1 利用坐标变换定义点

这些变换主要有：

- 平移;
- 缩放;
- 轴对称;
- 中心对称;
- 正交投影;
- 旋转 (度或弧度);
- 相对于圆的反转.

可以使用**\tkzDefPointBy**命令实现单点变换，也可以通过**\tkzDefPointsBy**实现多点变换，变换方式用选项。默认用 A' 表示点 A 的变换结果，例如：

```
\tkzDefPointBy[translation= from A to A'](B)
```

结果保存于**tkzPointResult**命令中。

1.1 \tkzDefPointBy: 通过变换定义一个点

\tkzDefPointBy[⟨ 命令选项⟩**](**⟨pt⟩**)**

参数是一个已知点，结果存储于**\tkzPointResult**命令，可用**\tkzGetPoint{M}**命令保存该点，并为点命名。

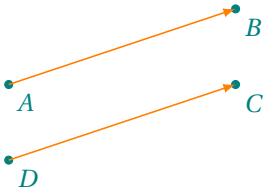
参数	含义	样例
pt	已存在的一个点的名称	(*A*)

选项		样例
translation	= from #1 to #2	[translation=from A to B](E)
homothety	= center #1 ratio #2	[homothety=center A ratio .5](E)
reflection	= over #1--#2	[reflection=over A--B](E)
symmetry	= center #1	[symmetry=center A](E)
projection	= onto #1--#2	[projection=onto A--B](E)
rotation	= center #1 angle #2	[rotation=center O angle 30](E)
rotation in rad	= center #1 angle #2	[rotation in rad=center O angle pi/3](E)
inversion	= center #1 through #2	[inversion =center O through A](E)

