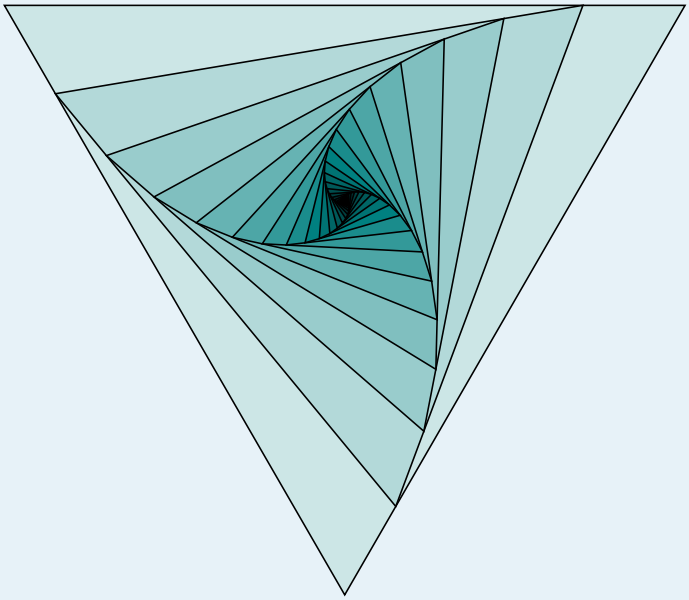
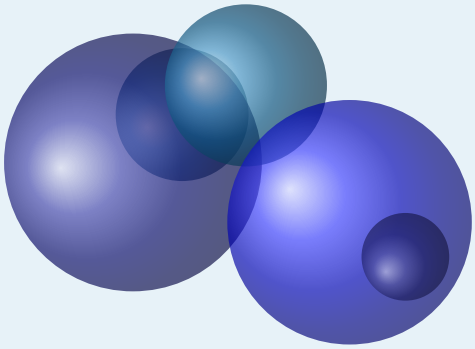
tkz-euclide 3.02c

AlterMundus





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February 6, 2020 Documentation V.3.02c

http://altermundus.fr

tkz-euclide

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☞ The **tkz-euclide** is a set of convenient macros for drawing in a plane (fundamental two-dimensional object) with a Cartesian coordinate system. It handles the more classic situations in Euclidean Geometry. **tkz-euclide** is built on top of PGF and its associated front-end TikZ and is a (La)TeX-friendly drawing package. The aim is to provide a high-level user interface to build graphics relatively simply. It uses a Cartesian coordinate system orthogonal provided by the **tkz-base** package as well as tools to define the unique coordinates of points and to manipulate them. The idea is to allow you to follow step by step a construction that would be done by hand as naturally as possible.
Now the package needs the version 3.0 of TikZ. English is not my native language so there might be some errors.

☞ Firstly, I would like to thank **Till Tantau** for the beautiful LATEX package, namely TikZ.

☞ I received much valuable advices, remarks, corrections and examples from **Jean-Côme Charpentier** , **Josselin Noirel**, **Manuel Pégourié-Gonnard**, **Franck Pastor** , **David Arnold**, **Ulrike Fischer**,**Stefan Kottwitz Christian Tellechea**, **Nicolas Kisselhoff**,**David Arnold**, **Wolfgang Büchel**, **John Kitzmiller**,**Dimitri Kapetas**,**Gaétan Marris**,**Mark Wibrow**, **Yve Combe** for his work on protractor, **Dimitri Kapetas**, **Gaétan Marris** and **Paul Gaborit** .

☞ I would also like to thank Eric Weisstein, Creator of MathWorld : MathWorld

☞ You can find some examples on my site : altermundus.fr under construction !

Contents

1 Presentation and Overview

1.1 Why tkz-euclide ?

My initial goal was to provide myself and other mathematics teachers with a tool to quickly create Euclidean geometry figures without investing too much effort in learning a new programming language. Of course, tkz-euclide is for math teachers who use latex and makes it possible to easily create correct drawings by means of LaTeX.

It appeared that the simplest method was to reproduce the one used to obtain construction by hand. To describe a construction, you must of course define the objects but also the actions that you perform. It seemed to me that a syntax close to the language of mathematicians and their students would be more easily understandable; moreover, it also seemed to me that this syntax should be close to that of LaTeX. The objects of course are points, segments, lines, triangles, polygons and circles. As for actions, I considered five to be sufficient, namely: define, create, draw, mark and label.

The syntax is perhaps too verbose but it is, I believe, easily accessible. As a result, the students like teachers were able to easily access this tool

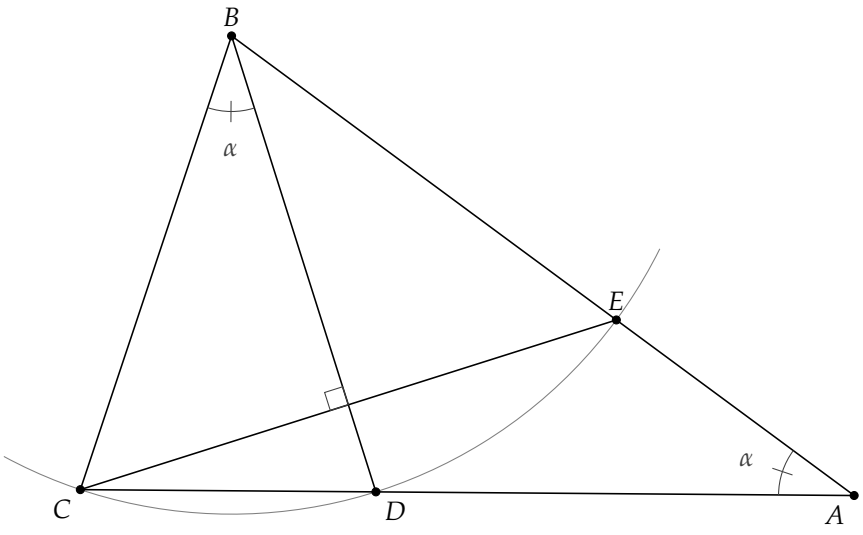
1.2 tkz-euclide vs TikZ

I love programming with TikZ and without TikZ I would never have had the idea to create tkz-euclide but never forget that behind it there is TikZ and that it is always possible to insert code from TikZ. tkz-euclide doesn't prevent you from using TikZ. That said, I don't think mixing syntax is a good thing.

There is no need to compare TikZ and tkz-euclide. The latter is not addressed to the same audience as Tikz. The first one allows you to do a lot of things, the second one only does geometry drawings. The first one can do everything the second one does, but the second one will more easily do what you want.

1.3 How it works

1.3.1 Example Part I gold triangle



Let's analyze the figure

1. CBD and DBE are isosceles triangles; BC=BE and BD is a bisector of the angle CBE.From this we deduce that the CBD and DBE angles are equal and have the same measure α.

$$\widehat{BAC} + \widehat{ABC} + \widehat{BCA} = 180°\text{in the triangle}BAC$$

$$3\alpha + \widehat{BCA} = 180° \text{in the triangle} CBD$$

then

$$\alpha + 2\widehat{BCA} = 180°$$

soit

$$\widehat{BCA} = 90° - \alpha/2$$

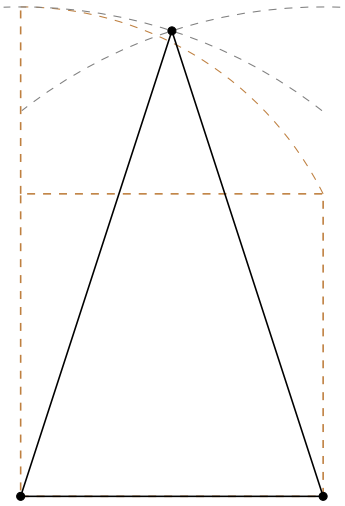
finally

$$\widehat{CBD} = \alpha = 36°$$

the triangle CBD is a "gold" triangle

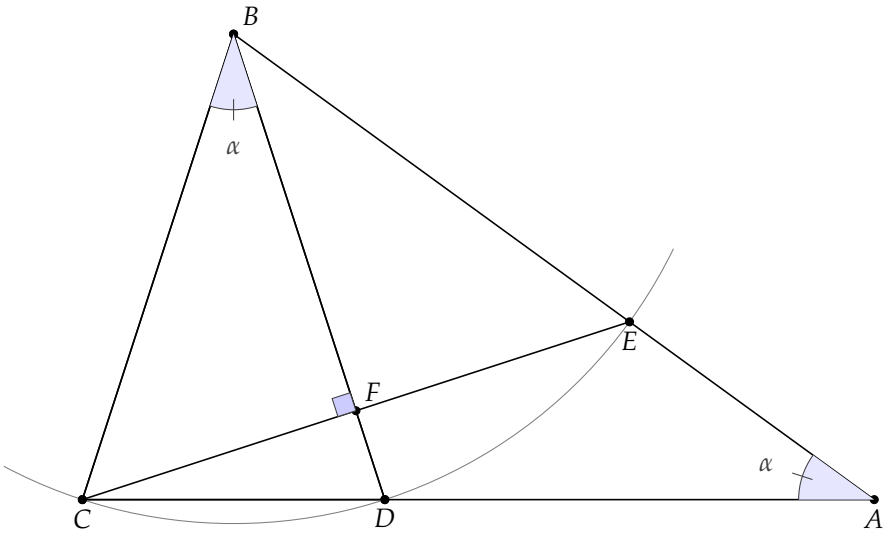
How construct a gold triangle or an angle of 36° ?

