Ti*k*Zfor Economists

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1 Introduction

convenient?

simple?

efficient?

Tantau(2015, p.11)
$\rightsquigarrow$ new “simple input mode”
(more pstricks like input)

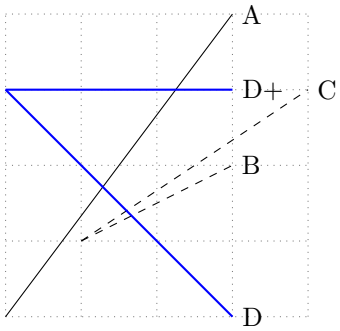
https://www.dante.de/events/dante2015/Programm/vortraege/vortrag-tantau.pdf

2 Lines

2.1 \tkzline

```
% syntax
  \tkzline(+)[<opt>]"<path name>"(coor1)(coor2)[<opt>]{<label>}
% defaults: (+)[]""(0,0)()[black,right]{}
```

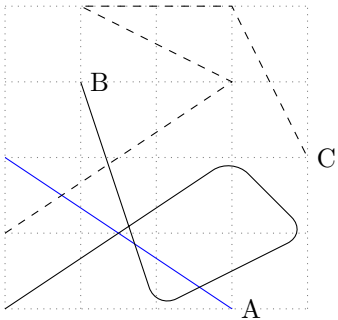
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzline(3,4){A}
\tkzline[dashed](1,1)(3,2){B}
\tkzline+[dashed](1,1)(3,2){C}
\tkzline[blue,thick](0,3)(3,0){D}
\tkzline+[blue,thick](0,3)(3,0){D+}
\end{tikzpicture}
```



2.2 \tkzlines

```
% syntax
  \tkzlines(+)[<opt>]"<path name>"(coor1)(coor2){(coor),(coor),...}[<opt>]{<label>}
% defaults: (+)[]""(0,0)(){}[black,right]{}
```

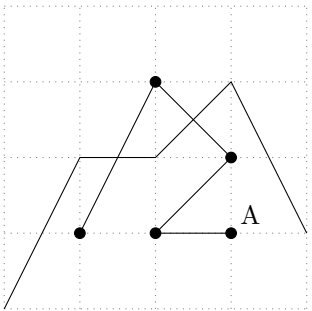
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzlines[blue](0,2)(3,0){}{A}
\tkzlines[rounded corners=3mm]
         (3,2){(4,1),(2,0),(1,3)}{B}
\tkzlines+[dashed](0,1)(3,2){(-2,1),(2,0),(1,-2)}{C}
\end{tikzpicture}
```



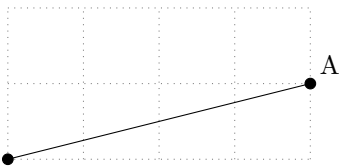
2.3 \tkzDraw

```
% syntax
  \tkzDraw[<opt>]"<path
    name>"{<tension>}(coor-1)...(coor-n);(cycle)[<opt>]{<label>}
% defaults: []""{0}()...();()[black,above right]{}
% syntax
  \tkzDraw*[<opt>]"<path name>"(coor-1)...(coor-n);(cycle)[<fillcolor>]
% defaults: []""{0}()...();()[]
```

```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzDraw(0,0)(1,2)(2,2)(3,3)(4,1);
\tkzDraw[mark=*](1,1)(2,3)(3,2)(2,1)(3,1);{A}
\end{tikzpicture}
```



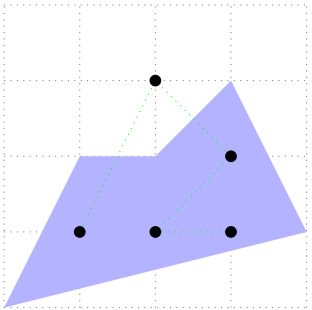

```
\begin{tikzpicture}
\tkzhelplines(4,2)
\tkzDraw[mark=*](0,0)(4,1);{A}
\end{tikzpicture}
```



2.4 \tkzPath

```
% syntax
  \tkzPath[<opt>]"<path name>"(coor-1)...(coor-n);
% defaults: []""()...();
% syntax
  \tkzPath*[<opt>]"<path name>"(coor-1)...(coor-n);[<fillcolor>]
% defaults: []""()...();
```

```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzPath*(0,0)(1,2)(2,2)(3,3)(4,1);[blue!30]
\tkzPath[draw,dotted,green](1,1)(2,3)(3,2)(2,1)(3,1);
\tkzPath[mark=*](1,1)(2,3)(3,2)(2,1)(3,1);
\end{tikzpicture}
```

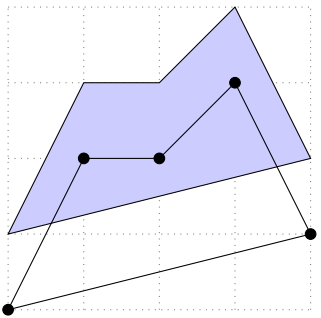


3 Polygons

3.1 \tkzPolygon

```
% syntax
  \tkzPolygon[<opt>]"<path name>"[<opt>](coor-1)...(coor-n);
% defaults: []""()...();
% syntax
  \tkzPolygon*[<opt>]"<path name>"(coor-1)...(coor-n);[<fillcolor>]
% defaults: []""()...();[]
```

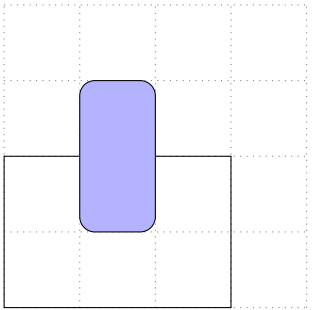
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzPolygon*[yshift=1cm](0,0)(1,2)(2,2)(3,3)(4,1);[blue!20]
\tkzPolygon[mark=*](0,0)(1,2)(2,2)(3,3)(4,1);
\end{tikzpicture}
```



3.2 \tkzframe

