tzplot: Basics

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2021/11/27

공주대학교 문서작성워크숍 2021

한국텍학회 · 한국텍사용자그룹(http://ktug.org)

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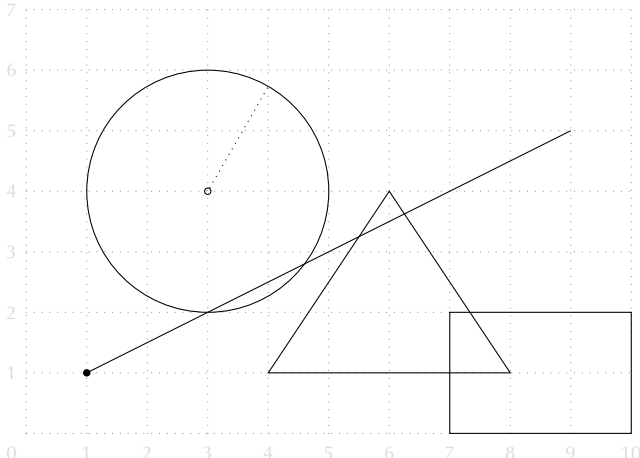
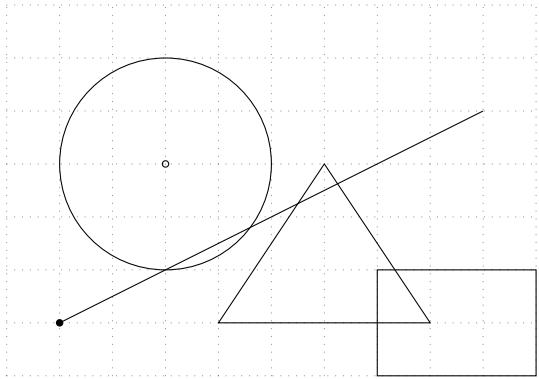
1 `tzplot`: Points, lines, circles, ect.




```
\usepackage{tzplot}
```

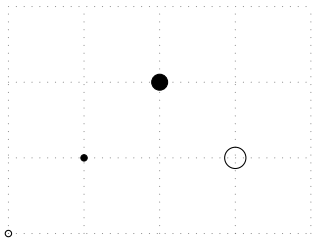
```
\documentclass{article}

\usepackage{tzplot}  %% loads tikz, xparse, expl3

\begin{document}
  \begin{tikzpicture}[scale=.8]
  \tzhelplines(10,7)
  \tzline(1,1)(9,5)
  \tzdot*(1,1)
  \tzdot(3,4)
  \tzcircle(3,4)(2cm)
  \tzpolygon(6,4)(4,1)(8,1);
  \tzframe(7,0)(10,2)
  \end{tikzpicture}
\end{document}
```



1.1 Dots

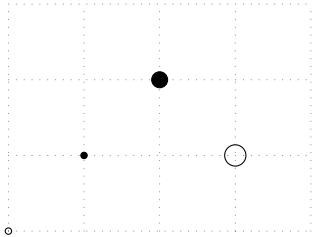
```
% \tzhelplines : 10 dots per 1cm
\begin{tikzpicture}
\tzhelplines[thick](4,2)
\end{tikzpicture}
```

```
% \tzcdot, \tzcdot* : small circles : radius
\begin{tikzpicture}
\tzhelplines(4,3)
\tzcdot(0,0)
\tzcdot*(1,1)(1.2pt) % default
\tzcdot*(2,2)(3pt)
\tzcdot(3,1)(4pt)
\end{tikzpicture}
```



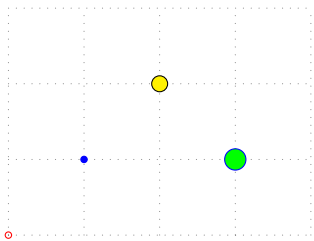
```
\tzcdot(0,0)       % works like:
  \draw        (0,0) circle (1.2pt);
\tzcdot*(2,2)(3pt) % works like:
  \draw [fill] (2,2) circle (3pt);
```

```
% \tzdot, \tzdot* : small node circles : diameter
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdot(0,0)
\tzdot*(1,1)(2.4pt)
\tzdot*(2,2)(6pt)
\tzdot(3,1)(8pt)
\end{tikzpicture}
```



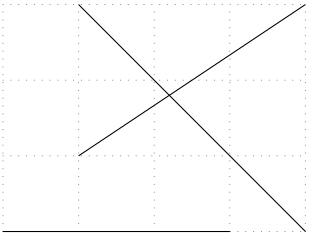
```
\tzdot*(2,2)(6pt) % works like:
\draw (2,2) node [draw,circle,solid,thin,fill,inner sep=0pt,minimum size=6pt] {};
```

```
% \tzdot, \tzdot*
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdot[red](0,0)
\tzdot*[blue](1,1)(2.4pt) % default
\tzdot*[fill=yellow](2,2)(6pt)
\tzdot[draw=blue,fill=green](3,1)(8pt)
\end{tikzpicture}
```

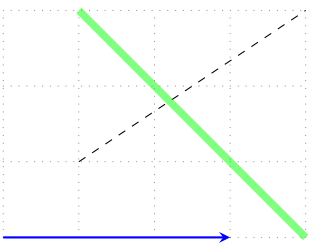


1.2 Lines

```
% \tzline
\begin{tikzpicture}
\tzhelplines(4,3)
\tzline(0,0)(3,0)
\tzline(1,1)(4,3)
\tzline(1,3)(4,0)
\end{tikzpicture}
```



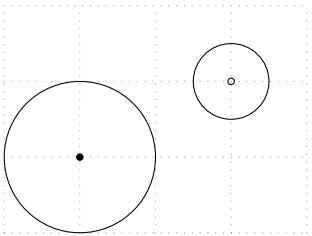
```
% \tzline[<opt>]
\begin{tikzpicture}
\tzhelplines(4,3)
\tzline[->,thick,blue](0,0)(3,0)
\tzline[dashed](1,1)(4,3)
\tzline[line width=1mm,opacity=.5,green](1,3)(4,0)
\end{tikzpicture}
```



```
\tzline[thick,blue](0,0)(3,0) % works like:
\draw [thick,blue] (0,0) -- (3,0);
```

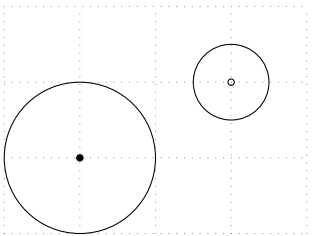
1.3 Circles

```
% \tzcircle : (radius)
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdot*(1,1)      \tzcircle(1,1)(1cm)
\tzcdot(3,2)      \tzcircle(3,2)(5mm)
\end{tikzpicture}
```



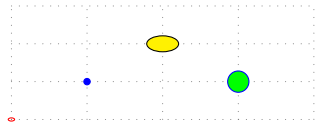
```
\tzcircle(1,1)(1cm) % works like:
\draw (1,1) circle (1cm);
```

```
% \tznodecircle : minimum size=<diameter>
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdot*(1,1)
\tznodecircle[minimum size=2cm](1,1)
\tzdot(3,2)
\tznodecircle[minimum size=1cm](3,2)
\end{tikzpicture}
```