该命令仅定义一个点，并不绘制该点。

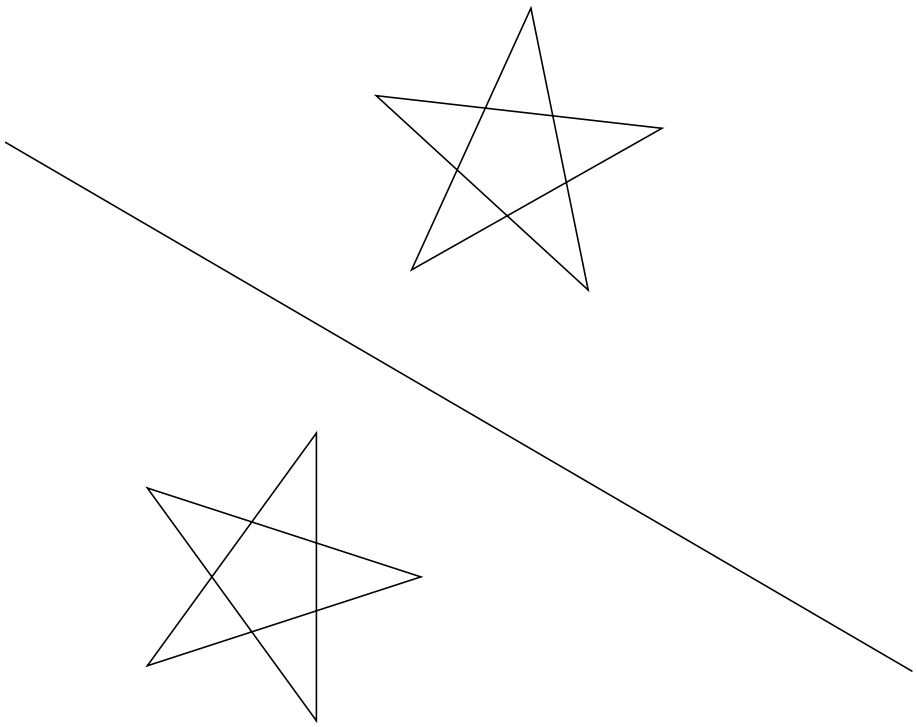
1.2 变换示例

1.2.1 平移示例



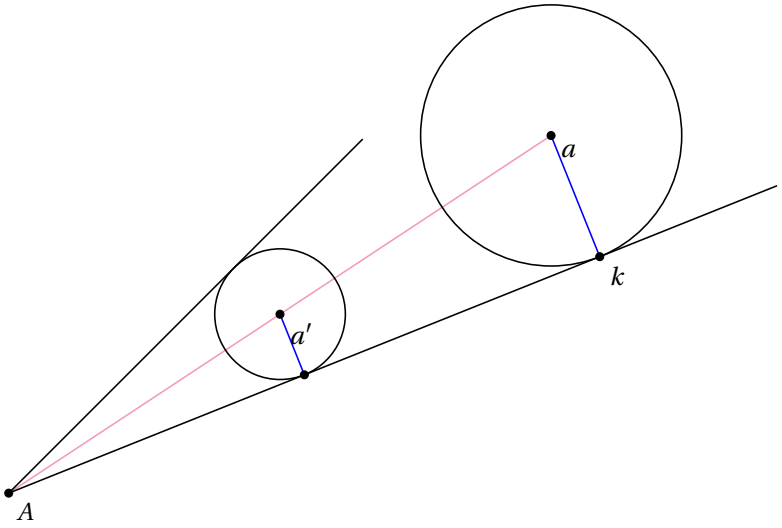

```
\begin{tikzpicture}[>=latex]
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(3,1){B}
 \tkzDefPoint(3,0){C}
 \tkzDefPointBy[translation= from B to A](C)
 \tkzGetPoint{D}
 \tkzDrawPoints[teal](A,B,C,D)
 \tkzLabelPoints[color=teal](A,B,C,D)
 \tkzDrawSegments[orange,->](A,B D,C)
\end{tikzpicture}
```

1.2.2 轴对称示例



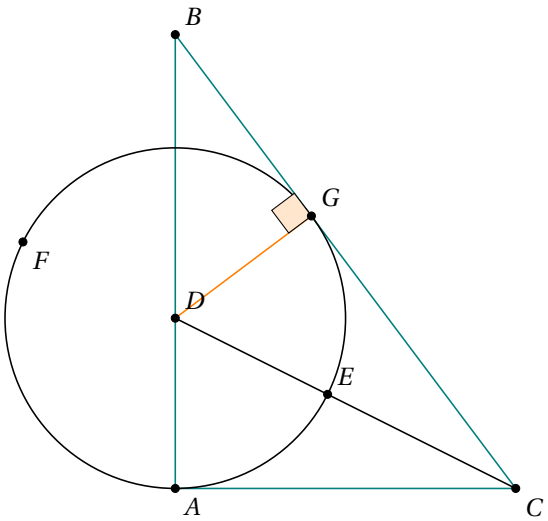
```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{1.5/-1.5/C,-4.5/2/D}
 \tkzDefPoint(-4,-2){O}
 \tkzDefPoint(-2,-2){A}
 \foreach \i in {0,1,...,4}{%
   \pgfmathparse{0+\i * 72}
   \tkzDefPointBy[rotation=%
      center O angle \pgfmathresult](A)
   \tkzGetPoint{A\i}
   \tkzDefPointBy[reflection = over C--D](A\i)
   \tkzGetPoint{A\i'}}
 \tkzDrawPolygon(A0, A2, A4, A1, A3)
 \tkzDrawPolygon(A0', A2', A4', A1', A3')
 \tkzDrawLine[add= .5 and .5](C,D)
\end{tikzpicture}
```

1.2.3 homothety和projection示例



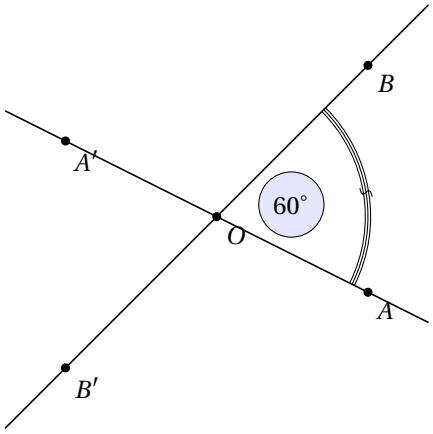

```
\begin{tikzpicture}[scale=1.2]
  \tkzDefPoint(0,1){A}   \tkzDefPoint(5,3){B}    \tkzDefPoint(3,4){C}
  \tkzDefLine[bisector](B,A,C)                   \tkzGetPoint{a}
  \tkzDrawLine[add=0 and 0,color=magenta!50 ](A,a)
  \tkzDefPointBy[homothety=center A ratio .5](a) \tkzGetPoint{a'}
  \tkzDefPointBy[projection = onto A--B](a')     \tkzGetPoint{k'}
  \tkzDefPointBy[projection = onto A--B](a)      \tkzGetPoint{k}
  \tkzDrawLines[add= 0 and .3](A,k A,C)
  \tkzDrawSegments[blue](a',k' a,k)
  \tkzDrawPoints(a,a',k,k',A)
  \tkzDrawCircles(a',k' a,k)
  \tkzLabelPoints(a,a',k,A)
\end{tikzpicture}
```