```
% syntax
  \tkzframe(+)[<opt>](coor)(coor)
% defaults: []()...();
% syntax
  \tkzframe*(+)[<opt>](coor-1)...(coor-n);[<fillcolor>]
% defaults: []()...();[black]
```

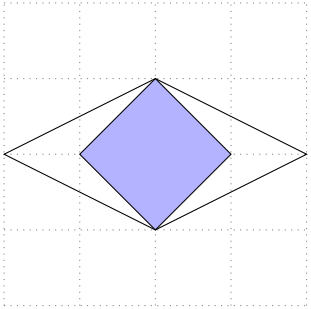
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzframe(0,0)(3,2)
\tkzframe*+[rounded corners=2mm](1,3)(1,-2)[blue!30]
\end{tikzpicture}
```



3.3 \tkzdiamond

```
% syntax
  \tkzdiamond(*)[<opt>](coor)(coor)[<fillcolor>]
```

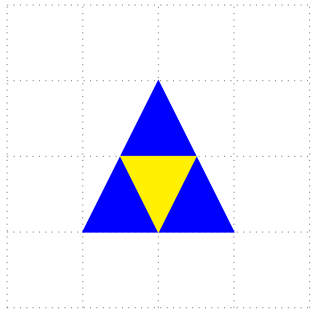
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzdiamond(2,2)(2,1)
\tkzdiamond*(2,2)(1,1)[blue!30]
\end{tikzpicture}
```



3.4 \tkztriangle

```
% syntax
  \tkzdiamond(*)[<opt>](base.center)(base,height)[<fillcolor>]
```

```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkztriangle*[blue](2,1)(2,2)
\tkztriangle*[yellow](2,2)(1,-1)
\end{tikzpicture}
```

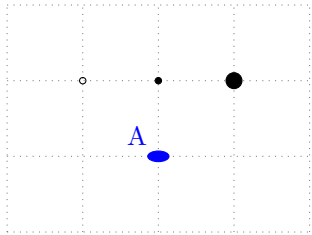


4 Dots

4.1 \tkzdot

```
% syntax:
\tkzdot(*)[<opt>](coor)<label angle>{<label>}[shape](radius)
% defaults: (*)[]()<above>{}[circle](1.2pt)
```

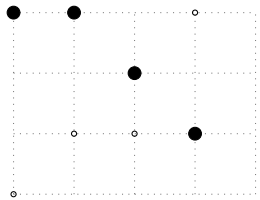
```
\begin{tikzpicture}
\tkzhelplines(4,3)
\tkzdot(1,2)
\tkzdot*(2,2)
\tkzdot*(3,2)(3pt)
\tkzdot*[blue](2,1)<135>{A}[ellipse](2*2pt and 2pt)
\end{tikzpicture}
```



4.2 \tkzdots

```
% syntax:
\tkzdots(*)[<opt>]{(coor1),(coor2),...}(radius)
% defaults:
[]{()()...}(1.2pt)
```

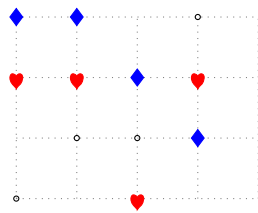
```
\begin{tikzpicture}[scale=.8]
\tkzhelplines(4,3)
\tkzdots{(0,0),(1,1),(2,1),(3,3)}
\tkzdots*{(0,3),(1,3),(2,2),(3,1)}(3pt)
\end{tikzpicture}
```



4.3 \tkzDots

```
% syntax:
\tkzDots(*)[<opt>](coor1)(coor2)...;(radius)
% defaults:
[]()()...;(1.2pt)
```

```
\begin{tikzpicture}[scale=.8]
\tkzhelplines(4,3)
\tkzDots(0,0)(1,1)(2,1)(3,3);
\tkzDots*[blue,mark=diamond*](0,3)(1,3)(2,2)(3,1);(4pt)
\tkzDots*[red,mark=heart](0,2)(1,2)(2,0)(3,2);(3pt)
\end{tikzpicture}
```

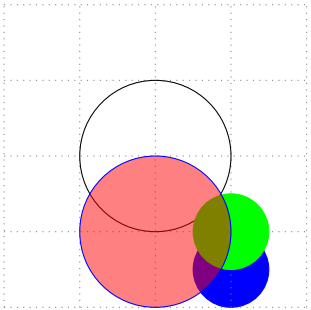


5 Circles, Arcs, Ellipses, and Angles

5.1 \tkzcircle

```
% syntax:
\tkzcircle[<opt>](center){radius}
\tkzcircle*[<opt>](center){radius}[fill color]
% defaults: [black](){1}[black]
```

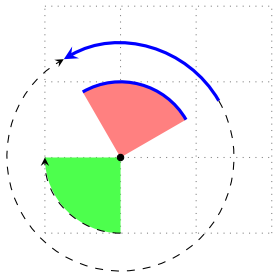
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzcircle(2,2)
\tkzcircle*[green](3,1){.5}
\tkzcircle*[draw=blue](2,1)[red,fill opacity=.5]
\begin{scope}[on background layer]
\tkzcircle*[blue](3,.5){.5}
\end{scope}
\end{tikzpicture}
```



5.2 \tkzarc

```
% syntax:
\tkzarc(')[<opt>](center){radius}{start angle}{end angle}[<opt>]{<label>}
% defaults: [](0,0){}{}{1}[midway]{}
\tkzarc(*)(')[<opt>](center){radius}{start angle}{end angle}[fill color]
% defaults: [](0,0){}{}{1}[]
```

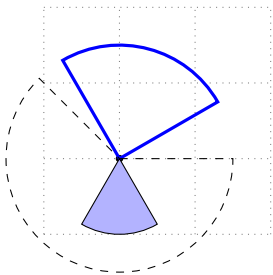
```
\begin{tikzpicture}[->,>=stealth]
\tkzhelplines[-](3,3)
\tkzarc[very thick,blue](1,1){1.5}{30}{120}
\tkzarc*[-,very thick,blue](1,1){1}{30}{120}[red!50]
\tkzarc'[dashed](1,1){1.5}{30}{120}]{clockwise}
\tkzarc*'[dashed](1,1){1}{-90}{180}[green!70]
\tkzdot*(1,1)
\end{tikzpicture}
```



5.3 \tkzwedge

```
% syntax:
\tkzwedge(*)(')[<opt>](center){radius}{start angle}{end angle}[<opt>]{<label>}
% defaults: [](0,0){}{}{1}[midway]{}
```