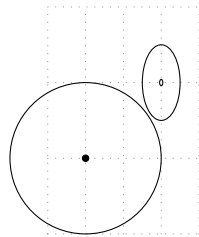
1.4 \tzcdot vs. \tzdot

```
% \tzdot vs. \tzcdot
\begin{tikzpicture}[yscale=.5]
\tzhelplines(4,3)
\tzcdot[red](0,0)
\tzdot*[blue](1,1)(2.4pt)
\tzcdot*[fill=yellow](2,2)(6pt)
\tzdot[draw=blue,fill=green](3,1)(8pt)
\end{tikzpicture}
```



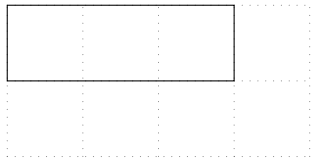
- \tzdot은 xscale과 yscale에 의존하지 않는다.
- tzplot 패키지에서는 \tzdot을 표준으로 삼는다.

```
% node circles vs. circles
\begin{tikzpicture}[xscale=.5]
\tzhelplines(4,3)
\tzdot*(1,1)
\tznodecircle[minimum size=2cm](1,1)
\tzcdot(3,2)
\tzcircle(3,2)(5mm)
\end{tikzpicture}
```



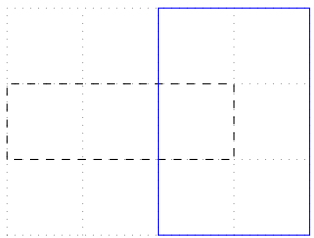
1.5 Rectangles

```
% \tzframe
\begin{tikzpicture}
\tzhelplines(4,2)
\tzframe(0,1)(3,2)
\end{tikzpicture}
```



```
\tzframe(0,1)(3,2) % works like:
\draw (0,0) rectangle (3,2);
```

```
% \tzframe = \tzrectagle
\begin{tikzpicture}
\tzhelplines(4,3)
\tzframe[dashed](0,1)(3,2)
\tzrectangle[blue](2,3)(4,0)
\end{tikzpicture}
```



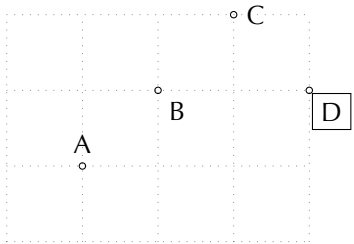
2 Adding text

```
%%  ...(0,0){label}[90]       % label after a coordinate

  \tzdot(0,0){label}[45]      % [angles]

%%  ...(0,0){text}[a](1,1)    % text between coordinates
%%  ...(0,0)(1,1){text}[r]    % text at end

  \tzline(0,0){text}[a](3,1)  % [abbreviations]
  \tzline(0,0)(3,1){my line}[r]
  \tzline(0,0){text}[a](3,1){my line}[r]
```

2.1 Dots: {label} nodes and [angles]

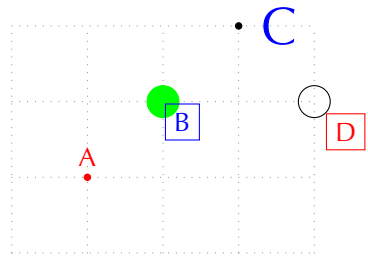
```
\begin{tikzpicture}
\tzhelplines(4,1)
\tzdot*(1,1){A}[0] % angle=0 or right
\end{tikzpicture}
```


```
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdot(1,1){A}                % default: [above] or [90]
\tzcdot(2,2){B}[below right] % [-45] degree
\tzdot(3,3){C}[right]         % [0] degree
\tzdot(4,2){D}[[draw]-45]     % [[opt]angle]
\end{tikzpicture}
```




```
\tzcdot(2,2){A}[below right] % works like:
\draw (2,2) circle (1.2pt) node [label={below right:A}] {};
% or
\draw (2,2) circle (1.2pt) node [label={-45:A}] {};
```

```
\begin{tikzpicture}
\tzhelplines(4,3)
\tzcdot*[red](1,1){A}                    % default: above
\tzcdot*[green](2,2){B}[[draw,blue]-45](6pt)
\tzdot*(3,3){C}[[blue,scale=2]right]
\tzdot(4,2){D}[[draw,red]-45](12pt)   % [angle](radius)
\end{tikzpicture}
```



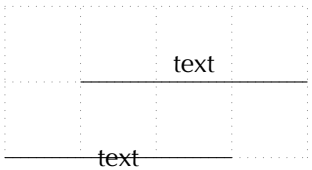
circle vs. node circle:

- circle 중심의 주위에 표시되는 label의 위치는 circle 크기와 관계없이 고정되어 있다.
- node circle의 경우, 테두리에 label이 표시되므로, 크기에 맞춰 이동한다.

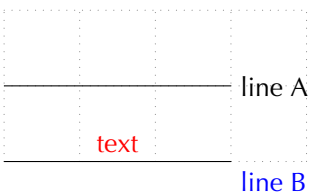
```
\tzcdot(4,2){A}[[draw,red]-45] % works like:
\draw (4,2) circle (1.2pt) node [label={[draw,red]-45:A}] {};
% or
\draw (4,2) circle (1.2pt) node [label={[draw,red]below right:A}] {};
```

2.2 Lines: main nodes with {text} and [abbreviations]

```
% abbreviations: but not by angle
\begin{tikzpicture}
\tzhelplines(4,2)
\tzline(1,1){text}(4,1)     % default: midway, above
\tzline(0,0){text}[c](3,0) % centered (TikZ default)
\end{tikzpicture}
```

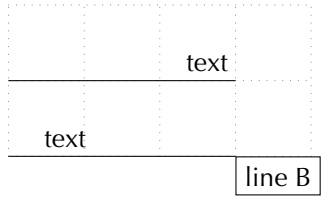



```
% abbreviations: but not by angle
\begin{tikzpicture}
\tzhelplines(4,2)
\tzline(0,1)(3,1){line A}[right]
\tzline(0,0){text}[red](3,0){line B}[br,blue]
\end{tikzpicture}
```

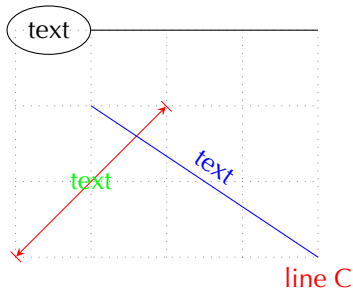



```
\tzline(0,0){text}[red](3,0){line B}[br,blue] % works like:
\draw (0,0) -- node [above,red] {text} (3,0) node [below right,blue] {line B};
```

```
% at start, near start, midway, very near end, etc.
\begin{tikzpicture}
\tzhelplines(4,2)
\tzline(0,1){text}[very near end] (3,1)
\tzline(0,0){text}[near start](3,0){line B}[br,draw]
\end{tikzpicture}
```