- ☞ We place the fixed points *C* and *D*.`\tkzDefPoint(0,0){C}` and `\tkzDefPoint(4,0){D}`.
- ☞ We construct a square *CDef* and we construct the midpoint *m* of *Cf*. We can do all of this with a compass and a rule.
- ☞ Then we trace an arc with center m through e. This arc cross the line *Cf* at *n*
- ☞ Now the two arcs with center *C* et *D* and radius *Cn* define the point *B*.



```
\begin{tikzpicture}
\tkzDefPoint(0,0){C}
\tkzDefPoint(4,0){D}
\tkzDefSquare(C,D)
\tkzGetPoints{e}{f}
\tkzDefMidPoint(C,f)
\tkzGetPoint{m}
\tkzInterLC(C,f)(m,e)
\tkzGetSecondPoint{n}
\tkzInterCC[with nodes](C,C,n)(D,C,n)
\tkzGetFirstPoint{B}
\tkzDrawSegment[brown,dashed](f,n)
\pgfinterruptboundingbox
\tkzDrawPolygon[brown,dashed](C,D,e,f)
\tkzDrawArc[brown,dashed](m,e)(n)
\tkzCompass[brown,dashed,delta=20](C,B)
\tkzCompass[brown,dashed,delta=20](D,B)
\endpgfinterruptboundingbox
\tkzDrawPoints(C,D,B)
\tkzDrawPolygon(B,...,D)
\end{tikzpicture}
```

After building the golden triangle *BCD*, we build the point *A* by noticing that $BD = DA$. Then we get the point *E* and finally the point *F*. This is done with already intersections of defined objects (line and circle).




```
\begin{tikzpicture}
  \tkzDefPoint(0,0){C}
  \tkzDefPoint(4,0){D}
  \tkzDefSquare(C,D)
  \tkzGetPoints{e}{f}
  \tkzDefMidPoint(C,f)
  \tkzGetPoint{m}
  \tkzInterLC(C,f)(m,e)
  \tkzGetSecondPoint{n}
  \tkzInterCC[with nodes](C,C,n)(D,C,n)
  \tkzGetFirstPoint{B}
  \tkzInterLC(C,D)(D,B) \tkzGetSecondPoint{A}
  \tkzInterLC(B,A)(B,D) \tkzGetSecondPoint{E}
  \tkzInterLL(B,D)(C,E) \tkzGetPoint{F}
  \tkzDrawPoints(C,D,B)
  \tkzDrawPolygon(B,...,D)
  \tkzDrawPolygon(B,C,D)
  \tkzDrawSegments(D,A A,B C,E)
  \tkzDrawArc[delta=10](B,C)(E)
  \tkzDrawPoints(A,...,F)
  \tkzMarkRightAngle[fill=blue!20](B,F,C)
  \tkzFillAngles[fill=blue!10](C,B,D E,A,D)
  \tkzMarkAngles(C,B,D E,A,D)
  \tkzLabelAngles[pos=1.5](C,B,D E,A,D){$\alpha$}
  \tkzLabelPoints[below](A,C,D,E)
  \tkzLabelPoints[above right](B,F)
\end{tikzpicture}
```

1.3.2 Example Part II two others methods gold and euclide triangle

tkz-euclide knows how to define a "gold" or "euclide" triangle. We can define BCD and BCA comme des triangles d'or

```
\begin{tikzpicture}
  \tkzDefPoint(0,0){C}
  \tkzDefPoint(4,0){D}
  \tkzDefTriangle[gold](C,D)
```

```
    \tkzGetPoint{B}
    \tkzDefTriangle[gold](B,C)
    \tkzGetPoint{A}
    \tkzInterLC(B,A)(B,D) \tkzGetSecondPoint{E}
    \tkzInterLL(B,D)(C,E) \tkzGetPoint{F}
    \tkzDrawPoints(C,D,B)
    \tkzDrawPolygon(B,...,D)
    \tkzDrawPolygon(B,C,D)
    \tkzDrawSegments(D,A A,B C,E)
    \tkzDrawArc[delta=10](B,C)(E)
    \tkzDrawPoints(A,...,F)
    \tkzMarkRightAngle[fill=blue!20](B,F,C)
    \tkzFillAngles[fill=blue!10](C,B,D E,A,D)
    \tkzMarkAngles(C,B,D E,A,D)
    \tkzLabelAngles[pos=1.5](C,B,D E,A,D){$\alpha$}
    \tkzLabelPoints[below](A,C,D,E)
    \tkzLabelPoints[above right](B,F)
  \end{tikzpicture}
```

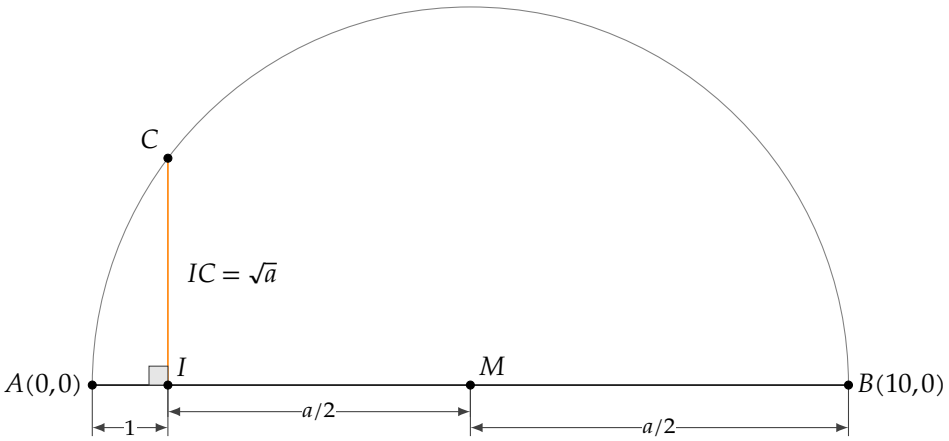
Voici une dernière méthode qui utilise des rotations

```
\begin{tikzpicture}
\tkzDefPoint(0,0){C} % possible
% \tkzDefPoint[label=below:$C$](0,0){C}
% but don't do this
\tkzDefPoint(2,6){B}
% We get D and E with a rotation
\tkzDefPointBy[rotation= center B angle 36](C) \tkzGetPoint{D}
\tkzDefPointBy[rotation= center B angle 72](C) \tkzGetPoint{E}
% To get A we use an intersection of lines
\tkzInterLL(B,E)(C,D) \tkzGetPoint{A}
\tkzInterLL(C,E)(B,D) \tkzGetPoint{H}
% drawing
\tkzDrawArc[delta=10](B,C)(E)
\tkzDrawPolygon(C,B,D)
\tkzDrawSegments(D,A B,A C,E)
% angles
\tkzMarkAngles(C,B,D E,A,D) %this is to draw the arcs
\tkzLabelAngles[pos=1.5](C,B,D E,A,D){$\alpha$}
\tkzMarkRightAngle(B,H,C)
\tkzDrawPoints(A,...,E)
% Label only now
\tkzLabelPoints[below left](C,A)
\tkzLabelPoints[below right](D)
\tkzLabelPoints[above](B,E)
\end{tikzpicture}
```

1.3.3 Complete but minimal example

A unit of length being chosen, the example shows how to obtain a segment of length $\sqrt{a}$ from a segment of length a, using a ruler and a compass.