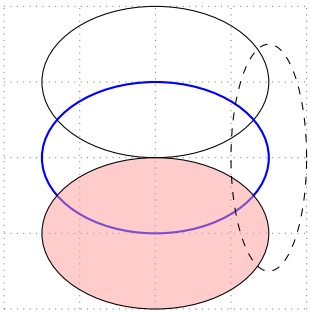
```
\begin{tikzpicture}
\tkzdot*(1,1)
\tkzhelplines[-](3,3)
\tkzwedge[blue,very thick](1,1){1.5}{30}{120}
\tkzwedge'[dashed](1,1){1.5}{0}{135}
\tkzwedge*'(1,1){1}{-60}{240}[blue!30]
\end{tikzpicture}
```



5.4 \tkzellipse

```
% syntax:
\tkzcircle[<opt>](center)(xradius,yradius)
\tkzcircle*[<opt>](center)(xradius,yradius)[fill color]
% defaults: [black]()(1.5,1)[black]
```

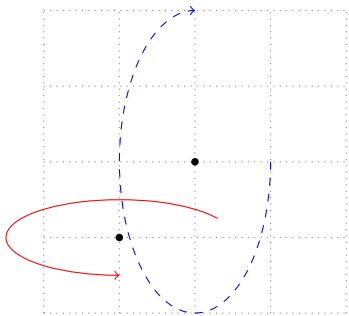
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzellipse(2,3)(1.5,1)
\tkzellipse[blue,thick](2,2)(1.5,1)
\tkzellipse*(2,1)(1.5,1)[red!40,fill opacity=.5]
\tkzellipse[dashed](3.5,2)(.5,1.5)
\end{tikzpicture}
```



5.5 tkzellipticarc

```
% syntax
\tkzellipticarc(center)(xradius,yradius){start angle}{end angle}
```

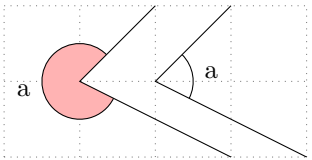
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzdot*(1,1)
\begin{scope}[->,color=red]
\tkzellipticarc(1,1)(1.5,0.5){30}{270}
\end{scope}
\tkzdot*(2,2)
\begin{scope}[->,color=blue,dashed]
\tkzellipticarc(2,2)(1,2){0}{-270}
\end{scope}
\end{tikzpicture}
```



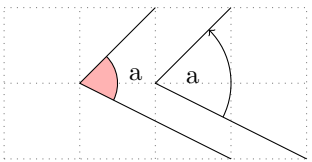
5.6 \tkzangle

```
% syntax: angle ABC or angle CBA
\tkzangle(')[<opt>](A)(B)(C){<label>}(arc dist)(label pos factor)[<angle opt>]
% defaults:(')[]()()(){}(5mm)(1.5)[]
```

```
\begin{tikzpicture}
\tkzhelplines(4,2)
\tkzangle(2,2)(1,1)(3,0){a}[fill=red!30]
\tkzangle'[xshift=1cm](2,2)(1,1)(3,0){a}
\end{tikzpicture}
```




```
\begin{tikzpicture}
\tkzhelplines(4,2)
\tkzangle(3,0)(1,1)(2,2){a}[fill=red!30]
\tkzangle'[xshift=1cm](2,2)(1,1)(3,0){a}(1cm)(.5)[->]
\end{tikzpicture}
```

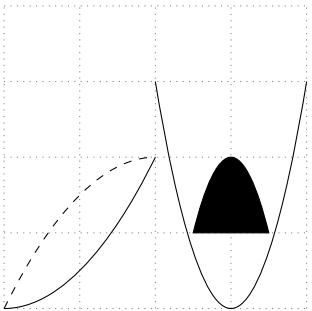


6 Curves

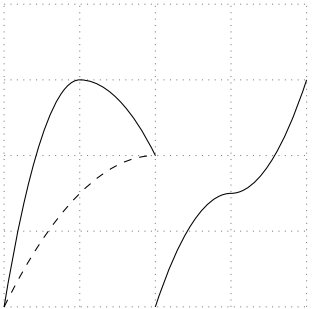
6.1 tkzparabola

```
% syntax:
\tkzparabola(*)[<opt>](coor1)(coor2)(coor3)[<parabola opt>][<fillcol>]
```

```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzparabola(0,0)(2,2)
\tkzparabola[dashed](0,0)(2,2)[bend at end]
\tkzparabola(2,3)(3,0)(4,3)
\tkzparabola*(2.5,1)(3,2)(3.5,1)
\end{tikzpicture}
```



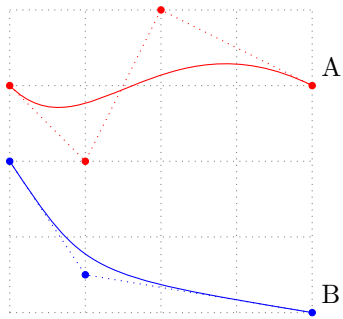
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzparabola[dashed](0,0)(2,2)[bend at end]
\tkzparabola(0,0)(2,2)[parabola height=2cm]
\tkzparabola(2,0)(4,3)[bend pos=.5]
\end{tikzpicture}
```



6.2 \tkzbezier

```
% syntax: from (coorA) to (coorB)
\tkzbezier[<opt>]"<path name>"(coorA)(^-coor)(^-coor)(coorB)[<opt>]{<label>}
% defaults: [black]""()()()()[black,avove right]{}
\tkzbezier[<opt>]"<path name>"(coorA)(^-coor)(coorB)[<opt>]{<label>}
% defaults: [black]""()()()[black,avove right]{}
```

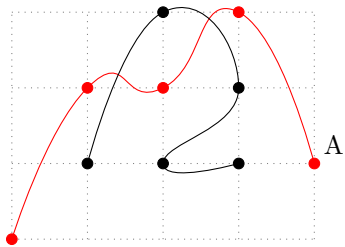
```
\begin{tikzpicture}
\tkzhelplines(4,4)
\tkzbezier[red](0,3)(1,2)(2,4)(4,3){A}
  \tkzDots*[red](0,3)(1,2)(2,4)(4,3);
  \tkzDraw[red,dotted](0,3)(1,2)(2,4)(4,3);
\tkzbezier[blue](0,2)(1,.5)(4,0){B}
  \tkzDots*[blue](0,2)(1,.5)(4,0);
  \tkzDraw[blue,dotted](0,2)(1,.5)(4,0);
\end{tikzpicture}
```



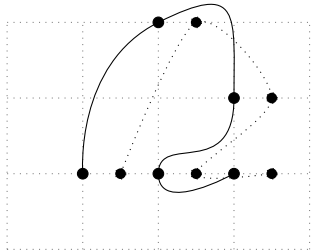
6.3 \tkzCurve

