.




```
\usetikzlibrary {paths.timer}
\begin{tikzpicture}
\draw[help lines]  (-2.25, -1.25) grid (2.25, 3.25);
\draw              ( 2,-1) parabola bend (0,0) (-1,3);
\draw[ultra thick] (-2,-1) parabola bend (0,0) ( 1,3)
  foreach \pos in {1,...,4,6,7,...,9}{
    node[
      pos=.\pos, sloped, fill=white, font=\small, inner sep=+0pt
    ] {\pos}
  };
\end{tikzpicture}
```

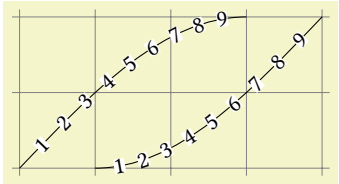
If no bend is specified half the positions will collapse into one end of the curve.




```
\usetikzlibrary {paths.timer}
\begin{tikzpicture}[every pin edge/.style={latex-, shorten <=1pt, gray}]
\draw (-2,-2) parabola (1,0)
  foreach \pos in {0, 1, ..., 10} {
    node [pos=\pos/10, pin={[anchor=-18*\pos+90]-18*\pos+270:\pos}]{}
  };
\end{tikzpicture}
```

6.3 Sine/Cosine

The `sin` and `cos` path operators also allow placing of nodes along their paths.




```
\usetikzlibrary {paths.timer}
\begin{tikzpicture}[mark nodes on line/.style={insert path={
  foreach \pos in {1, ..., 9} {node[
    sloped, fill=white, font=\small, inner sep=+0pt, pos=\pos/10] {\pos}}}}]
\draw[help lines] (-2.1,-2.1) grid (2.1,0.1);
\draw             (-2,-2) sin (1,0) [mark nodes on line];
\draw[shift=(0:1)](-2,-2) cos (1,0) [mark nodes on line];
\end{tikzpicture}
```

7 Using Images as a Pattern

TikZ Library `patterns.images`

```
\usetikzlibrary{patterns.images} % LaTeX and plain TeX
\usetikzlibrary[patterns.images] % ConTeXt
```

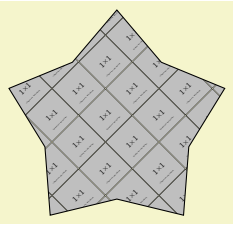
This library allows to use an image to be used as a repeating pattern for a path.

With this library arbitrary images (or indeed PDF documents) can be used as a repeating pattern for the background of a path.
This is a two-step process:

1. Declaring an image as an “image-pattern”.
2. Using the “image-pattern”.

`\pgfsetupimageaspattern[`⟨*options*⟩`]{`⟨*name*⟩`}{`⟨*image*⟩`}`

`/tikz/image as pattern=`⟨*options*⟩ (default {})



```
\usetikzlibrary {patterns.images}
\pgfsetupimageaspattern[width=.5cm]{grid}{example-image-1x1}
\tikz \node[star, minimum size=3cm, draw,
  image as pattern={name=grid,options={left, bottom, y=-.5cm, rotate=45}}] {};
```

`/tikz/image as pattern/name=`⟨*name*⟩ (no default)

Specifies the name of the “image-pattern” to be used.

`/tikz/image as pattern/option` (style, no value)

Options that’s be used by the internal `\pgftext`, only keys from `/pgf/text` should be used.

`/tikz/image as pattern/options=`⟨*style*⟩ (style, no default)

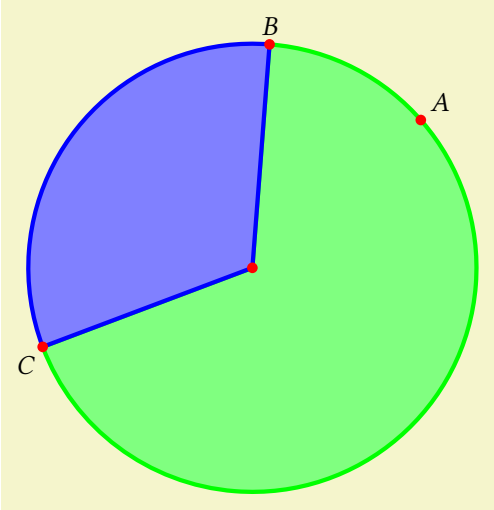
Appends style `/tikz/image as pattern/option`.