$IB = a$, $AI = 1$



Commentaires

☞ The Preamble

Let us first look at the preamble. If you need it, you have to load **xcolor** before **tkz-euclide**, that is, before TikZ . TikZ may cause problems with the active characters , but... provides a library in its latest version that's supposed to solve these problems babel.

```
\documentclass{standalone} % or another class
   % \usepackage{xcolor} % before tikz or tkz-euclide if necessary
\usepackage{tkz-euclide} % no need to load TikZ
   % \usetkzobj{all}  is no longer necessary
   % \usetikzlibrary{babel}  if there are problems with the active characters
```

The following code consists of several parts:

☞ Definition of fixed points: the first part includes the definitions of the points necessary for the construction, these are the fixed points. The macros **\tkkzInit** and **\tkkzClip** in most cases are not necessary.

```
\tkzDefPoint(0,0){O}
\tkzDefPoint(1,0){I}
\tkzDefPoint(10,0){B}
```

☞ The second part is dedicated to the creation of new points from the fixed points; a B point is placed at $10cm$ from A. The middle of $[AB]$ is defined by M and then the orthogonal line to the (AB) line is searched for at the I point. Then we look for the intersection of this line with the semi-circle of center M passing through A.

```
\tkzDefPointBy[homothety=center A ratio  10 ](I)
   \tkzGetPoint{B}
\tkzDefMidPoint(A,B)
   \tkzGetPoint{M}
\tkzDefPointWith[orthogonal](I,M)
   \tkzGetPoint{H}
\tkzInterLC(I,H)(M,A)
   \tkzGetSecondPoint{B}
```

☞ The third one includes the different drawings;

```
\tkzDrawSegment[style=dashed](I,H)
\tkzDrawPoints(O,I,A,B,M)
\tkzDrawArc(M,A)(O)
\tkzDrawSegment[dim={$1$,-16pt,}](O,I)   % voir la documentation pour l'usage de dim
\tkzDrawSegment[dim={$a/2$,-10pt,}](I,M)
\tkzDrawSegment[dim={$a/2$,-16pt,}](M,A)
```

☞ Marking: the fourth is devoted to marking;

```
\tkzMarkRightAngle(A,I,B)
```

☞ Labelling: the latter only deals with the placement of labels.

```
\tkzLabelPoint[left](O){$A(0,0)$}
\tkzLabelPoint[right](A){$B(10,0)$}
\tkzLabelSegment[right=4pt](I,B){$\sqrt{a^2}=a \ (a>0)$}
```

☞ The full code:

```
\begin{tikzpicture}[scale=1,ra/.style={fill=gray!20}]
   % fixed points
   \tkzDefPoint(0,0){A}
   \tkzDefPoint(1,0){I}
   % calculation
   \tkzDefPointBy[homothety=center A ratio  10 ](I) \tkzGetPoint{B}
   \tkzDefMidPoint(A,B)              \tkzGetPoint{M}
   \tkzDefPointWith[orthogonal](I,M) \tkzGetPoint{i}
   \tkzInterLC(I,i)(M,B)             \tkzGetSecondPoint{C}

   \tkzDrawSegment[style=orange](I,C)
   \tkzDrawArc(M,B)(A)
   \tkzDrawSegment[dim={$1$,-16pt,}](A,I)
   \tkzDrawSegment[dim={$a/2$,-10pt,}](I,M)
   \tkzDrawSegment[dim={$a/2$,-16pt,}](M,B)
   \tkzMarkRightAngle[ra](A,I,C)
   \tkzDrawPoints(I,A,B,C,M)
   \tkzLabelPoint[left](A){$A(0,0)$}
   \tkzLabelPoints[above right](I,M)
   \tkzLabelPoints[above left](C)
   \tkzLabelPoint[right](B){$B(10,0)$}
   \tkzLabelSegment[right=4pt](I,C){$IC=\sqrt{a}$}
\end{tikzpicture}
```

1.4 The Elements of tkz code

In this paragraph, we start looking at the "rules" and "symbols" used to create a figure with tkz-euclide.

The primitive objects are points. You can refer to a point at any time using the name given when defining it. (it is possible to assign a different name later on).

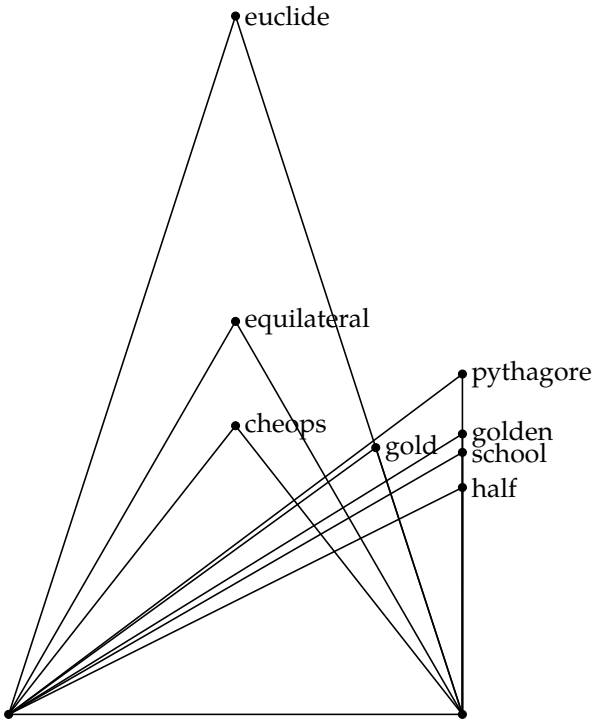
In general, tkz-euclide macros have a name beginning with tkz. There are four main categories starting with : `\tkzDef...` `\tkzDraw...` `\tkzMark...` et `\tkzLabel...`

Among the first category, `\tkzDefPoint` allows you to define fixed points. It will be studied in detail later. Here we will see in detail the macro DefTriangle `\tkzDefTriangle`.

This macro makes it possible to associate to a pair of points a third point in order to define a certain triangle `\tkzDefTriangle(A,B)`. The obtained point is referenced `tkzPointResult` and it is possible to choose another reference with `\tkzGetPoint{C}` for example. Parentheses are used to pass arguments. In `(A,B)` A and B are the points with which a third will be defined.

However, in `{C}` we use braces to retrieve the new point. In order to choose a certain type of triangle among the following choices : `equilateral`, `halftone`, `pythagoras`, `school`, `golden or sublime`, `euclide`, `gold`, `cheops`... and `two angles` you just have to choose between hooks, for example :

```
\tkzDefTriangle[euclide](A,B) \tkzGetPoint{C}
```




```
\begin{tikzpicture}[scale=.75]
\tkzDefPoints{0/0/A,8/0/B}
\foreach \tr in {equilateral,half,pythagore,%
        school,golden,euclide, gold,cheops}
{\tkzDefTriangle[\tr](A,B) \tkzGetPoint{C}
\tkzDrawPoint(C)
\tkzLabelPoint[right](C){\tr}
\tkzDrawSegments(A,C C,B)}
\tkzDrawPoints(A,B)
\tkzDrawSegments(A,B)
\end{tikzpicture}
```

1.5 Conventions

For this documentation, I used the geometric French and personal conventions for naming the points:

- ☞ O is a center for a circle, a rotation, etc.;
- ☞ M defined a midpoint;
- ☞ H defined the foot of an altitude;
- ☞ P' is the image of P by a transformation ;
- ☞ a defined an angle (degree), r the length of a radius, d a length (or dimension);
- ☞ (x_1,y_1) coordinates of the point A_1, (x_A,y_A) coordinates of the point A;
- ☞ $[AB]$ a line segment, (AB) a line.

1.6 How to use the tkz-euclide package ?

1.6.1 Let's look at a classic example

In order to show the right way, we will see how to build an equilateral triangle. Several possibilities are open to us, we are going to follow the steps of Euclid.

- ☞ First of all you have to use a document class. The best choice to test your code is to create a single figure with the class **standalone**.

  ```
  \documentclass{standalone}
  ```

- ☞ Then load the tkz-euclide package:

  ```
  \usepackage{tkz-euclide}
  ```

  You don't need to load TikZ because the tkz-euclide package works on top of TikZ and loads it.

- ☞ ~~\usetkzobjall~~ With the new version 3.02 you don't need this line anymore. All objects are now loaded.