```
% syntax
  \tkzCurve[<opt>]"<path
    name>"{<tension>}(coor-1)...(coor-n);(cycle)[<opt>]{<label>}
  \tkzCurve*[<opt>]"<path name>"{<tension>}(coor-1)...(coor-n);(cycle)[<fillcolor>]
% defaults:
  \tikzCurve[]""{1}()...();()[above right]{}
  \tikzCurve*[]""{1}()...();()[]
```

```
\begin{tikzpicture}
\tkzhelplines(4,3)
\tkzCurve[red,mark=*](0,0)(1,2)(2,2)(3,3)(4,1);{A}
\tkzCurve[mark=*](1,1)(2,3)(3,2)(2,1)(3,1);
\end{tikzpicture}
```



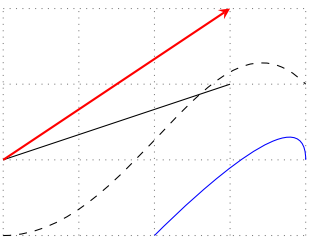
```
\begin{tikzpicture}
\tkzhelplines(4,3)
\begin{scope}[mark=*]
\tkzCurve{2}(1,1)(2,3)(3,2)(2,1)(3,1);
\tkzCurve[xshift=.5cm,dotted]{.5}(1,1)(2,3)(3,2)(2,1)(3,1);
\end{scope}
\end{tikzpicture}
```



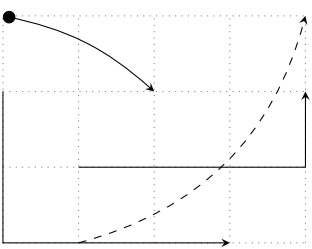
6.4 \tkzto

```
\begin{tikzpicture} %% >>>>>>>> visualtikz p.52
% syntax:
\tkzto(+)[<opt>](coor){<operation>}(coor)[<opt>]{<label>}
% default: [>=stealth](){to}()[]{}
\end{tikzpicture}
```

```
\begin{tikzpicture}
\tkzhelplines(4,3)
\tkzto(0,1)(3,2)
\tkzto+[->,red,thick](0,1)(3,2)
\tkzto[out=0,dashed](0,0)(4,2)
\tkzto[in=90,blue](2,0)(4,1)
\end{tikzpicture}
```



```
\begin{tikzpicture}
\tkzhelplines(4,3)
\tkzto[*->,bend left=15](0,3)(2,2)
\tkzto[->,bend right,dashed](1,0)(4,3)
\tkzto[->](0,2)[|-](3,0)
\tkzto+[->](1,1)[-|](3,1)
\end{tikzpicture}
```

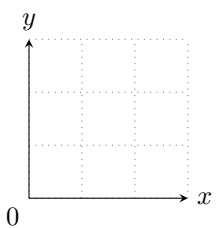


7 Axes, Projections and Ticks

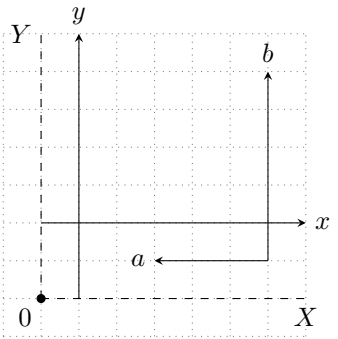
7.1 \tkzaxes

```
% syntax:
  \tkzaxes[<opt>]<x-shift,y-shift>(<x-min,ymin>)(<x-max,y-max>)
        [<x-opt>]{<xlabel>}[<y-opt>]{<ylabel>}
% defaults:
  [->,>=stealth]<0,0>(0,0)( )[black,right]{ }[black,above]{ }
% arguments:
  [#1]: line style, arrow type (for x-axis & y-axis)
  <#2>: axes shift %% default: <0,0>
  (#3): (x_min,y_min) %% could be omitted (default: {0,0})
  (#4): (x_max,y_max) %% mandatory
  [#5]: x-opt
  {#6}: x-label
  [#7]: y-opt
  {#8}: y-label
```

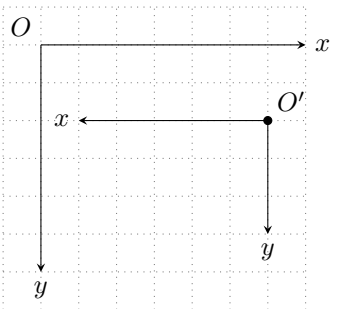
```
% Example:
\begin{tikzpicture}[scale=.7]
\tkzhelplines(3,3)
\tkzshoworigin
\tkzaxes(3,3){x}{y}
\end{tikzpicture}
```



```
% Example:
\begin{tikzpicture}[scale=.5]
\tkzhelplines(-1,-1)(7,7)
\tkzshoworigin*(0,0)(3pt)
\tkzaxes<1,2>(7,7){x}{y}
\tkzaxes[-,dashed](7,7)[below]{X}[left]{Y}
\tkzaxes<6,1>(6,1)(3,6)[left]{a}{b}
\end{tikzpicture}
```




```
% Example:
\begin{tikzpicture}[scale=.5]
\tkzhelplines(-1,-1)(7,7)
\tkzshoworigin(0,6)[above left]{$O$}
\tkzaxes<0,6>(0,6)(7,0){x}[below]{y}
\tkzaxes<6,4>(6,4)(1,1)[left]{x}[below]{y}
\tkzshoworigin*(6,4)[above right]{$O'$}(3pt)
\end{tikzpicture}
```

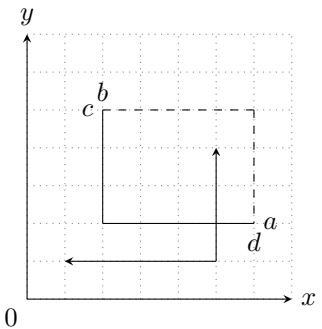