8 Arcs through Three Points

TikZ Library `topaths.arcthrough`

```
\usetikzlibrary{topaths.arcthrough} % LaTeX and plain TeX
\usetikzlibrary[topaths.arcthrough] % ConTeXt
```

This library allows to use an arc defined by three points.




```
\usetikzlibrary {topaths.arcthrough}
\begin{tikzpicture}
\coordinate[label=above right:$A$] (A) at ( 3, 1);
\coordinate[label=above:$B$]       (B) at ( 1, 2);
\coordinate[label=below left:$C$]  (C) at (-2,-2);

\draw[ultra thick, draw=green, fill=green!50]
  (B) to[arc through={clockwise,(A)}] (C)
  -- (arc through center) -- cycle;
\draw[ultra thick, draw=blue, fill=blue!50]
  (B) to[arc through=(A)]             (C)
  -- (arc through center) -- cycle;

\foreach \p in {A,B,C, arc through center} \fill[red] (\p) circle[radius=2pt];
\end{tikzpicture}
```

This can only by used for circles in the `canvas` coordinate system.

`/tikz/arc through/through`=⟨*coordinate*⟩ (no default, initially `(0,0)`)

The coordinate on the circle that defines – together with the starting and target point – a circle.

`/tikz/arc through/center suffix`=⟨*suffix*⟩ (no default, initially)

The `arc through` will define a coordinate named `arc through center`⟨*suffix*⟩ so that it can referenced later.

`/tikz/arc through/clockwise` (no value)

The resulting arc will go clockwise from the starting point to the target point. This will not necessarily go through the `through` point.

`/tikz/arc through/counter clockwise` (no value)

The resulting arc will go counter clockwise from the starting point to the target point. This will not necessarily go through the `through` point.

`/tikz/arc through`=⟨*key-value*⟩ (no default)

This key should be used with `to` or `edge`. A parameter other than `center suffix`, `clockwise` or `counter clockwise` will be assumed to be the `through` coordinate.

9 Mirror, Mirror on the Wall

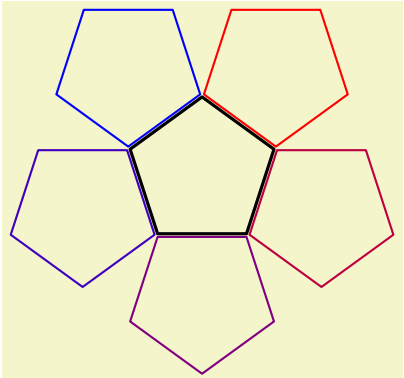
TikZ Library transformations.mirror

```
\usetikzlibrary{transformations.mirror} % LaTeX and plain TeX
\usetikzlibrary[transformations.mirror] % ConTeXt
```

This library adds more transformations to TikZ.

As explained in section 10, they are two approaches to setting a mirror transformation. As with the commands in PGF, we'll be using lowercase `m` for the "Spiegelungsmatrix" and uppercase `M` for the built-in approach.

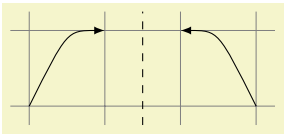
9.1 Using the "Spiegelungsmatrix"



```
\usetikzlibrary {shapes.geometric,transformations.mirror}
\begin{tikzpicture}[line join=round, thick, reg poly/.style={
  shape=regular polygon, regular polygon sides={#1}}]
\node[reg poly=5, minimum size=+2cm, draw, very thick] (a) {};
\foreach \i[evaluate={\col=(\i-1)/.04}] in {1,...,5}
  \node [mirror=(a.corner \i)--(a.side \i), transform shape,
         reg poly=5, minimum size=+2cm, draw=red!\col!blue] {};
\end{tikzpicture}
```

/tikz/xmirror=⟨*value or coordinate*⟩ (no default)

Sets up a transformation that mirrors along a horizontal line that goes through point (⟨*value*⟩, 0) or ⟨*coordinate*⟩.