- ☞ Start the document and open a TikZ picture environment:

  ```
  \begin{document}
  \begin{tikzpicture}
  ```

- ☞ Now we define two fixed points:

  ```
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(5,2){B}
  ```

- ☞ Two points define two circles, let's use these circles :

  circle with center A through B and circle with center B through A. These two circles have two points in common.

  ```
  \tkzInterCC(A,B)(B,A)
  ```

  we can get the points of intersection with

  ```
  \tkzGetPoints{C}{D}
  ```

- ☞ All the necessary points are obtained, we can move on to the final steps including the plots.

  ```
  \tkzDrawPolygon(A,B,C)% The triangle
  ```

- ☞ Draw all points A,B,C and D :

  ```
  \tkzDrawPoints(A,...,D)
  ```

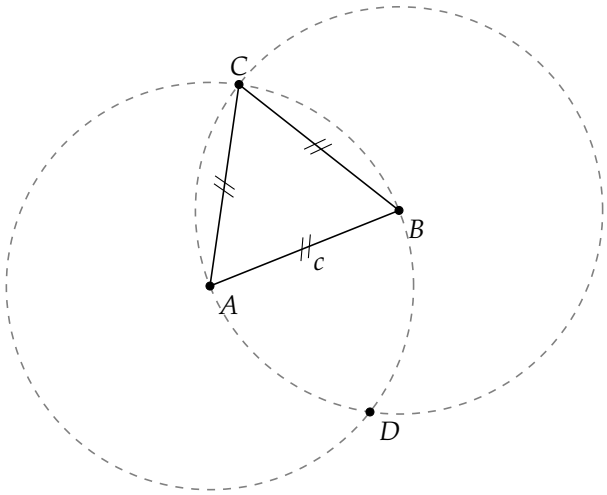
- ☞ The final step, we print labels to the points and use options for positioning:

  ```
  \tkzLabelPoints[below left](A)
  \tkzLabelPoints(B,D)
  \tkzLabelPoint (above] (C){$C$}
  ```

- ☞ We finally close both environments

  ```
  \end{tikzpicture}
  \end{document}
  ```

- ☞ The complete code




```
\begin{tikzpicture}[scale=.5]
  % fixed points
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(5,2){B}
 % calculus
 \tkzInterCC(A,B)(B,A)
 \tkzGetPoints{C}{D}
 % drawings
 \tkzDrawCircles[gray,dashed](A,B B,A)
 \tkzDrawPolygon(A,B,C)
 \tkzDrawPoints(A,...,D)
 % marking
 \tkzMarkSegments[mark=s||](A,B B,C C,A)
 % labelling
 \tkzLabelSegments[swap](A,B){$c$}
 \tkzLabelPoints(A,B,D)
 \tkzLabelPoints[above](C)
\end{tikzpicture}
```

1.6.2 "Set, Calculate, Draw, Mark, Label"

The title could have been : `Separation of Calculus and Drawings`

When a document is prepared using the LaTeX system, the source code of the document can be divided into two parts: the document body and the preamble. Under this methodology, publications can be structured, styled and typeset with minimal effort. I propose a similar methodology for creating figures with tkz-euclide.

The first part defines the fixed points, the second part allows the creation of new points. These are the two main parts. All that is left to do is to draw, mark and label.

2 Installation

tkz-euclide and **tkz-base** are now on the server of the **CTAN**[1]. If you want to test a beta version, just put the following files in a texmf folder that your system can find. You will have to check several points :

- The **tkz-base** and **tkz-euclide** folders must be located on a path recognized by **latex**.
- The **xfp** footnote**xfp** replaces **fp**, **numprint** , **tikz 3.00** must be installed as they are mandatory, for the proper functioning of **tkz-euclide**.
- This documentation and all examples were obtained with **lualatex-dev** but **pdflatex** should be suitable.

2.1 List of folder files tkzbase et tkzeuclide

In the folder **base** :

- **tkz-base.cfg**
- **tkz-base.sty**
- **tkz-lib-marks.tex**
- **tkz-obj-axes.tex**
- **tkz-obj-grids.tex**
- **tkz-obj-marks.tex**
- **tkz-obj-points.tex**
- **tkz-obj-rep.tex**
- **tkz-tools-arith.tex**
- **tkz-tools-base.tex**
- **tkz-tools-BB.tex**
- **tkz-tools-math.tex**
- **tkz-tools-misc.tex**
- **tkz-tools-modules.tex**
- **tkz-tools-print.tex**
- **tkz-tools-text.tex**
- **tkz-tools-utilities.tex**

In the **euclide** :

- **tkz-euclide.sty**
- **tkz-obj-eu-angles.tex**
- **tkz-obj-eu-arcs.tex**
- **tkz-obj-eu-circles.tex**
- **tkz-obj-eu-compass.tex**
- **tkz-obj-eu-draw-circles.tex**
- **tkz-obj-eu-draw-lines.tex**
- **tkz-obj-eu-draw-polygons.tex**

1 tkz-base and tkz-euclide are part of TeXLive and tlmgr allows you to install them. These packages are also part of MikTeX under Windows

- ☞ tkz-obj-eu-lines.tex
- ☞ tkz-obj-eu-points-by.tex
- ☞ tkz-obj-eu-points-rnd.tex
- ☞ tkz-obj-eu-points-with.tex
- ☞ tkz-obj-eu-points.tex
- ☞ tkz-obj-eu-polygons.tex
- ☞ tkz-obj-eu-protractor.tex
- ☞ tkz-obj-eu-sectors.tex

☞ Now **tkz-euclide** loads all the files.

3 News and compatibility

Some changes have been made to make the syntax more homogeneous and especially to distinguish the definition and search for coordinates from the rest, i.e. drawing, marking and labelling. In the future, the definition macros being isolated, it will be easier to introduce a phase of coordinate calculations using **Lua**.

An important novelty is the recent replacement of the **fp** package by **xfp**. This is to improve the calculations a little bit more and to make it easier to use.

Here are some of the changes.

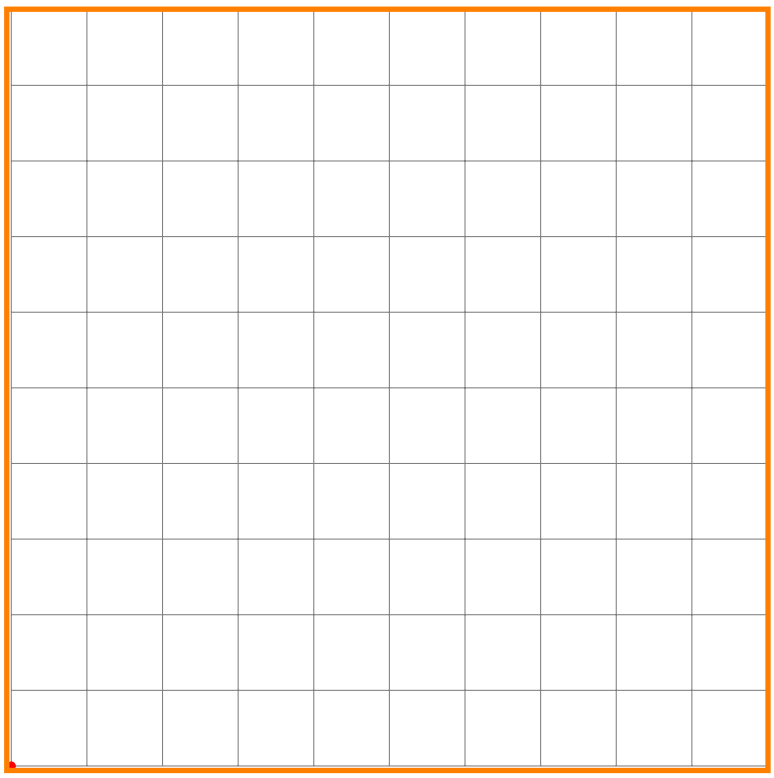
- Improved code and bug fixes.
- With **tkz-euclide** loads all objects, so there's no need to place. **\usetkzobjall**.
- The bounding box is now controlled in each macro (hopefully) to avoid the use of **\tkzInit** followed by **\tkzClip**.
- Added macros for the bounding box: **\tkzSaveBB** **\tkzClipBB** and so on.
- Logically most macros accept TikZ options. So I removed the "duplicate" options when possible; thus the "label options" option is removed.
- Random points are now in **tkz-euclide** and the macro **\tkzGetRandPointOn** is replaced by **\tkzDefRandPointOn**. For homogeneity reasons, the points must be retrieved with **\tkzGetPoint**.
- The options **end** and **start** which allowed to give a label to a straight line are removed. You now have to use the macro **\tkzLabelLine**
- Introduction of the libraries `quotes` and `angles` it allows to give a label to a point, even if I am not in favour of this practice.
- The notion of vector disappears to draw a vector just pass "->" as an option to **\tkzDrawSegment**.
- Many macros still exist, but are obsolete and will disappear:
  - `\tkzDrawMedians` trace and create midpoints on the sides of a triangle. The creation and drawing separation is not respected so it is preferable to first create the coordinates of these points with `\tkzSpcTriangle[median]` and then to choose the ones you are going to draw with `\tkzDrawSegments` or `\tkzDrawLines`.
  - `\tkzDrawMedians(A,B)(C)` is now spelled `\tkzDrawMedians(A,C,B)`. This defines the median from *C*.
  - Another example `\tkzDrawTriangle[equilateral]` was handy but it is better to get the third point with `\tkzDefTriangle[equilateral]` and then draw with `\tkzDrawPolygon`.
  - `\tkzDefRandPointOn` replaced by `\tkzGetRandPointOn`
  - now `\tkzTangent` is `\tkzDefTangent`
  - You can use `global path name` if you want find intersection but it's very slow like in TikZ.
- Appearance of the macro **\usetkztool** which allows to load new "tools".