```
% syntax:
  \tkzshoworigin(*)[<opt>](<coor>)(<radius>)[<opt>]{label}
% defaults: [fill](0,0)(1.2pt)[below left]{0}
```

7.2 \tkzaxesL

```
% syntax:
  \tkzaxesL[<opt>](<x-min,ymin>)(<x-max,y-max>)[<x-opt>]{<xname>}[<y-opt>]{<yname>}
% defaults:
  [>=stealth]( )( )[black,right]{ }[black,above]{ }
% starred(*) version
  \ktzaxesL* : from the diagonally opposite corner
```

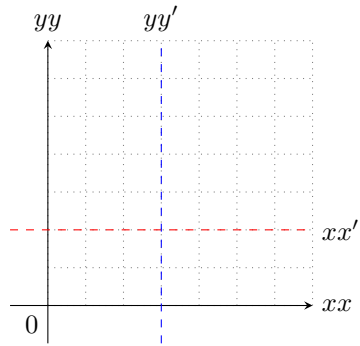
```
\begin{tikzpicture}[scale=.5]
\tkzhelplines(7,7)
\tkzshoworigin
\tkzaxes(7,7){x}{y}
\tkzaxesL(2,2)(6,5){a}{b}
\tkzaxesL*[dashed](2,2)(6,5){c}{d}
\tkzaxesL[->](5,1)(1,4)
\end{tikzpicture}
```



7.3 \tkzaxisx and \tkzaxisy

```
% syntax:
  \tkzaxisx[<opt>]<shift>{<from>}{<to>}[<opt>]{<x-label>}
  \tkzaxisy[<opt>]<shift>{<from>}{<to>}[<opt>]{<y-label>}
% defaults:
  [->,>=stealth]<0>{}{}[black,right]{}
```

```
\begin{tikzpicture}[scale=.5]
\tkzhelplines(7,7)
\tkzshoworigin
\tkzaxisx{-1}{7}{xx}
\tkzaxisy{-1}{7}{yy}
\tkzaxisx[-,dashed,red]<2>{-1}{7}{xx'}
\tkzaxisy[-,dashed,blue]<3>{-1}{7}{yy'}
\end{tikzpicture}
```

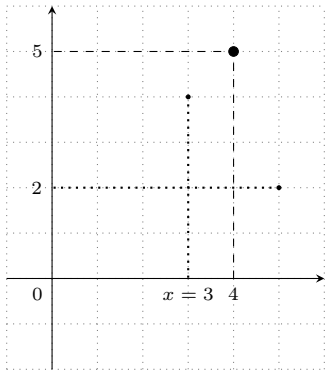


7.4 \tkzproj, \tkzprojx, and \tkzprojy

... depend on (xaxis) and (yaxis) assigned by \tkzaxes

```
% syntax:
\tkzproj[<opt>]<x-axis>(<coor>)<y-axis>[<x-pos>]{<x-label>}[<y-pos>]{<y-label>}
\tkzprojx[<opt>]<x-axis>(<coor>)[<pos>]{<label>}
\tkzprojy[<opt>]<y-axis>(<coor>)[<pos>]{<label>}
```

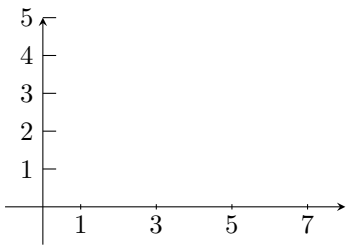
```
\begin{tikzpicture}[scale=.6,font=\scriptsize]
\tkzhelplines(-1,-2)(6,6)
\tkzshoworigin
\tkzaxes(-1,-2)(6,6)
\tkzproj*[dashed](4,5){4}{5}(3pt)
\tkzprojx*[thick](3,4){$x=3$}
\tkzprojy*[thick](5,2){2}
\end{tikzpicture}
```



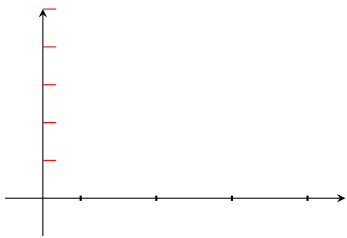
7.5 \tkzticks

```
% syntax:
\tkzticks[<x-opt>](xfrom..xto){<x-positions>}[<y-opt>](yfrom..yto){<y-positions>}
\tkzticks*[<x-opt>](xfrom..xto){<x-positions>}[<y-opt>](yfrom..yto){<y-positions>}
% starred(*) version suppresses the tick labels
% (x-y-from..x-y-to) -- tick dimensions: pt
% (x-y-positions) -- tick label position dimensions: cm
```

```
\begin{tikzpicture}[scale=.5]
\tkzaxes(-1,-1)(8,5)
\tkzticks(-2..2){1,3,...,7}(0..10){1,2,...,5}
\end{tikzpicture}
```



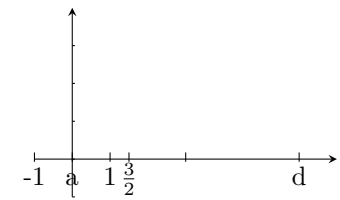

```
\begin{tikzpicture}[scale=.5]
\tkzaxes(-1,-1)(8,5)
\tkzticks*[thick](-2..2){1,3,...,7}[red](0..10){1,2,...,5}
\end{tikzpicture}
```



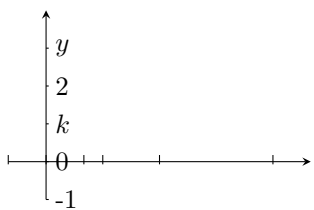
7.6 \tkzticksx, and \tkzticksy

```
% syntax:
\tkzticksx[<opt>](from..to){<tick positions>}
\tkzticksx*[<opt>](from..to){<tick positions>}[<tick label pos>]
\tkzticksy[<opt>](from..to){<tick positions>}
\tkzticksy*[<opt>](from..to){<tick positions>}[<tick label pos>]
% starred(*) versions suppress the tick labels
```