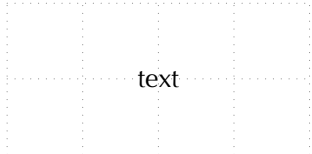

```
% sloped
\begin{tikzpicture}
\tzhelplines(4,3)
\tzline[draw=red,|<->|](0,0){text}[c,green](2,2)
\tzline(1,3){text}[at start,l,draw,ellipse](4,3)
\tzline[blue](1,2){text}[sloped](4,0){line C}[b,red]
\end{tikzpicture}
```



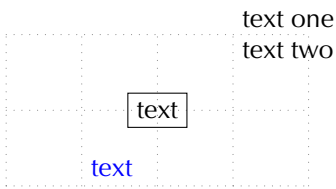
2.3 Putting text

2.3.1 \tznode

```
% \tznode
\begin{tikzpicture}
\tzhelplines*(4,2)
\tznode(2,1){text}
\end{tikzpicture}
```



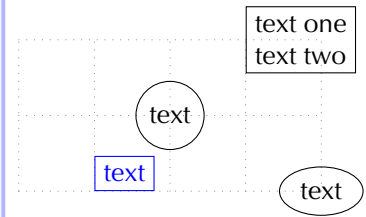

```
\begin{tikzpicture}
\tzhelplines(4,2)
\tznode(2,1){text}[draw]
\tznode(1,0){text}[ar,blue]
\tznode(3,2){text one\\text two}[r,align=left]
\end{tikzpicture}
```




```
\tznode(1,0){text}[ar,blue] % works like:
\path (1,0) node [above right,blue] {text};
```

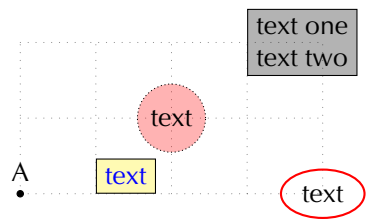
2.3.2 \tznodecircle, \tznodeframe, \tznodeellipse, and \tznodedot

```
\begin{tikzpicture}
\tzhelplines(4,2)
\tznodecircle(2,1){text}
\tznodeframe(1,0){text}[ar,blue]
\tznodeframe(3,2){text one\\text two}[r,align=left]
\tznodeellipse(4,0){text}
\end{tikzpicture}
```




```
\tznodeframe(1,0){text}[ar,blue] % works like
\path (1,0) node [draw,rectangle,above right,blue] {text};
```

```
% * versions and aliases
\begin{tikzpicture}
\tzhelplines(4,2)
\tznodedot*(0,0){A} % similar to \tzdot*
\tznodecircle*[red,densely dotted](2,1){text}
\tznoderectangle*[yellow](1,0){text}[ar,text=blue]
\tznodeframe*(3,2){text one\\text two}[r,align=left]
\tznodeoval(4,0){text}[draw=red,thick]
\end{tikzpicture}
```

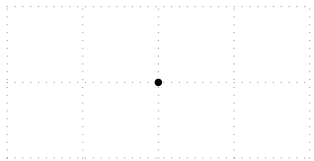


3 Coordinates

```
\tzcoor(0,0)(A)
\tzcoors(0,0)(A)(1,0)(B)(2,1)(C) ;  % semicolon version

\tzcoors     (0,0)(Amy) {Amy}[0]
             (1,0)(Ben) {Ben}[45]
             (2,1)(Coy) {Coy}[-90] ;
\tzcoorsquick(0,0)(Amy)
             (1,0)(Ben)
             (2,1)(Coy) ;

\tznode(0,0)(A){text}[ar]           % node coordinate
```

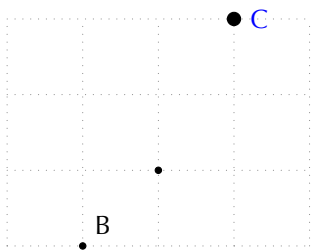
3.1 A coordinate: \tzcoor

```
\begin{tikzpicture}
% \tzcoor
\tzhelplines(4,2)
\tzcoor(2,1)(A) % invisible
\tzdot*(A)
\end{tikzpicture}
```



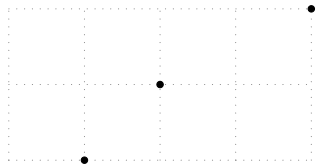
```
\tzcoor(2,1)(A) % works like:
\path (2,1) coordinate (A);
```

```
\begin{tikzpicture}
% \tzcoor, \tzcoor*
\tzhelplines(4,3)
\tzcoor(2,1)(A)
\tzdot*(A)
\tzcoor*(1,0)(B){B}[45]
\tzcoor*(3,3)(C){C}[0,blue](5pt)
\end{tikzpicture}
```

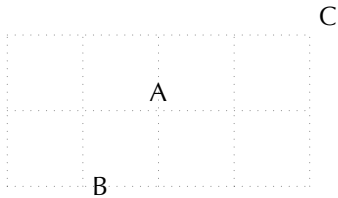


3.2 Multiple coordinates: \tzcoors: semicolon version

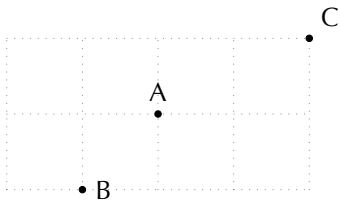
```
\begin{tikzpicture}
% \tzcoors : semicolon versioin
\tzhelplines(4,2)
\tzcoors(2,1)(A) (1,0)(B) (4,2)(C); % invisible
\tzdots*(A)(B)(C); % semicolon version
\end{tikzpicture}
```



```
\begin{tikzpicture}
% \tzcoors
\tzhelplines(4,2)
\tzcoors(2,1)(A){A} (1,0)(B){B}[0] (4,2)(C){C}[45];
\end{tikzpicture}
```

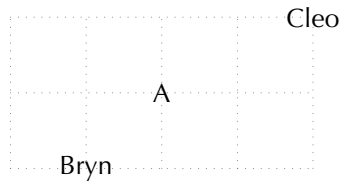



```
\begin{tikzpicture}
% \tzcoors*
\tzhelplines(4,2)
\tzcoors*(2,1)(A){A}(1,0)(B){B}[0](4,2)(C){C}[45];
\end{tikzpicture}
```

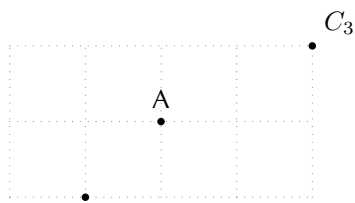


3.3 Coordinates at a quick glance: `\tzcoorsquick`

```
\begin{tikzpicture}
% \tzcoorsquick
\tzhelplines(4,2)
\tzcoorsquick(2,1)(A)
             (1,0)(Bryn)
             (4,2)(Cleo);
\end{tikzpicture}
```