4 Definition of a point

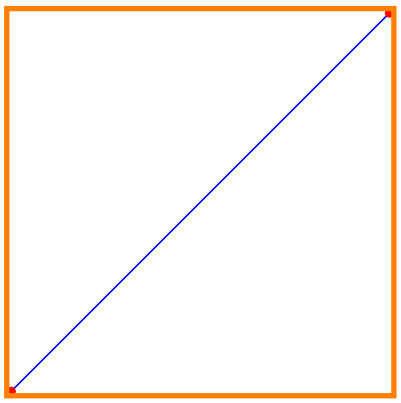
Points can be specified in any of the following ways:

- ☞ Cartesian coordinates
- ☞ Polar coordinates
- ☞ Named points
- ☞ Relative points

Even if it's possible, I think it's a bad idea to work directly with coordinates. Preferable is to use named points. A point is defined if it has a name linked to a unique pair of decimal numbers. Let (x,y) or $(a:d)$ i.e. (x abscissa, y ordinate) or (a angle : d distance). This is possible because the plan has been provided with an orthonormed Cartesian coordinate system. The working axes are supposed to be (ortho)normed with unity equal to $1cm$ or something equivalent like $0.39370\ in$. Now by default if you use a grid or axes, the rectangle used is defined by the coordinate points : $(0,0)$ et $(10,10)$. It's the macro **\tkzInit** of the package **tkz-base** that creates this rectangle. Look at the following two codes and the result of their compilation:



```
\begin{tikzpicture}
 \tkzGrid
 \tkzDefPoint(0,0){O}
 \tkzDrawPoint[red](O)
 \tkzShowBB[line width=2pt,
                    orange]
\end{tikzpicture}
```

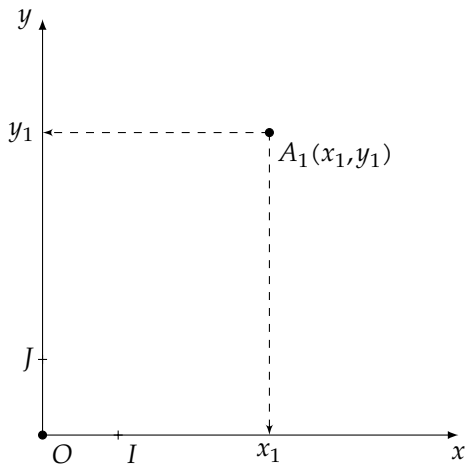


```
\begin{tikzpicture}
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(5,5){A}
 \tkzDrawSegment[blue](O,A)
 \tkzDrawPoints[red](O,A)
 \tkzShowBB[line width=2pt,orange]
\end{tikzpicture}
```

The Cartesian coordinate (a,b) refers to the point a centimeters in the x-direction and b centimeters in the y-direction.

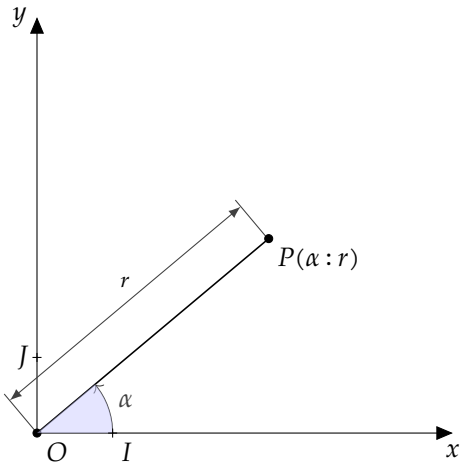
A point in polar coordinates requires an angle α, in degrees, and distance from the origin, d. Unlike Cartesian coordinates, the distance does not have a default dimensional unit, so one must be supplied. The syntax for a point specified in polar coordinates is $(\alpha : r\,dim)$, where dim is a dimensional unit such as `cm`, `pt`, `in`, or any other TEX-based unit. Other than syntax and the required dimensional unit, this follows usual mathematical usage.

Cartesian coordinates




```
\begin{tikzpicture}[scale=1]
  \tkzInit[xmax=5,ymax=5]
  \tkzDefPoints{0/0/O,1/0/I,0/1/J}
  \tkzDrawXY[noticks,>=latex]
  \tkzDefPoint(3,4){A}
  \tkzDrawPoints(O,A)
  \tkzLabelPoint(A){$A_1 (x_1,y_1)$}
  \tkzShowPointCoord[xlabel=$x_1$,ylabel=$y_1$](A)
  \tkzLabelPoints(O,I)
  \tkzLabelPoints[left](J)
  \tkzDrawPoints[shape=cross](I,J)
\end{tikzpicture}
```

Polar coordinates




```
\begin{tikzpicture}[,scale=1]
  \tkzInit[xmax=5,ymax=5]
  \tkzDefPoints{0/0/O,1/0/I,0/1/J}
  \tkzDefPoint(40:4){P}
  \tkzDrawXY[noticks,>=triangle 45]
  \tkzDrawSegment[dim={$r$,
                 16pt,above=6pt}](O,P)
  \tkzDrawPoints(O,P)
  \tkzMarkAngle[mark=none,->](I,O,P)
  \tkzFillAngle[fill=blue!20,
                opacity=.5](I,O,P)
  \tkzLabelAngle[pos=1.25](I,O,P){$\alpha$}
  \tkzLabelPoint(P){$P  (\alpha : r )$}
  \tkzDrawPoints[shape=cross](I,J)
  \tkzLabelPoints(O,I)
  \tkzLabelPoints[left](J)
\end{tikzpicture}
```

The **\tkzDefPoint** macro is used to define a point by assigning coordinates to it. This macro is based on **\coordinate**, a macro of TikZ . It can use TikZ-specific options such as `shift`. If calculations are required then the **xfp** package is chosen. We can use Cartesian or polar coordinates.

4.1 Defining a named point \tkzDefPoint

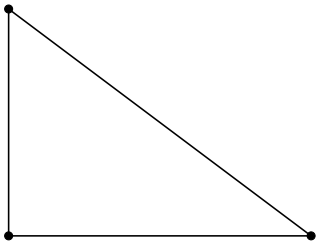
\tkzDefPoint[⟨local options⟩](⟨x,y⟩){⟨name⟩} ou (⟨a:r⟩){⟨name⟩}

arguments	défaut	définition
(x,y)	no default	x et y sont deux dimensions, par défaut en cm.
(a:d)	no default	a est un angle en degré, d une dimension
{name}	no default	Nom attribué au point : A, T_a ,$P1$ etc ...