```
\begin{tikzpicture}[scale=.5]
\tkzaxes(-1,-1)(7,4)
\tkzticksx(-2..5){-1,0/a,1,1.5/$\frac32$,3/{},6/d}
\tkzticksy*{-1,0,1/$k$,2,3/$y$}[right]
\end{tikzpicture}
```




```
\begin{tikzpicture}[scale=.5]
\tkzaxes(-1,-1)(7,4)
\tkzticksx*(-2..5){-1,0/a,1,1.5/$\frac32$,3/{},6/d}
\tkzticksy{-1,0,1/$k$,2,3/$y$}[right]
\end{tikzpicture}
```

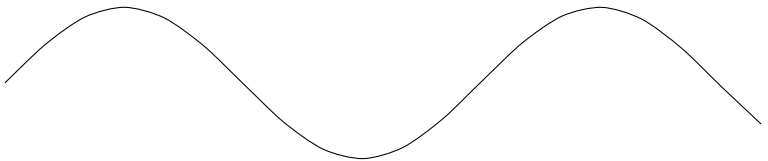


8 Plotting Data and Functions

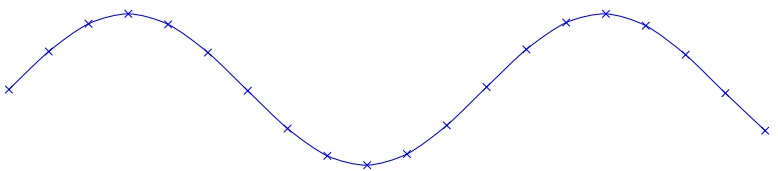
8.1 \tkzfileplot: plotting data

```
% syntax
\tkzfileplot[<opt>]{<file name>}[<plot opt>]
```

```
\begin{tikzpicture}
\tkzfileplot{sine.data}
\end{tikzpicture}
```



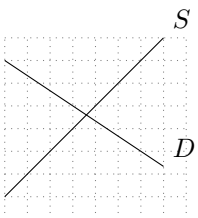
```
\begin{tikzpicture}
\tkzfileplot[blue]{sine.data}[mark=x]
\end{tikzpicture}
```



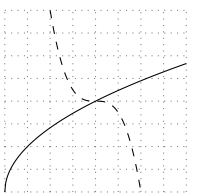
8.2 \tkzfn: plotting functions

```
% syntax
\tkzfn[<opt>]"path name"{<fn>}[from..to][<opt>]{<label>}
% defaults:
[]""{}[{1.1}..5][black,above right]{}
```

```
\begin{tikzpicture}[scale=.3]
\tkzhelplines(8,8)
\tkzfn{7-2/3*\x}[0..7]{$D$}
\tkzfn{1+\x}[0..7]{$S$}
\end{tikzpicture}
```




```
\begin{tikzpicture}[scale=.3]
\tkzhelplines(8,8)
\tkzfn{2*sqrt(\x)}[0..8]
\tkzfn[dashed]{4-.5*(\x-4)^3}[2..6]
\end{tikzpicture}
```

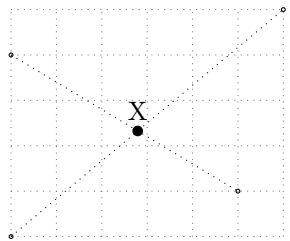


9 Intersections

9.1 \tkzintersectionpoint

```
% syntax: intersection of (A)--(B) and (C)--(D)
\tkzintersectionpoint(A)(B)(C)(D)(<point name>)<pos>{label}
\tkzintersectionpoint*(A)(B)(C)(D)(<point name>)<pos>{label}(<radius>)
% defaults:
()()()()()<90>{}(1.2pt)
```

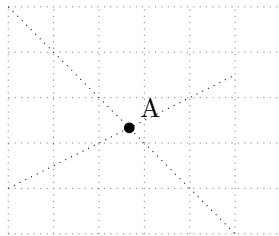
```
\begin{tikzpicture}[scale=.6]
\tkzhelplines(6,5)
\coordinate (B) at (5,1);
\tkzintersectionpoint*(0,0)(6,5)(0,4)(5,1)(X){X}(3pt)
\tkzDots(0,0)(6,5)(0,4)(5,1);
\tkzline[dotted](0,0)(6,5)
\tkzline[dotted](0,4)(5,1)
\end{tikzpicture}
```



9.2 \tkzLFXpoint

```
% syntax: intersection of function1 and function2
\tkzLFXpoint[<num1>][<num2>]{<fn1>}{<fn2>}(<point name>)<pos>{<label>}
\tkzLFXpoint*[<num1>][<num2>]{<fn1>}{<fn2>}(<point name>)<pos>{<label>}(<radius>)
% defaults
[1][2]{}{}()<45>{}(1.2pt)
```

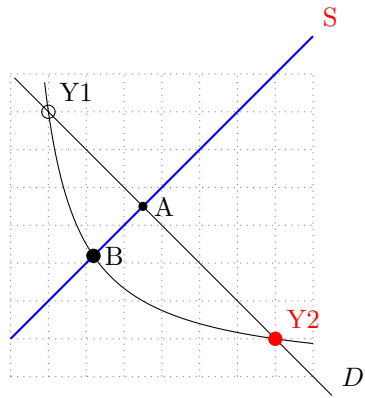
```
\begin{tikzpicture}[scale=.6]
\tkzhelplines(6,5)
\tkzLFXpoint*{5-\x}{1+1/2*\x}(A){A}(3pt)
\tkzfn[dotted]{5-\x}[0..5]
\tkzfn[dotted]{1+1/2*\x}[0..5]
\end{tikzpicture}
```



9.3 \tkzXpoint