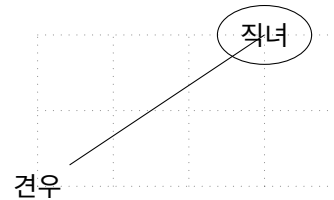



```
\begin{tikzpicture}
% \tzcoorsquick*
\tzhelplines(4,2)
\tzcoorsquick*(2,1)(A)
              (1,0)(Bryn){}  % no label
              (4,2)(Cleo){$C_3$}[45];
\end{tikzpicture}
```

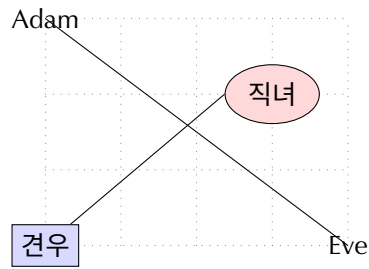


3.4 Node coordinates

```
\begin{tikzpicture}
% \tznode(0,0)(A) : node coordinate
\tzhelplines(4,2)
\tznode(0,0)(A){견우}
\tznode(3,2)(B){직녀}[draw,ellipse]
\tzline(A)(B.center)  %%
\end{tikzpicture}
```




```
\begin{tikzpicture}
% node coordinates
\tzhelplines(4,3)
\tznode(0,0)(A){견우}[draw,fill=blue!15]
\tznode(3,2)(B){직녀}[draw,ellipse,fill=red!15]
\tzline(A)(B.180)  % (B.west)
\tzcoorsquick(0,3)(Adam)(4,0)(Eve);
\tzline(Adam)(Eve)
\end{tikzpicture}
```



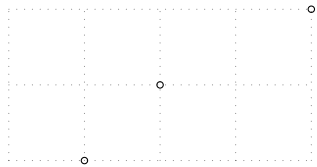
4 Many dots

```
\tzcdots(0,0)(1,0)(2,1) ;
\tzcdots*(0,0)(1,0)(2,1) ;

\tzdots(0,0)(1,0)(2,1) ;
\tzdots*(0,0)(1,0)(2,1) ;

\tzdots*(0,0){A}
        (1,0){B}[0]
        (2,1){C}[45] ;     %% semicolon version
```

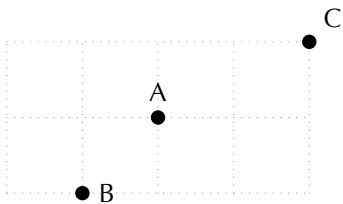
How many dots?

4.1 How many dots? : Semicolon versions

```
\begin{tikzpicture}
% \tzdots
\tzhelplines(4,2)
\tzdots(2,1)(1,0)(4,2);
\end{tikzpicture}
```



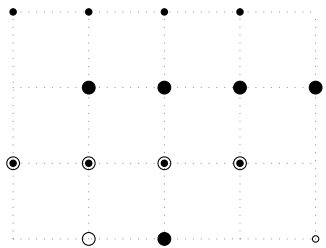
```
\begin{tikzpicture}
% \tzdots*
\tzhelplines(4,2)
\tzdots*(2,1){A}(1,0){B}[0](4,2){C}[45];(5pt)
\end{tikzpicture}
```



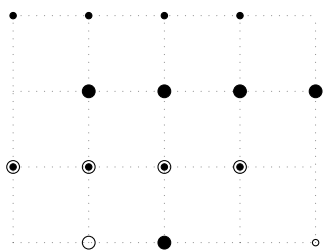
- 세미콜론(;)은 좌표 나열이 끝났다는 것을 의미한다.
- DO NOT FORGET ;.

4.2 \settzdotsize and \settzcdotradius

```
% \settzdotsize{<diameter>} : node dots
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdots*(0,3)(1,3)(2,3)(3,3);
\settzdotsize{4.8pt}    %%
\tzdots*(1,2)(2,2)(3,2)(4,2);
\tzdots(0,1)(1,1)(2,1)(3,1);
\tzdots*(0,1)(1,1)(2,1)(3,1);(2.4pt)
\tzdot(1,0)  \tzdot*(2,0)  \tzdot(4,0)(2.4pt)
\end{tikzpicture}
```

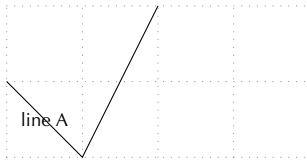


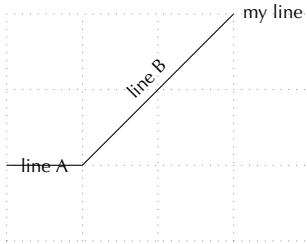
```
% \settzdotradius{<radius>} : circle dots
\begin{tikzpicture}
\tzhelplines(4,3)
\tzcdots*(0,3)(1,3)(2,3)(3,3);
\settzcdotradius{2.4pt} %%
\tzcdots*(1,2)(2,2)(3,2)(4,2);
\tzcdots(0,1)(1,1)(2,1)(3,1);
\tzcdots*(0,1)(1,1)(2,1)(3,1);(1.2pt)
\tzcdot(1,0)  \tzcdot*(2,0)  \tzcdot(4,0)(1.2pt)
\end{tikzpicture}
```



5 Connected lines

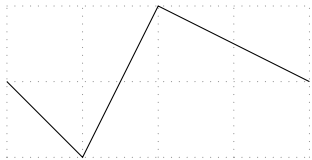
```
\tzlines(0,1)(1,0)(2,2) ;
\tzlines(0,1){line A}
        (1,0)
        (2,2) ;

\tzlines+(0,1)(1,0)(2,2) ;
\tzlines+(0,1){line A}
         (1,0){line B}[sloped,a]
         (2,2){my line}[r] ;
```



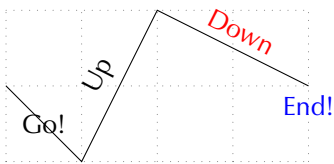


5.1 \tzlines

```
% \tzlines : semicolon version
\begin{tikzpicture}
\tzhelplines(4,2)
\tzlines(0,1)
        (1,0)
        (2,2)
        (4,1);
\end{tikzpicture}
```

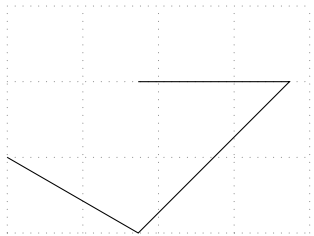


```
% \tzlines*
\begin{tikzpicture}
\tzhelplines(4,2)
\tzlines(0,1){Go!}
        (1,0){Up}[a,sloped]
        (2,2){Down}[a,sloped,red]
        (4,1){End!}[b,blue];
\end{tikzpicture}
```