Les arguments obligatoires de cette macro sont deux dimensions exprimées avec des décimaux, dans le premier cas ce sont deux mesures de longueur, dans le second ce sont une mesure de longueur et la mesure d'un angle en degré

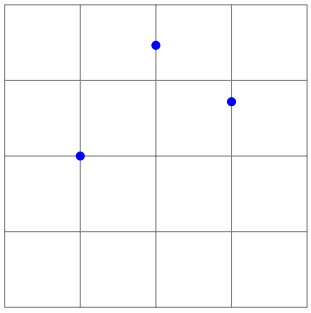
options	default	definition
label	no default	permet de placer un label à une distance prédéfinie
shift	no default	Ajoute (x,y) ou (a:d) à toutes les coordonnées

4.1.1 Cartesian coordinates



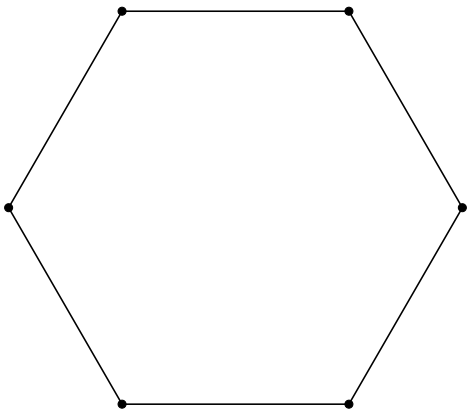
```
\begin{tikzpicture}
\tkzInit[xmax=5,ymax=5]
\tkzDefPoint(0,0){A}
\tkzDefPoint(4,0){B}
\tkzDefPoint(0,3){C}
\tkzDrawPolygon(A,B,C)
\tkzDrawPoints(A,B,C)
\end{tikzpicture}
```

4.1.2 Calculations with xfp



```
\begin{tikzpicture}[scale=1]
  \tkzInit[xmax=4,ymax=4]
  \tkzGrid
  \tkzDefPoint(-1+2,sqrt(4)){O}
  \tkzDefPoint({3*ln(exp(1))},{exp(1)}){A}
  \tkzDefPoint({4*sin(pi/6)},{4*cos(pi/6)}){B}
  \tkzDrawPoints[color=blue](O,B,A)
\end{tikzpicture}
```

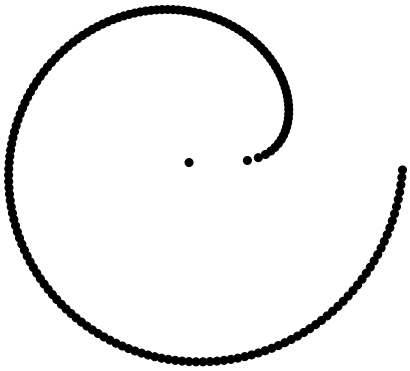
4.1.3 Polar coordinates



```
\begin{tikzpicture}
\foreach \an [count=\i] in {0,60,...,300}
 { \tkzDefPoint(\an:3){A_\i}}
\tkzDrawPolygon(A_1,A_...,A_6)
\tkzDrawPoints(A_1,A_...,A_6)
\end{tikzpicture}
```

4.1.4 Calculations and coordinates

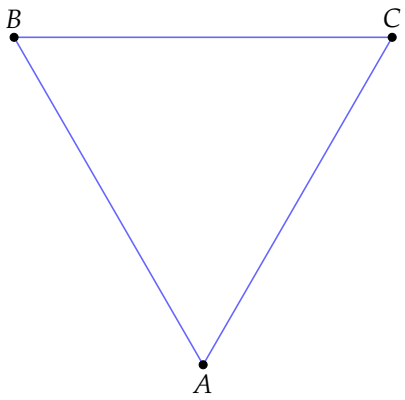
You must follow the syntax of **fxp** here. It is always possible to go through **pgfmath** but in this case, the coordinates must be calculated before using the macro **\tkzDefPoint**.



```
\begin{tikzpicture}[scale=.5]
\foreach \an [count=\i] in {0,2,...,358}
 { \tkzDefPoint(\an:sqrt(sqrt(\an mm))){A_\i}}
 \tkzDrawPoints(A_1,A_...,A_180)
\end{tikzpicture}
```

4.1.5 Relative points

First, we can use the **scope** environment from TikZ .. In the following example, we have a way to define an equilateral triangle.




```
\begin{tikzpicture}[scale=1]
  \tkzSetUpLine[color=blue!60]
 \begin{scope}[rotate=30]
  \tkzDefPoint(2,3){A}
  \begin{scope}[shift=(A)]
     \tkzDefPoint(90:5){B}
     \tkzDefPoint(30:5){C}
  \end{scope}
 \end{scope}
 \tkzDrawPolygon(A,B,C)
\tkzLabelPoints[above](B,C)
\tkzLabelPoints[below](A)
\tkzDrawPoints(A,B,C)
\end{tikzpicture}
```

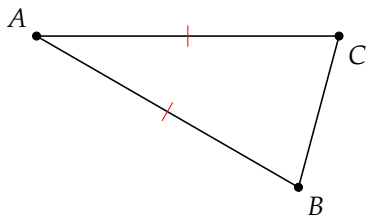
4.2 Point relative to another : \tkzDefShiftPoint

\tkzDefShiftPoint[⟨Point⟩](⟨x,y⟩){⟨name⟩} ou (⟨a:d⟩){⟨name⟩}

arguments	default	definition
(x,y)	no default	x and y are two dimensions, by default in cm.
(a:d)	no default	a is an angle in degrees, d is a dimension
options	**default**	**definition**
[pt]	no default	**\tkzDefShiftPoint**[A](0:4){B}

4.2.1 Isosceles triangle with \tkzDefShiftPoint

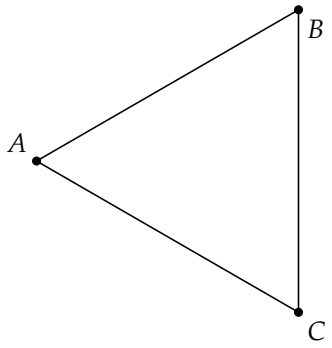
This macro allows you to place one point relative to another. This is equivalent to a translation. Here is how to construct an isosceles triangle with main vertex A and angle at vertex of 30°.




```
\begin{tikzpicture}[rotate=-30]
 \tkzDefPoint(2,3){A}
 \tkzDefShiftPoint[A](0:4){B}
 \tkzDefShiftPoint[A](30:4){C}
 \tkzDrawSegments(A,B B,C C,A)
 \tkzMarkSegments[mark=|,
           color=red](A,B A,C)
 \tkzDrawPoints(A,B,C)
 \tkzLabelPoints(B,C)
 \tkzLabelPoints[above left](A)
\end{tikzpicture}
```

4.2.2 Equilateral triangle

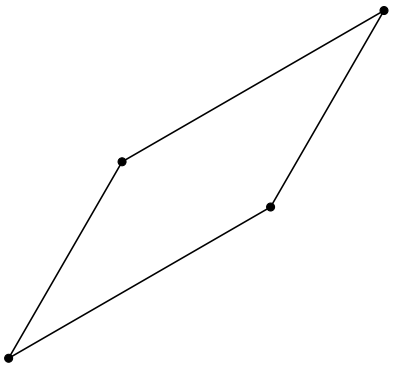
Let's see how to get an equilateral triangle (there is much simpler)




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoint(2,3){A}
 \tkzDefShiftPoint[A](30:4){B}
 \tkzDefShiftPoint[A](-30:4){C}
 \tkzDrawPolygon(A,B,C)
 \tkzDrawPoints(A,B,C)
 \tkzLabelPoints(B,C)
 \tkzLabelPoints[above left](A)
\end{tikzpicture}
```

4.2.3 Parallelogram

There's a simpler way



```
\begin{tikzpicture}
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(60:3){B}
 \tkzDefShiftPointCoord[B](30:4){C}
 \tkzDefShiftPointCoord[A](30:4){D}
 \tkzDrawPolygon(A,...,D)
 \tkzDrawPoints(A,...,D)
\end{tikzpicture}
```

4.3 Definition of multiple points : \tkzDefPoints

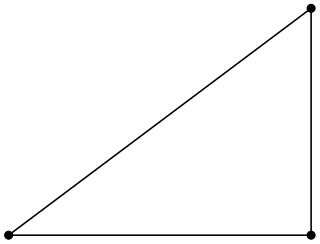
\tkzDefPoints[⟨local options⟩]{⟨$x_1/y_1/n_1$,$x_2/y_2/n_2$, ...⟩}

x_i et y_i are the coordinates of a referenced point n_i

arguments	default	example
$x_i/y_i/n_i$		`\tkzDefPoints{0/0/O,2/2/A}`

options	default	definition
label	no default	allows you to place a label at a predefined distance
shift	no default	Adds (x,y) or (a:d) to all coordinates

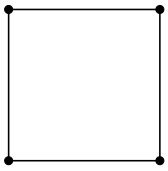
4.4 Create a triangle



```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/A,4/0/B,4/3/C}
 \tkzDrawPolygon(A,B,C)
 \tkzDrawPoints(A,B,C)
\end{tikzpicture}
```

4.5 Create a square

Note here the syntax for drawing the polygon.