```
% syntax: intersection of path1 and path2
\tkzXpoint[<opt>]{<path1>}{<path2>}[<X-num>](<name>)<pos>{<label>}
\tkzXpoint*[<opt>]{<path1>}{<path2>}[<X-num>](<name>)<pos>{<label>}(<radius>)
% defaults:
[]{}{}[1]()<45>{}(1.2pt)
```

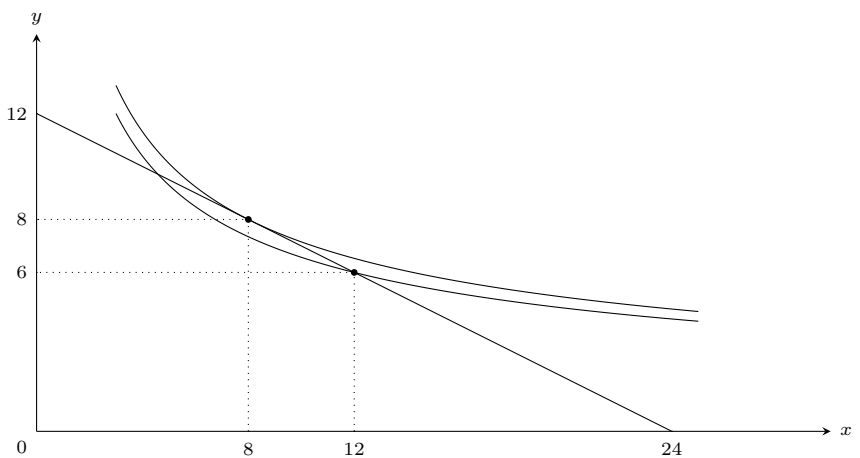
```
\begin{tikzpicture}[scale=.5]
\tkzhelplines(8,8)
\tkzfn"Fx"{8-\x}[{0.1}..{8.5}]{$D$}
\tkzfn[thick,blue]"Gx"{1+\x}[0..8][red]{S}
\tkzfn"Ux"{7/\x}[{.9}..8]
\tkzXpoint*{Fx}{Gx}(A)<right>{A}(3pt)
\tkzXpoint*{Gx}{Ux}(B)<0>{B}(5pt)
\tkzXpoint*[fill=none]{Fx}{Ux}(Y1)[1]<45>{Y1}(5pt)
\tkzXpoint*[red]{Fx}{Ux}(Y-2)[2]<[red]45>{Y2}(5pt)
\end{tikzpicture}
```



10 Examples in Economics

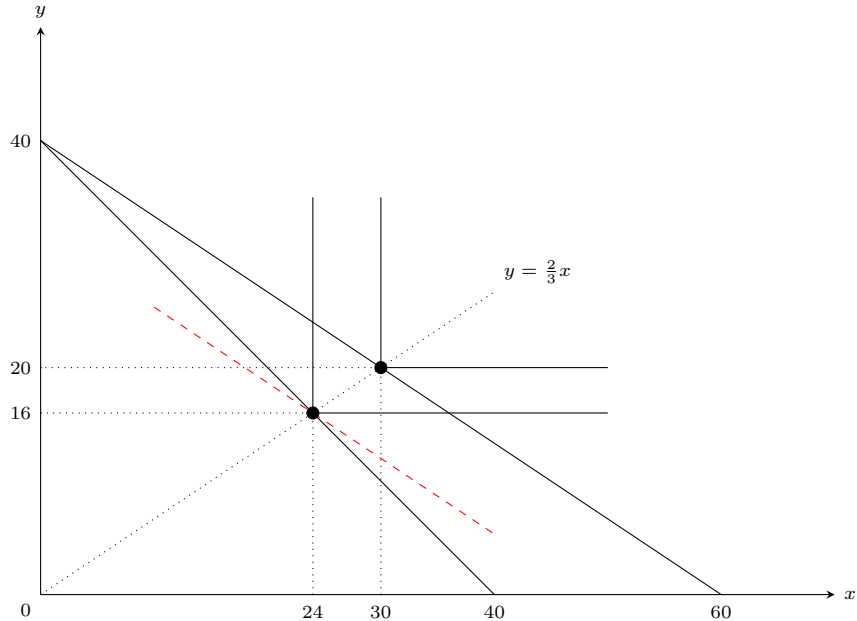
10.1 utility maximization

```
\begin{tikzpicture}[scale=.35,font=\scriptsize]
\tkzaxes(30,15){x}{y}
\tkzshoworigin
\def\bgt{12-\x/2} \def\Fx{16*1.414/sqrt(\x)} \def\Gx{12*1.732/sqrt(\x)}
\tkzfn{\bgt}[0..24] \tkzfn{\Fx}[3..25] \tkzfn{\Gx}[3..25]
\tkzproj*(8,8)(3pt) \tkzproj*(12,6)(3pt)
\tkzticks{8,12,24}{6,8,12}
\end{tikzpicture}
```



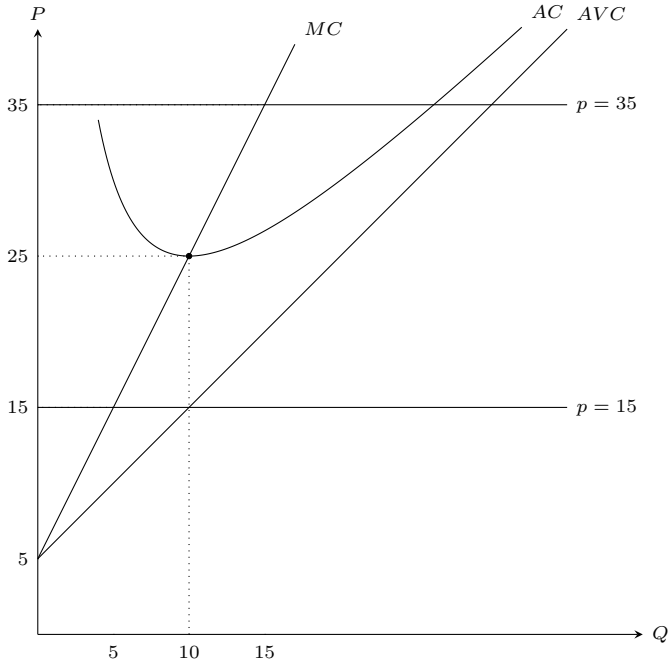
10.2 Leontief utility

```
\begin{tikzpicture}[scale=.15,font=\scriptsize]
\settkzcircleradius{15pt}
\tkzaxes(0,0)(70,50){x}{y}
\tkzaxesL(24,16)(50,35)
\tkzaxesL(30,20)(50,35)
\tkzshoworigin