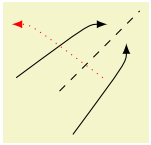
```
\usetikzlibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-0.25, -.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);
\draw[xmirror=(m),-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

/tikz/ymirror=⟨*value or coordinate*⟩ (no default)

Sets up a transformation that mirrors along a vertical line that goes through point $(0, \langle value \rangle)$ or ⟨*coordinate*⟩.

/tikz/mirror x=⟨*coordinate*⟩ (no default)

Similar to /tikz/xmirror, this however uses the xyz coordinate system instead of the canvas system.



```
\usetikzlibrary {transformations.mirror}
\begin{tikzpicture}[x=.5cm, y=(45:1cm)]

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);

\draw[ xmirror=(m), -latex, red, dotted] (0,0) .. controls (.5,1) .. (1,1);
\draw[mirror x=(m), -latex]              (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

/tikz/mirror y=⟨*coordinate*⟩ (no default)

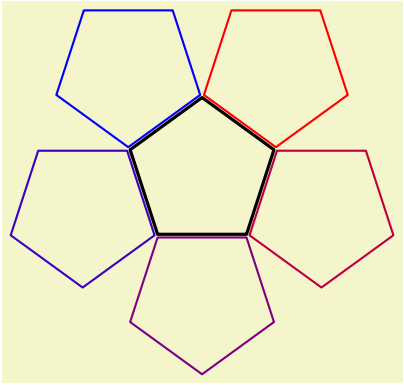
Similar to /tikz/ymirror, this however uses the xyz coordinate system instead of the canvas system.

/tikz/mirror=⟨*point A*⟩--⟨*point B*⟩ (no default)

Sets up a transformation that mirrors along a line that goes through ⟨*point A*⟩ and ⟨*point B*⟩.

When only ⟨*point A*⟩ is given that line goes through ⟨*point A*⟩ and the origin.

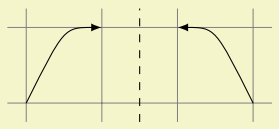
9.2 Using built-in transformations



```
\usetikzlibrary {shapes.geometric,transformations.mirror}
\begin{tikzpicture}[line join=round, thick, reg poly/.style={
  shape=regular polygon, regular polygon sides={#1}}]
\node[reg poly=5, minimum size=+2cm, draw, very thick] (a) {};
\foreach \i[evaluate={\col=(\i-1)/.04}] in {1,...,5}
  \node [Mirror=(a.corner \i)--(a.side \i), transform shape,
         reg poly=5, minimum size=+2cm, draw=red!\col!blue] {};
\end{tikzpicture}
```

/tikz/xMirror=⟨*value or coordinate*⟩ (no default)

Sets up a transformation that mirrors along a horizontal line that goes through point (⟨*value*⟩, 0) or ⟨*coordinate*⟩.



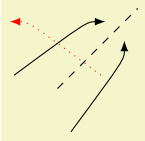
```
\usetikzlibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-0.25, -.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);
\draw[xMirror=(m),-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

/tikz/yMirror=⟨*value or coordinate*⟩ (no default)

Sets up a transformation that mirrors along a vertical line that goes through point (0, ⟨*value*⟩) or ⟨*coordinate*⟩.

/tikz/Mirror x=⟨*coordinate*⟩ (no default)

Similar to `/tikz/xMirror`, this however uses the `xyz` coordinate system instead of the `canvas` system.



```
\usetikzlibrary {transformations.mirror}
\begin{tikzpicture}[x=.5cm, y=(45:1cm)]

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (1.5, -.25) coordinate (m) -- (1.5, 1.25);

\draw[ xMirror=(m), -latex, red, dotted] (0,0) .. controls (.5,1) .. (1,1);
\draw[Mirror x=(m), -latex]              (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

/tikz/Mirror y=⟨*coordinate*⟩ (no default)

Similar to `/tikz/yMirror`, this however uses the `xyz` coordinate system instead of the `canvas` system.

/tikz/Mirror=⟨*point A*⟩--⟨*point B*⟩ (no default)

Sets up a transformation that mirrors along a line that goes through ⟨*point A*⟩ and ⟨*point B*⟩.

When only ⟨*point A*⟩ is given that line goes through ⟨*point A*⟩ and the origin.

Part III
PGF Libraries

These libraries (should) work with both PGF and Ti*k*Z.