```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/A,2/0/B,2/2/C,0/2/D}
 \tkzDrawPolygon(A,...,D)
 \tkzDrawPoints(A,B,C,D)
\end{tikzpicture}
```

5 Special points

The introduction of the dots was done in **tkz-base**, the most important macro being **\tkzDefPoint**. Here are some special points.

5.1 Middle of a segment \tkzDefMidPoint

It is a question of determining the middle of a segment.

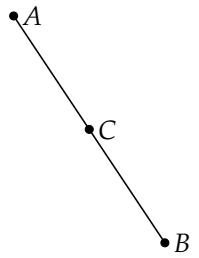
\tkzDefMidPoint(⟨pt1,pt2⟩)

The result is in **tkzPointResult**. We can access it with **\tkzGetPoint**.

arguments	default	definition
(pt1,pt2)	no default	pt1 and pt2 are two points

5.1.1 Use of \tkzDefMidPoint

Review the use of **\tkzDefPoint** in .




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoint(2,3){A}
 \tkzDefPoint(4,0){B}
 \tkzDefMidPoint(A,B) \tkzGetPoint{C}
 \tkzDrawSegment(A,B)
 \tkzDrawPoints(A,B,C)
 \tkzLabelPoints[right](A,B,C)
\end{tikzpicture}
```

5.2 Barycentric coordinates

pt_1, pt_2, ..., pt_n being n points, they define n vectors $\overrightarrow{v_1}$, $\overrightarrow{v_2}$, ..., $\overrightarrow{v_n}$ with the origin of the referential as the common endpoint. α_1, α_2, ...α_n is n numbers, the vector obtained by :

$$\frac{\alpha_1\overrightarrow{v_1}+\alpha_2\overrightarrow{v_2}+\cdots+\alpha_n\overrightarrow{v_n}}{\alpha_1+\alpha_2+\cdots+\alpha_n}$$

defines a single point.

\tkzDefBarycentricPoint(⟨pt1=α_1,pt2=α_2,…⟩)

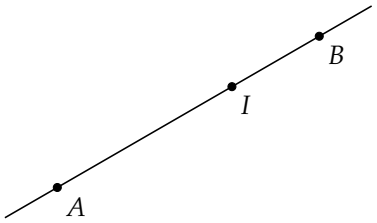
arguments	default	definition
(pt1=α_1,pt2=α_2,…)	no default	Each point has a assigned weight

You need at least two points.

5.2.1 Using \tkzDefBarycentricPoint with two points

In the following example, we obtain the barycentre of points A and B with coefficients 1 and 2, in other words:

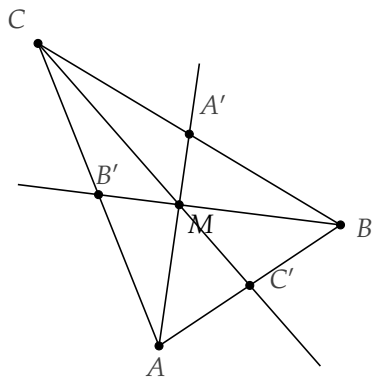
$$\overrightarrow{AI} = \frac{2}{3}\overrightarrow{AB}$$




```
\begin{tikzpicture}
  \tkzDefPoint(2,3){A}
  \tkzDefShiftPointCoord[2,3](30:4){B}
  \tkzDefBarycentricPoint(A=1,B=2)
  \tkzGetPoint{I}
  \tkzDrawPoints(A,B,I)
  \tkzDrawLine(A,B)
  \tkzLabelPoints(A,B,I)
\end{tikzpicture}
```

5.2.2 Using \tkzDefBarycentricPoint with three points

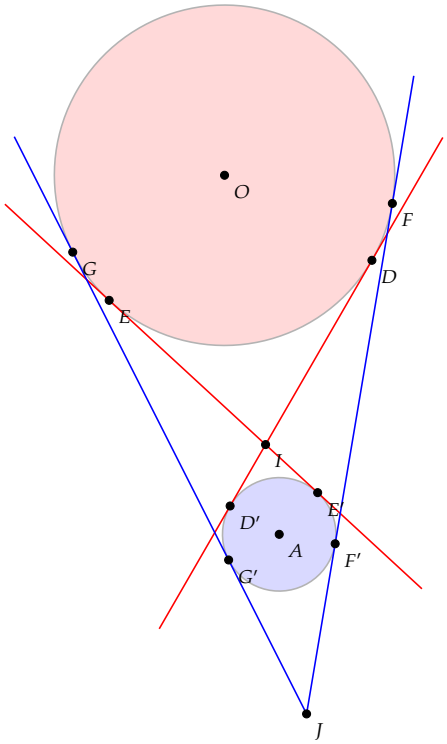
This time M is simply the centre of gravity of the triangle. For reasons of simplification and homogeneity, there is also **\tkzCentroid**




```
\begin{tikzpicture}[scale=.8]
  \tkzDefPoint(2,1){A}
  \tkzDefPoint(5,3){B}
  \tkzDefPoint(0,6){C}
  \tkzDefBarycentricPoint(A=1,B=1,C=1)
  \tkzGetPoint{M}
  \tkzDefMidPoint(A,B)  \tkzGetPoint{C'}
  \tkzDefMidPoint(A,C)  \tkzGetPoint{B'}
  \tkzDefMidPoint(C,B)  \tkzGetPoint{A'}
  \tkzDrawPolygon(A,B,C)
  \tkzDrawPoints(A',B',C')
  \tkzDrawPoints(A,B,C,M)
  \tkzDrawLines[add=0 and 1](A,M B,M C,M)
  \tkzLabelPoint(M){$M$}
  \tkzAutoLabelPoints[center=M](A,B,C)
  \tkzAutoLabelPoints[center=M,above right](A',B',C')
\end{tikzpicture}
```

5.3 Internal Similitude Center

The centres of the two homotheties in which two circles correspond are called external and internal centres of similitude.




```
\begin{tikzpicture}[scale=.75,rotate=-30]
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(4,-5){A}
 \tkzDefIntSimilitudeCenter(O,3)(A,1)
 \tkzGetPoint{I}
 \tkzExtSimilitudeCenter(O,3)(A,1)
 \tkzGetPoint{J}
 \tkzDefTangent[from with R= I](O,3 cm)
 \tkzGetPoints{D}{E}
 \tkzDefTangent[from with R= I](A,1 cm)
 \tkzGetPoints{D'}{E'}
 \tkzDefTangent[from  with R= J](O,3 cm)
 \tkzGetPoints{F}{G}
 \tkzDefTangent[from with R= J](A,1 cm)
 \tkzGetPoints{F'}{G'}
 \tkzDrawCircle[R,fill=red!50,opacity=.3](O,3 cm)
 \tkzDrawCircle[R,fill=blue!50,opacity=.3](A,1 cm)
 \tkzDrawSegments[add = .5 and .5,color=red](D,D' E,E')
 \tkzDrawSegments[add= 0 and 0.25,color=blue](J,F J,G)
 \tkzDrawPoints(O,A,I,J,D,E,F,G,D',E',F',G')
 \tkzLabelPoints[font=\scriptsize](O,A,I,J,D,E,F,G,D',E',F',G')
\end{tikzpicture}
```

6 Special points relating to a triangle

6.1 Triangle center : \tkzDefTriangleCenter

This macro allows you to define the center of a triangle.

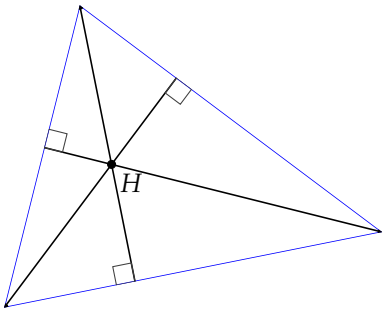
\tkzDefTriangleCenter[⟨local options⟩](⟨A,B,C⟩)

Be careful, the arguments are lists of three points. This macro is used in conjunction with **\tkzGetPoint** to get the center you are looking for. You can use **tkzPointResult** if it is not necessary to keep the results.

arguments	default	definition
(pt1,pt2,pt3)	no default	three points
options	**default**	**definition**
ortho	circum	Intersection of the altitudes of a triangle
centroid	circum	centre of gravity. Intersection of the medians
circum	circum	circle center circumscribed
in	circum	centre du cercle inscrit dans à un triangle
ex	circum	center of a circle exinscribed to a triangle
euler	circum	centre of Euler's circle
symmedian	circum	Lemoine's point or symmedian centre or Grebe's point
spieker	circum	Spieker Circle Center
nagel	circum	Nagel Centre
mittenpunkt	circum	or else MiddlePoint center
feuerbach	circum	Feuerbach Point

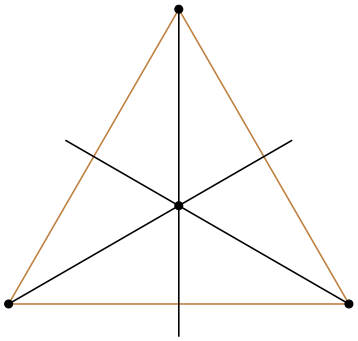
6.1.1 ortho

The intersection H of the three altitudes of a triangle is called the orthocenter.