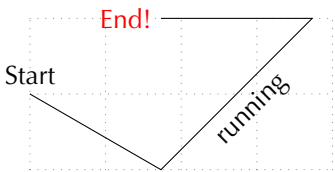


5.2 \tzlines+

```
% \tzlines+ : relative coordinates
\begin{tikzpicture}
\tzhelplines(4,3)
\tzlines+(0,1)
         (-30:2cm)
         (2,2)
         (180:2cm);
\end{tikzpicture}
```



```
% \tzlines+
\begin{tikzpicture}
\tzhelplines(4,2)
\tzlines+(0,1){Start}[a,at start]
         (-30:2cm){running}[b,sloped]
         (2,2)
         (180:2cm){End!}[l,red];
\end{tikzpicture}
```

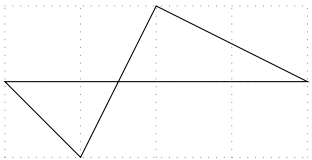


6 Polygons

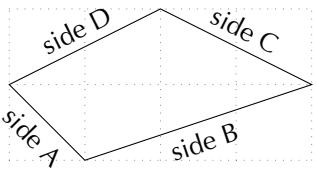
```
%% closed paths
%% <--cycle> version of \tzlines

  \tzpolygon(0,1)(2,0)(3,3) ;
  \tzpolygon+(0,1)(-30:2cm)(3,3) ;

  \tzpolygon*(0,1)(2,0)(3,3) ;
  \tzpolygon*+[blue](0,1)(-30:2cm)(3,3) ;
```

6.1 \tzpolygon

```
% \tzpolygon : semicolon version
\begin{tikzpicture}
\tzhelplines(4,2)
\tzpolygon(0,1)
          (1,0)
          (2,2)
          (4,1);
\end{tikzpicture}
```

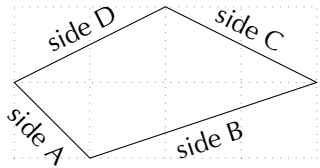


```
% \tzpolygon
\begin{tikzpicture}[auto,sloped]
\tzhelplines(4,2)
\tzpolygon(0,1){side A}[b]
          (1,0){side B}[b]
          (4,1){side C}
          (2,2){side D}
          (0,1);
\end{tikzpicture}
```

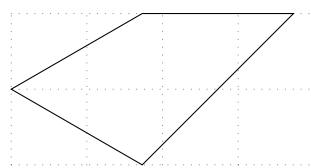


6.2 \tzpolygon+

```
% \tzpolygon+
\begin{tikzpicture}[auto,sloped]
\tzhelplines(4,2)
\tzpolygon+(0,1){side A}[b]
           (1,-1){side B}[b]
           (3,1){side C}
           (-2,1){side D}
           (-2,-1);
\end{tikzpicture}
```

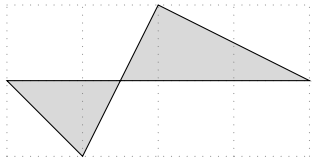



```
% \tzpolygon+
\begin{tikzpicture}
\tzhelplines(4,2)
\tzpolygon+(0,1)
           (-30:2cm)
           (2,2)
           (180:2cm);
\end{tikzpicture}
```

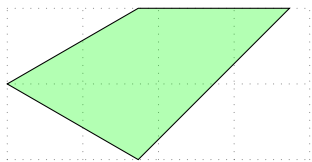


6.3 \tzpolygon*(+)

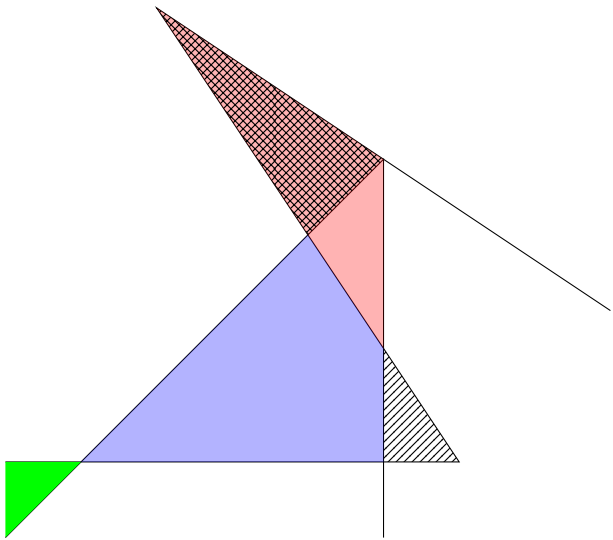
```
% \tzpolygon* : [black!50,fill opacity=.3] by default
\begin{tikzpicture}
\tzhelplines(4,2)
\tzpolygon*(0,1)
           (1,0)
           (2,2)
           (4,1);
\end{tikzpicture}
```



```
% \tzpolygon*+
\begin{tikzpicture}
\tzhelplines(4,2)
\tzpolygon*+[fill=green](0,1)
            (-30:2cm)
            (2,2)
            (180:2cm);
\end{tikzpicture}
```

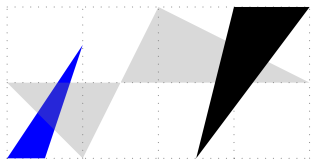


7 Filling area

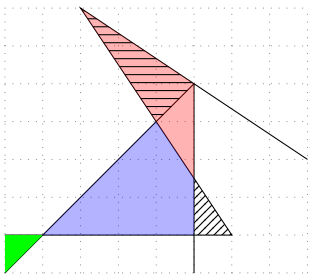


7.1 \tzpath* and \tzpath

```
% \tzpath* : [black!50,fill opacity=.3] by default
\begin{tikzpicture}
\tzhelplines(4,2)
\tzpath[fill=blue](0,0)(.5,0)(1,1.5);
\tzpath*(0,1)(1,0)(2,2)(4,1);          % semicolon
↪  version
\tzpath[fill](3,2)(4,2)(2.5,0);
\end{tikzpicture}
```

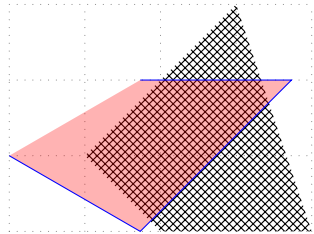


```
% \tzpath(*)
\begin{tikzpicture}[scale=.5]
\tzhelplines(8,7)
\tzlines(0,0)(5,5)(5,0);
\tzlines(0,1)(6,1)(2,7)(8,3);
\tzpath*[blue](1,1)(4,4)(5,2.5)(5,1);
\tzpath[fill=green](0,0)(0,1)(1,1);
\tzpath[pattern=north east lines](5,1)(5,2.5)(6,1);
\tzpath*[red](2,7)(5,2.5)(5,5);
\tzpath[pattern=horizontal lines](2,7)(4,4)(5,5);
\end{tikzpicture}
```