\def\Fx{2*\x/3}L*
\def\bgt{40-\x}
\def\bgtb{40-2*\x/3}
\def\bgtc{32-2/3*\x}

\tkzfn[dotted]{\Fx}[0..40]{$y=\frac23 x$}
\tkzfn{\bgt}[0..40]
\tkzfn{\bgtb}[0..60]
\tkzfn[red,dashed]{\bgtc}[10..40]

\tkzticks{24,30,40,60}{16,20,40}
\tkzLFXpoint*{\bgt}{\Fx}(A)
\tkzLFXpoint*{\bgtb}{\Fx}(B)
\tkzproj(A)
\tkzproj(B)
\end{tikzpicture}
```


y
40
20
16
0
24
30
40
60
x
y = 2/3 x

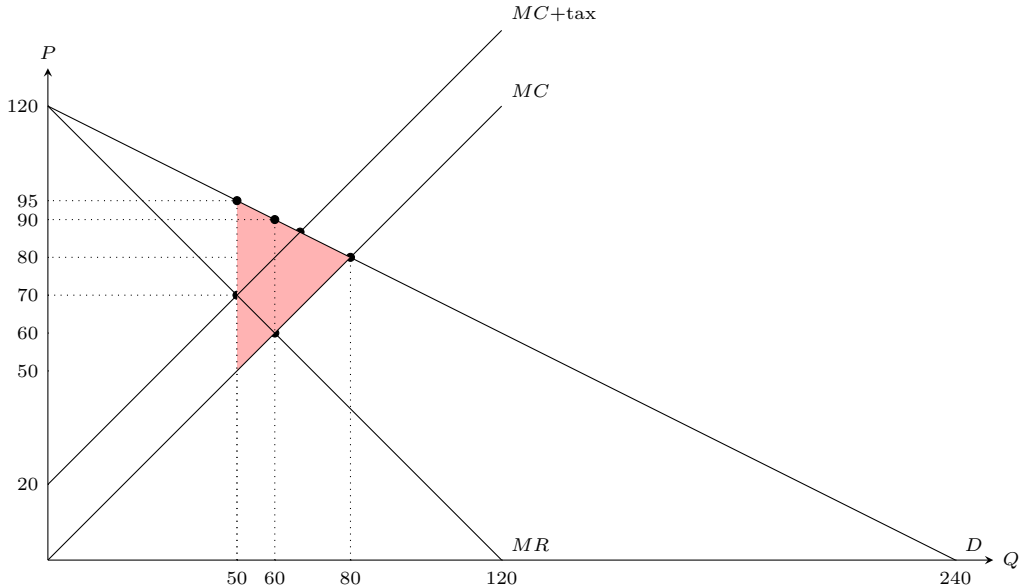
10.3 competitive firm

```
\begin{tikzpicture}[scale=.2,font=\scriptsize]
\tkzaxes(40,40){Q}{P}

\def\AVC{5+\x}
\def\AC{5+\x+100/\x}
\def\MC{5+2*\x}
\def\Pa{35}
\def\Pb{15}

\tkzfn{\AVC}[0..35]{$AVC$}
\tkzfn{\AC}[4..32]{$AC$}
\tkzfn{\MC}[0..17]{$MC$}
\tkzfn{\Pa}[0..35][right]{$p=35$}
\tkzfn{\Pb}[0..35][right]{$p=15$}

\tkzproj*(10,25)(5pt)
\tkzprojy(15,35)
\tkzprojy(5,15)
\tkzticks{5,10,15}{5,15,25,35}
\end{tikzpicture}
```

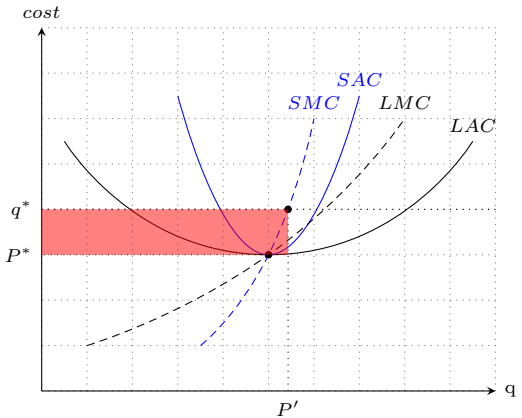

P
MC
AC
AVC
35
p = 35
25
15
p = 15
5
Q
5
10
15

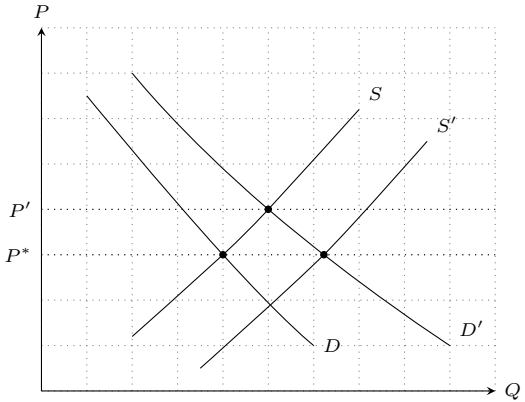
10.4 welfare analysis: monopoly tax

```
\begin{tikzpicture}[scale=.05,smooth,font=\scriptsize]
\settkzcircleradius{30pt}
\tkzaxes(250,130){Q}{P}
\def\Dx{120-(1/2)*\x}
\def\MC{\x}
\def\MCtax{\x+20}
\def\MR{120-\x}

\tkzLFXpoint*{\MR}{\MC}(e)
\tkzLFXpoint*{\Dx}{\MC}(ec)
\tkzproj(ec)
\tkzLFXpoint*{\MR}{\MCtax}(ee)
\tkzproj(ee)
\tkzLFXpoint*{\Dx}{\MCtax}(x)
\tkzPath*(ec)(50,95)(50,50);[red!30]

\tkzproj*(60,90)
\tkzproj*(50,95)
\tkzfn{\Dx}[0..240]{$D$}
\tkzfn{\MR}[0..120]{$MR$}
\tkzfn{\MC}[0..120]{$MC$}
\tkzfn{\MCtax}[0..120]{$MC$+tax}
\tkzticks{50,60,80,120,240}{20,50,60,70,80,90,95,120}
\end{tikzpicture}
```


MC+tax
MC
P
120
95
90
80
70
60
50
20
MR
D
Q
50
60
80
120
240

10.5 long-run equilibrium





10.6 natural monopoly