10 Transformations: Mirroring

Ti*k*Z Library transformations.mirror

```
\usepgflibrary{transformations.mirror}  % LaTeX and plain TeX and pure pgf
\usepgflibrary[transformations.mirror]  % ConTeXt and pure pgf
\usetikzlibrary{transformations.mirror} % LaTeX and plain TeX when using TikZ
\usetikzlibrary[transformations.mirror] % ConTeXt when using TikZ
```

This library adds mirror transformations to PGF.

Two approaches to mirror transformation exist:

1. Using the "Spiegelmatrix" (see section 10.1).

   This depends on `\pgfpointnormalised` which involves the sine and the cosine functions of PGFmath.

2. Using built-in transformations (see section 10.2).

   This depends on `\pgfmathanglebetween` which involves the arctangent (`atan2`) function of PGFmath.

Which one is better? I don't know. Choose one you're comfortable with.

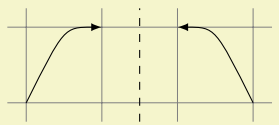
10.1 Using the "Spiegelungsmatrix"

The following commands use the "Spiegelungsmatrix" that sets the transformation matrix following

$$A = \frac{1}{\|\vec{l}\|^2}\begin{bmatrix} l_x^2 - l_y^2 & 2l_xl_y \\ 2l_xl_y & l_y^2 - l_x^2 \end{bmatrix}.$$

\pgftransformxmirror{⟨*value*⟩}

Sets up a transformation that mirrors along a vertical line that goes through point (⟨*value*⟩, 0).



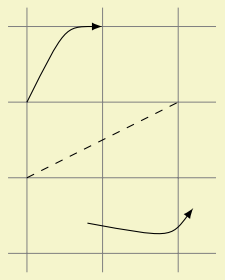
```
\usepgflibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-0.25, -.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (1.5, -.25) -- (1.5, 1.25);
\pgftransformxmirror{1.5}

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

`\pgftransformymirror{`⟨*value*⟩`}`

Sets up a transformation that mirrors along a horizontal line that goes through point $(0, \langle value \rangle)$.

`\pgftransformmmirror{`⟨*point A*⟩`}{`⟨*point B*⟩`}`

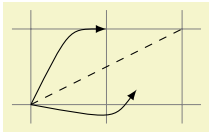
Sets up a transformation that mirrors along the line that goes through ⟨*point A*⟩ and ⟨*point B*⟩.



```
\usepgflibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-.25, -2.25) grid (2.5, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (0, -1) -- (2, 0);
\pgftransformmmirror{\pgfpointxy{0}{-1}}{\pgfpointxy{2}{0}}

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

`\pgfqtransformmmirror{`⟨*point A*⟩`}`

Sets up a transformation that mirrors along the line that goes through the origin and ⟨*point A*⟩.



```
\usepgflibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-.25, -.25) grid (2.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (0, 0) -- (2, 1);
\pgfqtransformmmirror{\pgfpointxy{2}{1}}

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

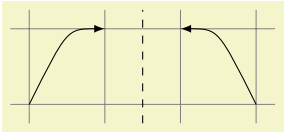
10.2 Using built-in transformations

The following commands use a combination of shifting, rotating, −1 scaling, rotating back and shifting back to reach the mirror transformation.

The commands are named the same as above, only the `m` in `mirror` is capitalized.

`\pgftransformxMirror{`⟨*value*⟩`}`

Sets up a transformation that mirrors along a vertical line that goes through point $(\langle value \rangle, 0)$.



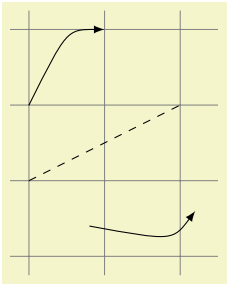
```
\usepgflibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-0.25, -.25) grid (3.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (1.5, -.25) -- (1.5, 1.25);
\pgftransformxMirror{1.5}

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

`\pgftransformyMirror{`⟨*value*⟩`}`

Sets up a transformation that mirrors along a horizontal line that goes through point $(0, \langle value \rangle)$.