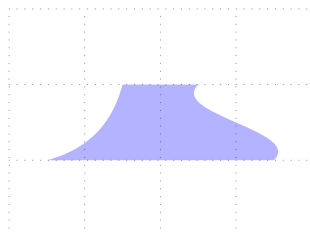


7.2 \tzpath*+

```
% \tzpath*+
\begin{tikzpicture}
\tzhelplines(4,3)
\tzpath[pattern=crosshatch](1,1)(3,3)(4,0)(2,0);
\tzpath*+[draw=blue,fill=red]
         (0,1)(-30:2cm)(2,2)(180:2cm);
\end{tikzpicture}
```



```
% \tzpath : does MUCH MORE! (See manual)
%           [how to connect]
\begin{tikzpicture}
\tzhelplines(4,3)
\tzpath*+[blue]
         <.5,1>                % shift
         (0,0)[to[bend right]]
         (1,1)
         (1,0)[to[out=-135,in=45]]
         (1,-1) ; <--cycle>
\end{tikzpicture}
```

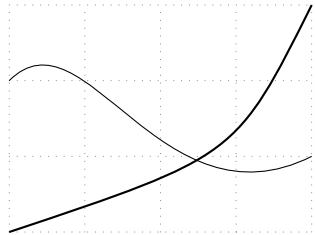


8 Curves

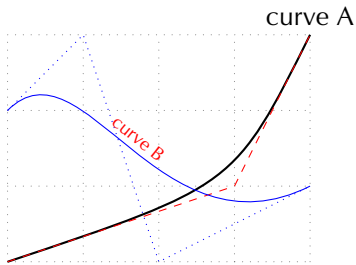
```
\tzbezier(0,0)(0,1)(4,3)
\tzbezier(0,0)(0,1)(3,0)(4,3)

\tzparabola(0,0)(3,3)
\tzparabola(0,0)(2,2)(3,3)

\tzto(0,0)[bend right](1,0)
\tztos(0,0)[bend right](1,0)[bend left=10](2,1) ;

\tzplotcurve(0,0)(1,2)(3,3) ;  % semicolon version

\tzfn\Fx[0:4]  %% predefined fn \def\Fx{(\x-2)^2-1}
```

8.1 \tzbezier

```
% \tzbezier : 3 or 4 coordinates
\begin{tikzpicture}
\tzhelplines(4,3)
\tzbezier[thick](0,0)(3,1)(4,3) % 1 control point
\tzbezier(0,2)(1,3)(2,0)(4,1)   % 2 control points
\end{tikzpicture}
```

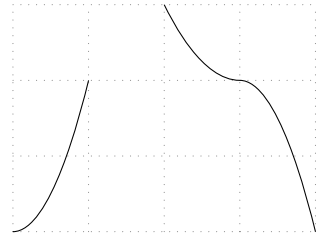


```
% \tzbezier: [tzshowcontrols]
\begin{tikzpicture}
\tzhelplines(4,3)
\tzbezier[thick,tzshowcontrols={red,dashed,thin}]
  (0,0)(3,1)(4,3)
  {curve A}[a]
\tzbezier[blue,tzshowcontrols]
  (0,2)(1,3)(2,0)(4,1)
  {curve B}[midway,a,sloped,scale=.7,text=red]
\end{tikzpicture}
```

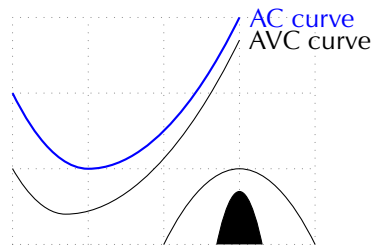


8.2 \tzparabola

```
% \tzparaola : 2 or 3 coordinates
\begin{tikzpicture}
\tzhelplines(4,3)
\tzparabola(0,0)(1,2)
\tzparabola(2,3)(3,2)(4,0) % bend at (3,2)
\end{tikzpicture}
```

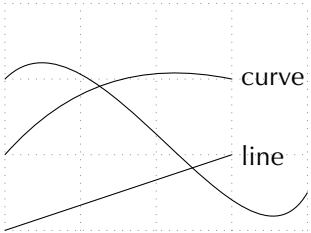


```
% \tzparaola : 2 or 3 coordinates
\begin{tikzpicture}
\tzhelplines(4,3)
\tzparabola[thick,blue](0,2)(1,1)(3,3){AC curve}[r]
\tzparabola(0,1)(.7,.4)(3,2.7){AVC curve}[r]
\tzparabola(2,0)(3,1)(4,0)
\tzparabola[fill](2.7,0)(3,.7)(3.3,0)
\end{tikzpicture}
```

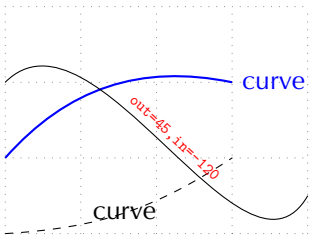


8.3 \tzto and \tzto+

```
% \tzto
\begin{tikzpicture}
\tzhelplines(4,3)
\tzto(0,0)(3,1){line}[r]
\tzto[bend left](0,1)(3,2){curve}[r]
\tzto[out=45,in=-120](0,2)(4,.5)
\end{tikzpicture}
```

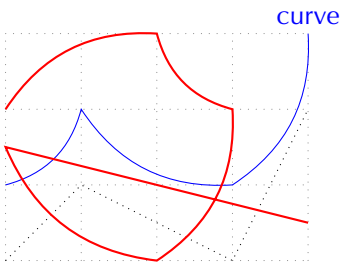



```
% \tzto+ : relative coordinate
\begin{tikzpicture}
\tzhelplines(4,3)
\tzto[bend right=15,dashed](0,0){curve}[c](3,1)
\tzto+[bend left,blue,thick](0,1)(3,1){curve}[r]
\tzto+[out=45,in=-120]
      (0,2)
      {out=45,in=-120}
      [a,red,sloped,scale=.6,font=\ttfamily]
      (4,-1.5)
\end{tikzpicture}
```

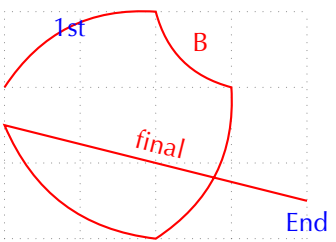


8.4 \tztos and \tztos+

```
% \tztos : semicolon version
\begin{tikzpicture}
\tzhelplines(4,3)
\tztos[dotted](0,0)(1,1)(3,0)(4,2); % line
\tztos[bend right,blue](0,1)(1,2)(3,1)(4,3){curve}[a];
\tztos[red,thick]
  (0,2)[bend left]  (2,3)[bend right]
  (3,2)[bend left]  (2,0)[bend left]
  (0,1.5)           (4,.5) ;
\end{tikzpicture}
```

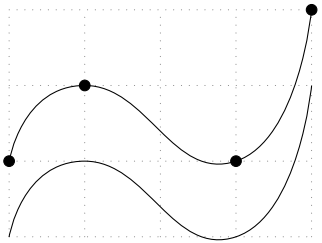



```
% \tztos+ : relative coordinates
\begin{tikzpicture}
\tzhelplines(4,3)
\tztos+[red,thick]
  (0,2)[bend left]{1st}[blue] (2,1)[bend right]{B}[ar]
  (1,-1)[bend left]           (-1,-2)[bend left]
  (-2,1.5){final}[a,sloped]   (4,-1){End}[b,blue];
\end{tikzpicture}
```