1.2.4 投影示例



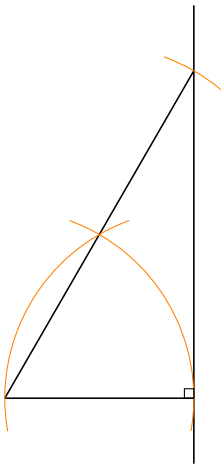

```
\begin{tikzpicture}[scale=1.5]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(0,4){B}
  \tkzDefTriangle[pythagore](B,A) \tkzGetPoint{C}
  \tkzDefLine[bisector](B,C,A)    \tkzGetPoint{c}
  \tkzInterLL(C,c)(A,B)           \tkzGetPoint{D}
  \tkzDefPointBy[projection=onto B--C](D)
  \tkzGetPoint{G}
  \tkzInterLC(C,D)(D,A) \tkzGetPoints{E}{F}
  \tkzDrawPolygon[teal](A,B,C)
  \tkzDrawSegment(C,D) \tkzDrawCircle(D,A)
  \tkzDrawSegment[orange](D,G)
  \tkzMarkRightAngle[fill=orange!20](D,G,B)
  \tkzDrawPoints(A,C,F) \tkzLabelPoints(A,C,F)
  \tkzDrawPoints(B,D,E,G)
  \tkzLabelPoints[above right](B,D,E,G)
\end{tikzpicture}
```

1.2.5 中心对称示例



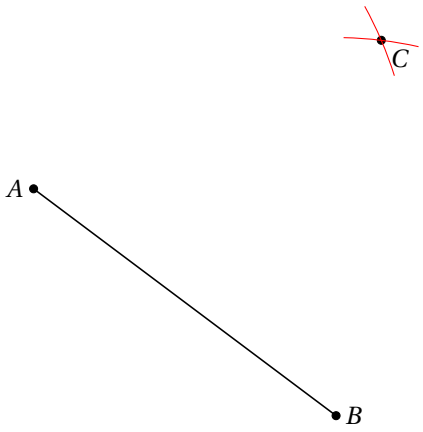

```
\begin{tikzpicture}[scale=1]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,-1){A}
  \tkzDefPoint(2,2){B}
  \tkzDefPointsBy[symmetry=center O](B,A){}
  \tkzDrawLine(A,A')
  \tkzDrawLine(B,B')
  \tkzMarkAngle[mark=s,arc=lll,
     size=2 cm,mkcolor=red](A,O,B)
  \tkzLabelAngle[pos=1,circle,draw,
     fill=blue!10](A,O,B){$60^{\circ}$}
  \tkzDrawPoints(A,B,O,A',B')
  \tkzLabelPoints(A,B,O,A',B')
\end{tikzpicture}
```

1.2.6 旋转示例（度）



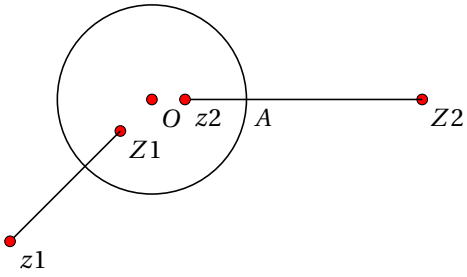
```
\begin{tikzpicture}[scale=0.5]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(5,0){B}
  \tkzDrawSegment(A,B)
  \tkzDefPointBy[rotation=center A angle 60](B)
  \tkzGetPoint{C}
  \tkzDefPointBy[symmetry=center C](A)
  \tkzGetPoint{D}
  \tkzDrawSegment(A,tkzPointResult)
  \tkzDrawLine(B,D)
  \tkzDrawArc[orange,delta=10](A,B)(C)
  \tkzDrawArc[orange,delta=10](B,C)(A)
  \tkzDrawArc[orange,delta=10](C,D)(D)
  \tkzMarkRightAngle(D,B,A)
\end{tikzpicture}
```

1.2.7 旋转示例（弧度）



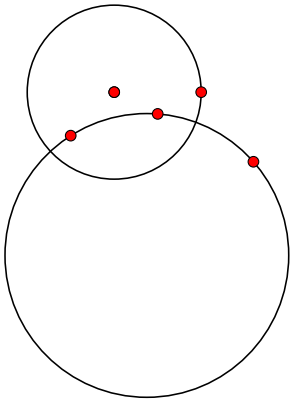

```
\begin{tikzpicture}
  \tkzDefPoint["$A$" left](1,5){A}
  \tkzDefPoint["$B$" right](5,2){B}
  \tkzDefPointBy[rotation in rad=center A angle pi/3](B)
  \tkzGetPoint{C}
  \tkzDrawSegment(A,B)
  \tkzDrawPoints(A,B,C)
  \tkzCompass[color=red](A,C)
  \tkzCompass[color=red](B,C)
  \tkzLabelPoints(C)
\end{tikzpicture}
```