`\pgftransformMirror{`⟨*point A*⟩`}{`⟨*point B*⟩`}`

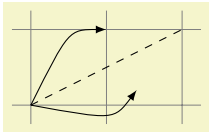
Sets up a transformation that mirrors along the line that goes through ⟨*point A*⟩ and ⟨*point B*⟩.



```
\usepgflibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-.25, -2.25) grid (2.5, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (0, -1) -- (2, 0);
\pgftransformMirror{\pgfpointxy{0}{-1}}{\pgfpointxy{2}{0}}

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

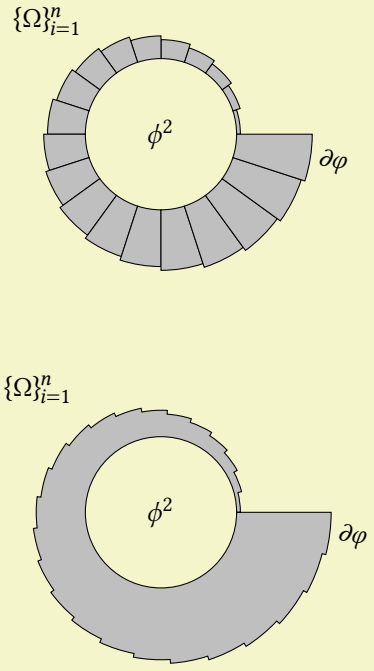
`\pgfqtransformMirror{`⟨*point A*⟩`}`

Sets up a transformation that mirrors along the line that goes through the origin and ⟨*point A*⟩.



```
\usepgflibrary {transformations.mirror}
\begin{tikzpicture}
\draw[help lines] (-.25, -.25) grid (2.25, 1.25);
\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);

\draw[dashed] (0, 0) -- (2, 1);
\pgfqtransformMirror{\pgfpointxy{2}{1}}

\draw[-latex] (0,0) .. controls (.5,1) .. (1,1);
\end{tikzpicture}
```

Part IV
Miscellaneous




```
\usetikzlibrary {misc}
\begin{tikzpicture}[
  declare function={bigR(\n)=smallR+.05*\n;},
  declare constant={smallR=1; segments=20;},
  full arc=segments]
\foreach \iN[evaluate={\endRadius=bigR(\iN+1);}, use int=0 to segments-1]
  \filldraw[fill=gray!50] (\iN R:\endRadius)
    arc [radius=\endRadius, start angle=\iN R, delta angle=+1R] -- (\iN R+1R:smallR)
    arc [radius=smallR,       end angle=\iN R, delta angle=-1R] -- cycle;

\node                                              {$\phi^2$};
\node at (north west:{sqrt 2 * bigR(segments/2)})  {$\{\Omega\}_{i=1}^n$};
\node[rotate=-.5R, right] at (-.5R: bigR segments) {$\partial \varphi$};

\tikzset{yshift=-5cm, declare constant={segments=25;}, full arc=segments}
\filldraw[fill=gray!50] (right:smallR)
  \foreach \iN[evaluate={\endRadius=bigR(\iN+1);}, use int=0 to segments-1] {
    -- (\iN R:\endRadius) arc[radius=\endRadius, start angle=\iN R, delta angle=1R]}
    -- (right:smallR)     arc[radius=smallR,     start angle=0,     delta angle=-360];

\node                                              {$\phi^2$};
\node at (north west:{sqrt 2 * bigR(segments/2)})  {$\{\Omega\}_{i=1}^n$};
\node[rotate=-.5R, right] at (-.5R: bigR segments) {$\partial \varphi$};
\end{tikzpicture}
```

Ti*k*Z Library misc

```
\usetikzlibrary{misc} % LaTeX and plain TeX
\usetikzlibrary[misc] % ConTeXt
```

This library adds miscelleaneos utilities to PGFmath, PGF or Ti*k*Z.

11 PGFmath

11.1 Postfix operator R

Similar to `\segments[<num>]` in PSTricks, the postfix operator `R` allows the user to use an arbitrary number of segments of a circle to be used instead of an angle.

`/tikz/full arc=`⟨*num*⟩ (default)

The number ⟨*num*⟩ of segments will be set up. Using `full arc` with an empty value disables the segmentation and `1R` equals 1°.

The given value ⟨*num*⟩ is evaluated when the key is used and doesn't change when ⟨*num*⟩ contains variables that change.

The `R` operator can then be used.

x`R` (postfix operator; uses the `fullarc` function)

Multiplies *x* with $\frac{360}{\langle num \rangle}$.

11.2 Functions

`strrepeat("`*Text*`", `*x*`)`
`\pgfmathstrrepeat{"`*Text*`"}{`*x*`}`

Returns a string with *Text* repeated *x* times.

foofoofoofoofoo