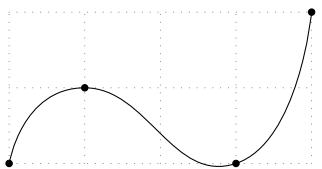
8.5 \tzplotcurve(*)

```
% \tzplotcurve(*) : [mark=*,mark size=2pt] by default
\begin{tikzpicture}
\tzhelplines(4,3)
\tzplotcurve(0,0)(1,1)(3,0)(4,2);  % [tension=1]
\tzplotcurve*(0,1)(1,2)(3,1)(4,3); % [mark=*]
\end{tikzpicture}
```

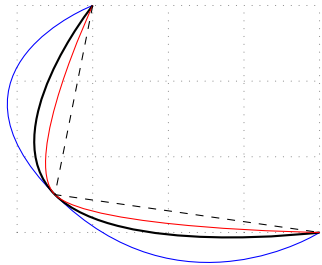


```
\tzplotcurve*(0,1)(1,2)(3,1)(4,3) % works like:
  \draw [tension=1,mark=*] plot [smooth] coordinates {(0,1)(1,2)(3,1)(4,3)};
\end{tikzpicture}
```

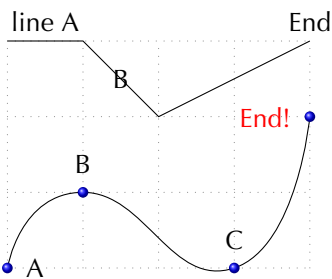
```
% mark size : radius
\begin{tikzpicture}
\tzhelplines(4,2)
\tzplotcurve*(0,0)(1,1)(3,0)(4,2);(1.2pt) % radius
\end{tikzpicture}
```



```
% \tzplotcurve: [tension=1] by default
\begin{tikzpicture}
\tzhelplines*(4,3)
\tzcoor(.5,.5)(A)
\tzplotcurve[blue]{2}(1,3)(A)(4,0);
\tzplotcurve[thick](1,3)(A)(4,0); % default: tension=1
\tzplotcurve[red]{.55}(1,3)(A)(4,0); % TikZ default
\tzplotcurve[dashed]{0}(1,3)(A)(4,0);
\end{tikzpicture}
```

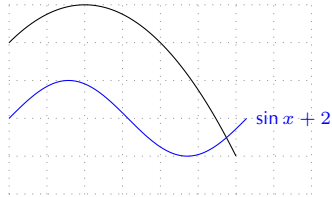


```
% \tzplotcurve : {<label>}[<angle>] for coordinates
\begin{tikzpicture}
\tzhelplines(4,3)
\tzplotcurve*[mark=ball]
  (0,0){A}[0]
  (1,1){B}
  (3,0){C}
  (4,2){End!}[[red]180] ;
\tzlines(0,3){line A}[a](1,3){B}(2,2)(4,3){End}[a]; %
\end{tikzpicture}
```



8.6 \tzfn

```
% \tzfn : plots points (x,f(x))
\begin{tikzpicture}[scale=.5,font=\scriptsize]
\tzhelplines*(8,5)
\tzfn{-.25*(\x-2)^2+5}[0:6]
\tzfn[blue]{sin(\x r)+2}[0:2*pi]{$\sin x+2$}[r]
\end{tikzpicture}
```



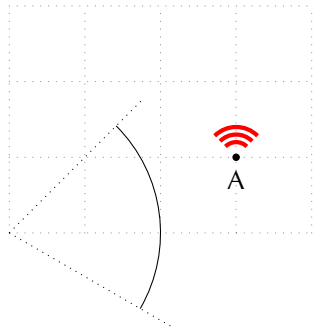
9 Arcs and wedges

```
\tzarc(1,1)(30:60:1cm)
\tzarc'(1,1)(30:60:1cm)

\tzwedge(1,1)(30:60:1cm)
\tzwedge'(1,1)(30:60:1cm)

\tzarcfrom(1,1)(30:60:1cm)
\tzarcsfrom(1,1)
           (30:60:1cm)
           (180:120:2cm) ;
```

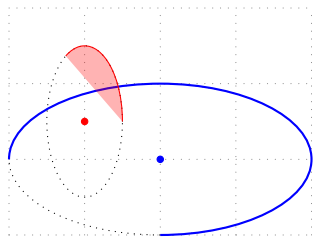
9.1 Arcs

9.1.1 Arcs and elliptical arcs

```
\begin{tikzpicture}
\tzhelplines(4,3)
\tzarc(0,0)(-30:45:2)
\tzline[dotted](0,0)(-30:2.5)
\tzline[dotted](0,0)(45:2.5)
\tzcoor*(3,1)(A){A}[-90]
\tzarc[ultra thick,red](A)(45:135:.2)
\tzarc[ultra thick,red](A)(45:135:.3)
\tzarc[ultra thick,red](A)(45:135:.4)
\end{tikzpicture}
```

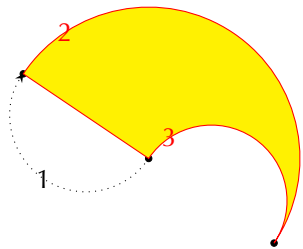



```
\begin{tikzpicture}
\tzhelplines(4,3)
\tzdot*[blue](2,1)
\tzcircle[dotted](2,1)(2cm and 1cm)
\tzarc[thick,blue](2,1)(-90:180:2cm and 1cm)
\tzcoor*[red](1,1.5)(B)
\tzcircle[dotted](B)(.5cm and 1cm)
\tzarc'[red,fill,fill opacity=.3](B)(120:360:.5 and 1)
\end{tikzpicture}
```

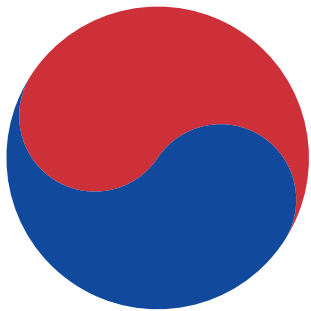


9.1.2 \tzarcfrom and \tzarcsfrom

```
% \tzarcfrom : works as in TikZ
% \tzarcsfrom : semicolon version
\begin{tikzpicture}
\tzdots*(0,0)(-34-180:2)(-34:2);
\tzarcfrom[->,dotted](0,0)(-34:-34-180:1){1}[midway] %
\tzarcsfrom[->,red,fill=yellow] (-34-180:2)
  (-34+180:-34:2){2}[very near start]
  (-34:-34+180:1){3}[very near end] ; <--cycle>
\end{tikzpicture}
```