1.2.8 反转示例




```
\begin{tikzpicture}[scale=1.25]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(1,0){A}
  \tkzDefPoint(-1.5,-1.5){z1}
  \tkzDefPoint(0.35,0){z2}
  \tkzDefPointBy[inversion = center O through A](z1)
  \tkzGetPoint{Z1}
  \tkzDefPointBy[inversion = center O through A](z2)
  \tkzGetPoint{Z2}
  \tkzDrawCircle(O,A)
  \tkzDrawPoints[color=black,fill=red,size=4](Z1,Z2)
  \tkzDrawSegments(z1,Z1 z2,Z2)
  \tkzDrawPoints[color=black,fill=red,size=4](O,z1,z2)
  \tkzLabelPoints(O,A,z1,z2,Z1,Z2)
\end{tikzpicture}
```

1.2.9 点的反转：正交圆



```
\begin{tikzpicture}[scale=1.15]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(1,0){A}
  \tkzDrawCircle(O,A)
  \tkzDefPoint(0.5,-0.25){z1}
  \tkzDefPoint(-0.5,-0.5){z2}
  \tkzDefPointBy[inversion = center O through A](z1)
  \tkzGetPoint{Z1}
  \tkzCircumCenter(z1,z2,Z1)
  \tkzGetPoint{c}
  \tkzDrawCircle(c,Z1)
  \tkzDrawPoints[color=black,fill=red,size=4]%
(O,z1,z2,Z1,O,A)
\end{tikzpicture}
```

1.3 \tkzDefPointsBy命令：通过变换定义多个点

该命令是单点变换命令的变体，用于定义多点变换。必须在圆括号中，通过参数指定变换点名称，也可以在大括号中给出变换后点的名称。

```
\tkzDefPointsBy[translation= from A to A'](B,C){}
```

变换后的点是 B' 和 C'.

```
\tkzDefPointsBy[translation= from A to A'](B,C){D,E}
```

变换后的点是 D 和 E.

```
\tkzDefPointsBy[translation= from A to A'](B)
```

变换后的点是 B'

\tkzDefPointsBy[⟨ 命令选项⟩](⟨ 变换点列表⟩){⟨ 变换结果点名称列表⟩}

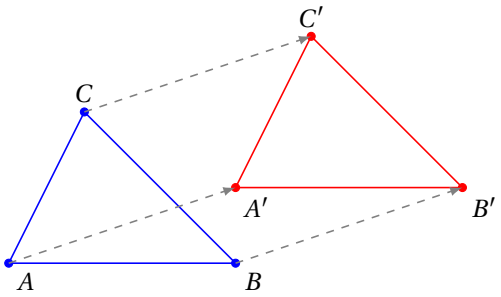
参数	示例
(⟨ 变换点列表⟩){⟨ 变换结果点名称列表⟩}	(A,B){E,F} E 是 A 的变换，F 是 B 的变换。

如果变换结果点名称列表为空，变换结果点的名称是在原名称后添加“'”号。

选项	示例
translation = from #1 to #2	[translation=from A to B](E){}
homothety = center #1 ratio #2	[homothety=center A ratio .5](E){F}
reflection = over #1--#2	[reflection=over A--B](E){F}
symmetry = center #1	[symmetry=center A](E){F}
projection = onto #1--#2	[projection=onto A--B](E){F}
rotation = center #1 angle #2	[rotation=center angle 30](E){F}
rotation in rad = center #1 angle #2	for instance angle pi/3

该命令仅定义变换结果点，并不绘制这些点。

1.3.1 变换示例




```
\begin{tikzpicture}[>=latex]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(3,1){A'}
  \tkzDefPoint(3,0){B}
  \tkzDefPoint(1,2){C}
  \tkzDefPointsBy[translation= from A to A'](B,C){}
  \tkzDrawPolygon[color=blue](A,B,C)
  \tkzDrawPolygon[color=red](A',B',C')
  \tkzDrawPoints[color=blue](A,B,C)
  \tkzDrawPoints[color=red](A',B',C')
  \tkzLabelPoints(A,B,A',B')
  \tkzLabelPoints[above](C,C')
  \tkzDrawSegments[color = gray,->,%
     style=dashed](A,A' B,B' C,C')
\end{tikzpicture}
```