```
\pgfmathparse{strrepeat("foo", 5)} \pgfmathresult
```

`isInString("`*String*`", "`*Text*`")`
`\pgfmathisInString{"`*String*`"}{"`*Text*`"}`

Returns `1` (true) if *Text* contains *String*, otherwise `0` (false).

0 and 1

```
\pgfmathparse{isInString("foo", "bar")} \pgfmathresult
\ and\
\pgfmathparse{isInString("foo", "foobar")} \pgfmathresult
```

`strcat("`*Text A*`", "`*Text B*`", …)`
`\pgfmathstrcat{"`*Text A*`"}{"`*Text B*`"}{…}`

Returns the concatenation of all given parameters.

blue!21!green

```
\pgfmathparse{strcat("blue!", int(7*3), "!green")} \pgfmathresult
```

`isEmpty("`*Text*`")`
`\pgfmathisEmpty{"`*Text*`"}`

Returns `1` (true) if *Text* is empty, otherwise `0` (false).

0 and 1 and 1

```
\pgfmathparse{isEmpty("foo")} \pgfmathresult\ and\
\pgfmathparse{isEmpty("")}    \pgfmathresult\ and\
\def\emptyText{}
\pgfmathparse{isEmpty("\emptyText")} \pgfmathresult
```

`atanXY(`x`,`y`)`
`\pgfmathatanXY{`x`}{`y`}`

Arctangent of $y \div x$ in degrees. This also takes into account the quadrant. This is just a argument-swapped version of `atan2` which makes it easier to use the `\p` commands of the `calc` library.

53.13011

```
\pgfmathparse{atanXY(3,4)} \pgfmathresult
```

`atanYX(`y`,`x`)`
`\pgfmathatanYX{`y`}{`x`}`

Arctangent of $y \div x$ in degrees. This also takes into account the quadrant.

53.13011

```
\pgfmathparse{atanYX(4,3)} \pgfmathresult
```

11.3 Functions: using coordinates

The following functions can only be used with PGF and/or Ti*k*Z. Since the arguments are usually plain text (and not numbers) one has to wrap them in `"`.

`anglebetween("`*p1*`", "`*p2*`")`

`\pgfmathanglebetween{"p1"}{"p2"}`

Return the angle between the centers of the nodes *p1* and *p2*.

`qanglebetween("p")`
`\pgfmathqanglebetween{"p"}`

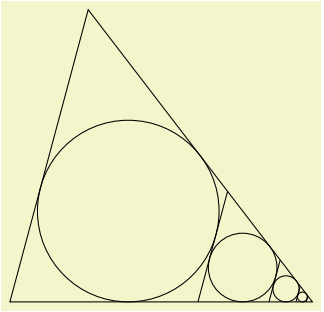
Return the angle between the origin and the center of the node *p*.

`distancebetween("p1", "p2")`
`\pgfmathdistancebetween{"p1"}{"p2"}`

Return the distance (in pt) between the centers of the nodes *p1* and *p2*.

`qdistancebetween("p")`
`\pgfmathqdistancebetween{"p"}`

Return the distance (in pt) between the origin and the center of the node *p*.