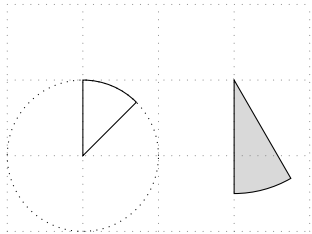



```
\definecolor{flagred}{RGB}{205,48,57}
\definecolor{flagblue}{RGB}{17,73,156}
\begin{tikzpicture}
\edef\x{atan(2/3)}
\tzarcsfrom[draw=none,fill=flagred](0,0)
  (-\x:-\x-180:1)(-\x+180:-\x:2)
  (-\x:-\x+180:1);<-- cycle>
\tzarcsfrom[draw=none,fill=flagblue](0,0)
  (180-\x:-\x:1)(-\x:-\x-180:2)
  (-\x+180:-\x+360:1) ; <-- cycle>
\end{tikzpicture}
```

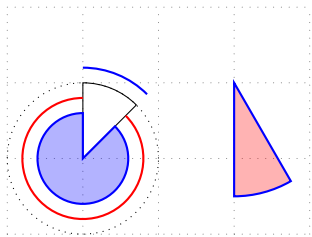


9.2 Wedges

```
% \tzwedge, \tzwedge*
\begin{tikzpicture}
\tzhelplines(4,3)
\tzcircle[dotted](1,1)(1cm)
\tzwedge(1,1)(45:90:1cm)
\tzwedge*(3,2)(-90:-60:1.5cm)
\end{tikzpicture}
```

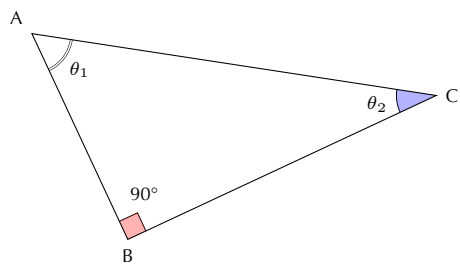


```
% \tzarc', \tzwedge' : swap versions
\begin{tikzpicture}
\tzhelplines(4,3)
\tzcircle[dotted](1,1)(1cm)
\tzwedge(1,1)(45:90:1cm)
\tzwedge*'[thick,blue](1,1)(45:90:.6cm) % swap
\tzarc[blue,thick](1,1)(45:90:1.2cm)
\tzarc'[red,thick](1,1)(45:90:.8cm)     % swap
\tzwedge*[thick,blue,fill=red](3,2)(-90:-60:1.5cm)
\end{tikzpicture}
```



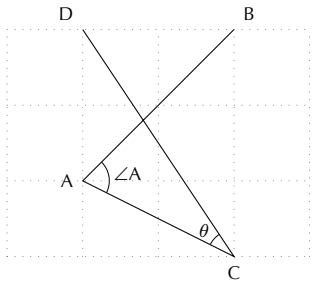
10 Angles (Experimental)

```
\tzmarkangle(B)(A)(C){$\theta_1$}
\tzmarkangle'(B)(A)(C)

\tzfillangle(C)(A)(B)
\tzfillangle'(C)(A)(B)

\tzmarkrightangle(A)(B)(C)
\tzfillrightangle(A)(B)(C)
```

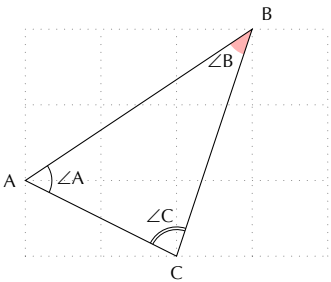


10.1 Angle marks: `\tzmarkangle` (Experimental)

```
% \tzmarkangle, \tzmarkangle'
\begin{tikzpicture}[font=\scriptsize]
\tzhelplines(4,3)
\tzcoors(1,1)(A){A}[180](3,3)(B){B}[45]
        (3,0)(C){C}[-90](1,3)(D){D}[135];
\tzlines(B)(A)(C)(D);
\tzmarkangle'(B)(A)(C){$\angle$A}[pos=1.7] % swap
\tzmarkangle(A)(C)(D){$\theta$}
\end{tikzpicture}
```

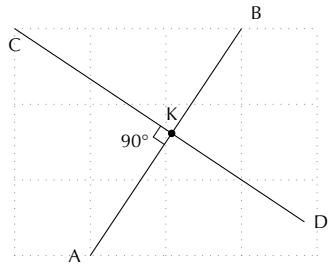



```
% \tzfillangle(')
\begin{tikzpicture}[font=\scriptsize]
\tzhelplines(4,3)
\tzcoors(0,1)(A){A}[180](3,3)(B){B}[45]
        (2,0)(C){C}[-90];
\tzpolygon(A)(B)(C);
\tzmarkangle'(C)(A)(B){$\angle$A}[pos=1.7] % swap
\tzfillangle[red](A)(B)(C){$\angle$B}[xshift=-1mm]
\tzmarkangle(A)(C)(B){$\angle$C}(11pt) % radius=11pt
\tzmarkangle(A)(C)(B)
\end{tikzpicture}
```

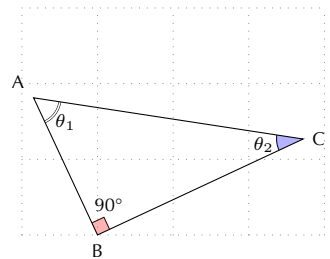


10.2 Right angle marks: `\tzmarkrightangle` (Experimental)

```
\begin{tikzpicture}[font=\scriptsize]
\tzhelplines(4,3)
\tzcoors(1,0)(A){A}[180](3,3)(B){B}[45]
        (0,3)(C){C}[-90](3,1)(D);
\tzline"AB"(A)(B)
\tzlines"CD"(C)(D)([turn]0:1cm){D}[r];
\tzXpoint*{AB}{CD}(K){K}[90] % intersection
\tzmarkrightangle(A)(K)(C){90\textdegree}
\end{tikzpicture}
```




```
\begin{tikzpicture}[font=\scriptsize]
\tzhelplines(4,3)
\tzcoor(1,0)(B){B}[-90]
\tzcoors($(B)+(115:2)$)(A){A}[135]
        ($(B)+(25:3)$)(C){C}[0];
\tzpolygon(A)(B)(C);
\tzmarkangle[double](B)(A)(C){$\theta_1$} % double
\tzmarkangle(B)(C)(A){$\theta_2$}
\tzfillangle[blue](B)(C)(A)
\tzmarkrightangle(A)(B)(C){90\textdegree}[pos=1.7]
\tzfillrightangle[red](A)(B)(C)
\end{tikzpicture}
```



11 References

- The Ti*k*Z and PGF Package: Manual for version 3.1.9a (`https://github.com/pgf-tikz/pgf`).
- `tzplot.sty`: Plot Graphs with Ti*k*Z Abbreviations, version 1.0.1 (`https://www.ctan.org/pkg/tzplot`).
- 경제학자를 위한 Ti*k*Z (`http://wiki.ktug.org/wiki/wiki.php/LaTeXWorkshop/2017`).
- 그림과 함수 플로팅 (`http://wiki.ktug.org/wiki/wiki.php/LaTeXWorkshop/2018`).
- tikz coordinates: memoir (`http://wiki.ktug.org/wiki/wiki.php/LaTeXWorkshop/2019`).