```
\usetikzlibrary {calc,misc,through}
\begin{tikzpicture}
\path (0,0) coordinate (A) + (0:4) coordinate (B) +(75:4) coordinate (C);
\draw (A) -- (B) -- (C) -- cycle;
\foreach \cnt in {1,...,4}{
  \pgfmathsetmacro\triA{distancebetween("B","C")}
  \pgfmathsetmacro\triB{distancebetween("C","A")}
  \pgfmathsetmacro\triC{distancebetween("A","B")}
  \path (barycentric cs:A=\triA,B=\triB,C=\triC) coordinate (M)
       node [draw, circle through=($(A)!(M)!(C)$)] (M) {};
  \draw ($(C)-(A)$) coordinate (vecB)
      (M.75-90) coordinate (@)
      (intersection of @--[shift=(vecB)]@ and B--C) coordinate (C) --
      (intersection of @--[shift=(vecB)]@ and B--A) coordinate (A);}
\end{tikzpicture}
```

12 PGFkeys

12.1 Conditionals

`/utils/if`=⟨*cond*⟩⟨*true*⟩⟨*false*⟩ (no default)

This key checks the conditional ⟨*cond*⟩ and applies the styles ⟨*true*⟩ if ⟨*cond*⟩ is true, otherwise ⟨*false*⟩. ⟨*cond*⟩ can be anything that PGFmath understands.

As a side effect on how PGFkeys parses argument, the ⟨*false*⟩ argument is actually optional.

The following keys use TEX' macros `\if`, `\ifx`, `\ifnum` and `\ifdim` for faster executions.

`/utils/TeX/if`=⟨*token A*⟩⟨*token B*⟩⟨*true*⟩⟨*false*⟩ (no default)

This key checks via `\if` if ⟨*token A*⟩ matches ⟨*token B*⟩ and applies the styles ⟨*true*⟩ if it does, otherwise ⟨*false*⟩.

As a side effect on how PGFkeys parses argument, the ⟨*false*⟩ argument is actually optional.

`/utils/TeX/ifx`=⟨*token A*⟩⟨*token B*⟩⟨*true*⟩⟨*false*⟩ (no default)

As above.

`/utils/TeX/ifnum`=⟨*num cond*⟩⟨*true*⟩
opt⟨*false*⟩ (no default)

This key checks `\ifnum`⟨*num cond*⟩ and applies the styles ⟨*true*⟩ if true, otherwise ⟨*false*⟩. A delimiting `\relax` will be inserted after ⟨*num cond*⟩.

As a side effect on how PGFkeys parses argument, the ⟨*false*⟩ argument is actually optional.

`/utils/TeX/ifdim`=⟨*dim cond*⟩⟨*true*⟩⟨*false*⟩ (no default)

As above.

`/utils/TeX/ifempty`=⟨*Text*⟩⟨*true*⟩⟨*false*⟩ (no default)

This checks whether ⟨*Text*⟩ is empty and applies styles ⟨*true*⟩ if true, otherwise ⟨*false*⟩.

12.2 Handlers

While already a lot of values given to keys are evaluated by PGFmath at some point, not all of them are.

Key handler ⟨*key*⟩`/.pgfmath`=⟨*eval*⟩

This handler evaluates ⟨*eval*⟩ before it is handed to the key.

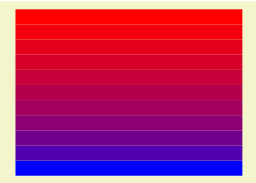
Key handler ⟨*key*⟩`/.pgfmath int`=⟨*eval*⟩

As above but truncates the result.

Key handler ⟨*key*⟩`/.pgfmath strcat`=⟨*eval*⟩

As above but uses the `strcat` function.

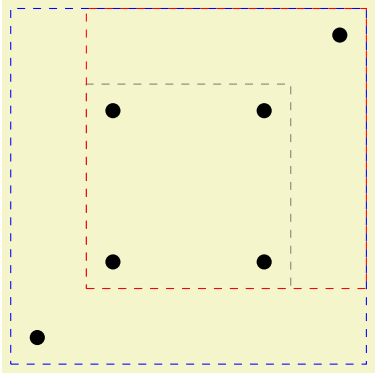
In the example below, one could have used the `/pgf/foreach/evaluate` key from `\foreach`.



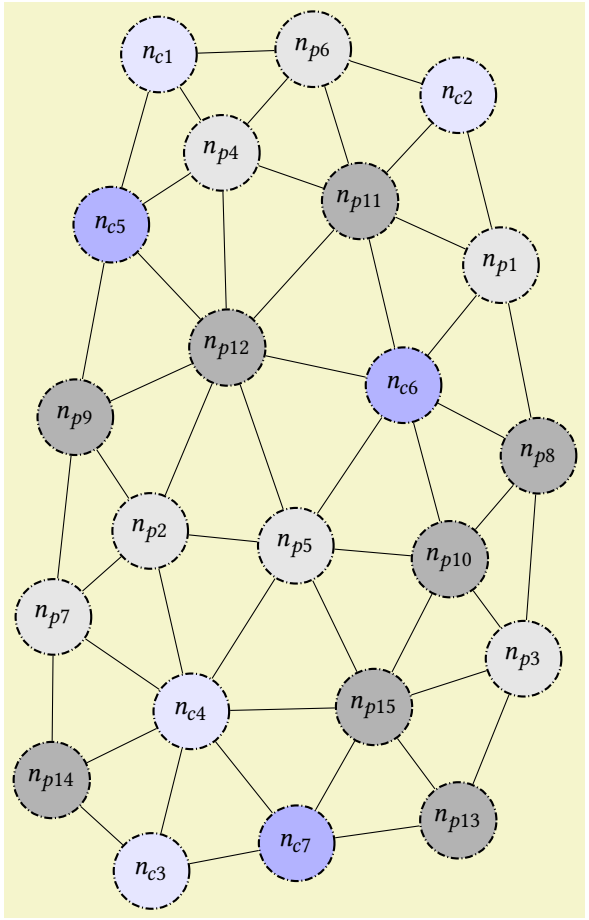
```
\usetikzlibrary {misc}
\tikz\foreach \i in {0,10,...,100}
  \draw[line width=+.2cm, color/.pgfmath strcat={"red!",sqrt(\i)*10,"!blue"}]
    (0,\i/50) -- +(right:3);
```

Key handler ⟨*key*⟩/.List=⟨⟨*e1*⟩, ⟨*e2*⟩, ..., ⟨*en*⟩⟩

This handler evaluates the given list with \foreach and concatenates the element and the result is then given to the used key.



```
\usetikzlibrary {fit,misc}
\begin{tikzpicture}[nodes={draw, dashed, inner sep=+10pt}]
  \foreach \point [count=\cnt] in {(0,0), (0,2), (2,0), (2,2), (3,3), (-1,-1)}
    \fill \point circle[radius=.1] coordinate (point-\cnt);
  \node[gray, fit/.List={(point-1),(point-...),(point-4)}] {};
  \node[red,  fit/.List={(point-1),(point-...),(point-5)}] {};
  \node[blue, fit/.List={(point-1),(point-...),(point-6)}] {};
\end{tikzpicture}
```




```
\usetikzlibrary {graphs,graphdrawing} \usegdlibrary {force}
\tikzset{
  mynode/.style={
    circle, minimum size=10mm, draw, densely dashdotted, thick,
    decide color/.expand once=#1},
  decide color/.style 2 args={
    /utils/TeX/if=c#1
      {/utils/TeX/ifnum={#2<5}{bluelight}{bluedark}}
      {/utils/TeX/ifnum={#2<8}{light}{dark}}},
  light/.style={fill=gray!20},  bluelight/.style={fill=blue!10},
  dark/.style ={fill=gray!60},  bluedark/.style ={fill=blue!30}}
\tikz\graph[
  spring electrical layout, vertical=c2 to p13,
  node distance=1.5cm, typeset=$n_{\tikzgraphnodetext}$,
  nodes={mynode=\tikzgraphnodetext}] {
  % outer ring
  c2 -- {p1, p11, p6};
    p1 -- {p8, c6, p11};
      p8 -- {p3, p10, c6};
       p3 -- {p13, p15, p10};
         p13 -- {p15, c7};
           c7  -- {c3, c4, p15};
           c3  -- {p14, c4};
           p14 -- {p7, c4};
         p7 -- {p9, p2, c4};
       p9 -- {c5, p12, p2};
     c5 -- {c1, p4, p12};
   c1 -- {p6, p4};
  p6 -- {p11, p4};
  % inner ring
  p11 -- {c6, p12, p4};
  p5 -- {c6 -- {p10, p12}, p10 -- p15, p15 -- c4, c4 -- p2, p2 -- p12, p12 -- p4};
};
```

13 PGFfor

Instead of `\foreach \var in {start, start + delta, ..., end}` one can use `\foreach \var[use int=start to end step delta]`.

`/pgf/foreach/use int=`⟨*start*⟩`to`⟨*end*⟩`step`⟨*delta*⟩ (no default)

The values ⟨*start*⟩, ⟨*end*⟩ and ⟨*delta*⟩ are evaluates by PGFmath at initialization. The part `step` ⟨*delta*⟩ is optional (⟨*delta*⟩ = 1).

`/pgf/foreach/use float`=⟨*start*⟩ `o`⟨*end*⟩`optstep`⟨*delta*⟩ (no default)

Same as above, however the results are not truncated.

Index

This index only contains automatically generated entries. A good index should also contain carefully selected keywords. This index is not a good index.