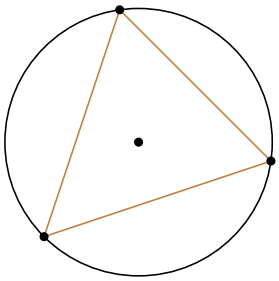

```
\begin{tikzpicture}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(5,1){B}
  \tkzDefPoint(1,4){C}
  \tkzClipPolygon(A,B,C)
  \tkzDefTriangleCenter[ortho](B,C,A)
    \tkzGetPoint{H}
  \tkzDefSpcTriangle[orthic,name=H](A,B,C){a,b,c}
  \tkzDrawPolygon[color=blue](A,B,C)
  \tkzDrawPoints(A,B,C,H)
  \tkzDrawLines[add=0 and 1](A,Ha B,Hb C,Hc)
  \tkzLabelPoint(H){$H$}
  \tkzAutoLabelPoints[center=H](A,B,C)
  \tkzMarkRightAngles(A,Ha,B B,Hb,C C,Hc,A)
\end{tikzpicture}
```

6.1.2 centroid



```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoints{-1/1/A,5/1/B}
  \tkzDefEquilateral(A,B)
  \tkzGetPoint{C}
  \tkzDefTriangleCenter[centroid](A,B,C)
      \tkzGetPoint{G}
  \tkzDrawPolygon[color=brown](A,B,C)
  \tkzDrawPoints(A,B,C,G)
  \tkzDrawLines[add = 0 and 2/3](A,G B,G C,G)
\end{tikzpicture}
```

6.1.3 circum

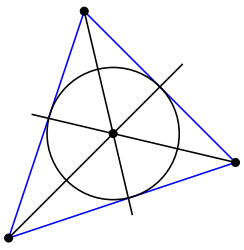


```
\begin{tikzpicture}
 \tkzDefPoints{0/1/A,3/2/B,1/4/C}
 \tkzDefTriangleCenter[circum](A,B,C)
 \tkzGetPoint{G}
 \tkzDrawPolygon[color=brown](A,B,C)
 \tkzDrawCircle(G,A)
 \tkzDrawPoints(A,B,C,G)
\end{tikzpicture}
```

6.1.4 in

In geometry, the incircle or inscribed circle of a triangle is the largest circle contained in the triangle; it touches (is tangent to) the three sides. The center of the incircle is a triangle center called the triangle's incenter. The center of the incircle, called the incenter, can be found as the intersection of the three internal angle bisectors. The center of an excircle is the intersection of the internal bisector of one angle (at vertex A, for example) and the external bisectors of the other two. The center of this excircle is called the excenter relative to the vertex A, or the excenter of A.[3] Because the internal bisector of an angle is perpendicular to its external bisector, it follows that the center of the incircle together with the three excircle centers form an orthocentric system.(https://en.wikipedia.org/wiki/Incircle_and_excircles_of_a_triangle)

We get the centre of the inscribed circle of the triangle. The result is of course in **tkzPointResult**. We can retrieve it with **\tkzGetPoint**.



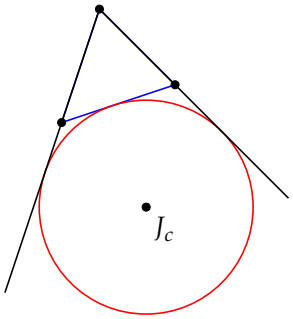
```
\begin{tikzpicture}
  \tkzDefPoints{0/1/A,3/2/B,1/4/C}
  \tkzDefTriangleCenter[in](A,B,C)\tkzGetPoint{I}
  \tkzDefPointBy[projection=onto A--C](I)
  \tkzGetPoint{Ib}
  \tkzDrawPolygon[color=blue](A,B,C)
  \tkzDrawPoints(A,B,C,I)
  \tkzDrawLines[add = 0 and 2/3](A,I B,I C,I)
  \tkzDrawCircle(I,Ib)
\end{tikzpicture}
```

6.1.5 ex

An excircle or escribed circle of the triangle is a circle lying outside the triangle, tangent to one of its sides and tangent to the extensions of the other two. Every triangle has three distinct excircles, each tangent to one

of the triangle's sides. (https://en.wikipedia.org/wiki/Incircle_and_excircles_of_a_triangle)

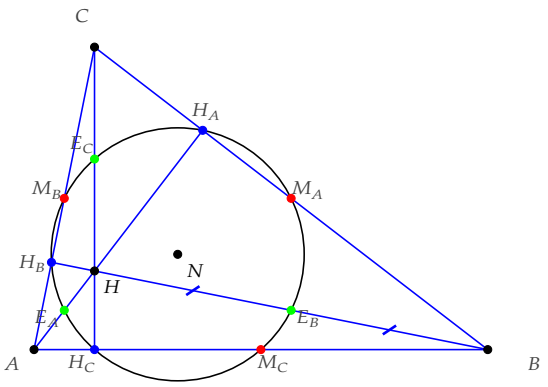
We get the centre of an inscribed circle of the triangle. The result is of course in **tkzPointResult**. We can retrieve it with **\tkzGetPoint**.




```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoints{0/1/A,3/2/B,1/4/C}
  \tkzDefCircle[ex](B,C,A)
  \tkzGetFirstPoint{J_c}
  \tkzGetSecondPoint{Tc}
  \tkzDrawPolygon[color=blue](A,B,C)
  \tkzDrawPoints(A,B,C,J_c)
  \tkzDrawCircle[red](J_c,Tc)
  \tkzDrawLines[add=1.5 and 0](A,C B,C)
  \tkzLabelPoints(J_c)
\end{tikzpicture}
```

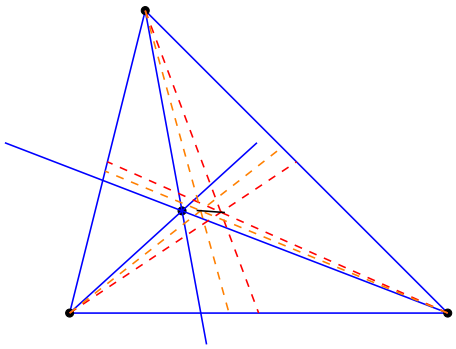
6.1.6 Utilisation de euler

This macro allows to obtain the center of the circle of the nine points or euler's circle or Feuerbach's circle. The nine-point circle, also called Euler's circle or the Feuerbach circle, is the circle that passes through the perpendicular feet H_A, H_B, and H_C dropped from the vertices of any reference triangle ABC on the sides opposite them. Euler showed in 1765 that it also passes through the midpoints M_A, M_B, M_C of the sides of ABC. By Feuerbach's theorem, the nine-point circle also passes through the midpoints E_A, E_B, and E_C of the segments that join the vertices and the orthocenter H. These points are commonly referred to as the Euler points. (http://mathworld.wolfram.com/Nine-PointCircle.html)




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
 \tkzDefSpcTriangle[medial,
     name=M](A,B,C){_A,_B,_C}
 \tkzDefTriangleCenter[euler](A,B,C)
    \tkzGetPoint{N} % I= N nine points
 \tkzDefTriangleCenter[ortho](A,B,C)
    \tkzGetPoint{H}
 \tkzDefMidPoint(A,H) \tkzGetPoint{E_A}
 \tkzDefMidPoint(C,H) \tkzGetPoint{E_C}
 \tkzDefMidPoint(B,H) \tkzGetPoint{E_B}
 \tkzDefSpcTriangle[ortho,name=H](A,B,C){_A,_B,_C}
 \tkzDrawPolygon[color=blue](A,B,C)
 \tkzDrawCircle(N,E_A)
 \tkzDrawSegments[blue](A,H_A B,H_B C,H_C)
 \tkzDrawPoints(A,B,C,N,H)
 \tkzDrawPoints[red](M_A,M_B,M_C)
 \tkzDrawPoints[blue]( H_A,H_B,H_C)
 \tkzDrawPoints[green](E_A,E_B,E_C)
 \tkzAutoLabelPoints[center=N,
  font=\scriptsize](A,B,C,%
   M_A,M_B,M_C,%
   H_A,H_B,H_C,%
   E_A,E_B,E_C)
 \tkzLabelPoints[font=\scriptsize](H,N)
 \tkzMarkSegments[mark=s|,size=3pt,
     color=blue,line width=1pt](B,E_B E_B,H)
\end{tikzpicture}
```

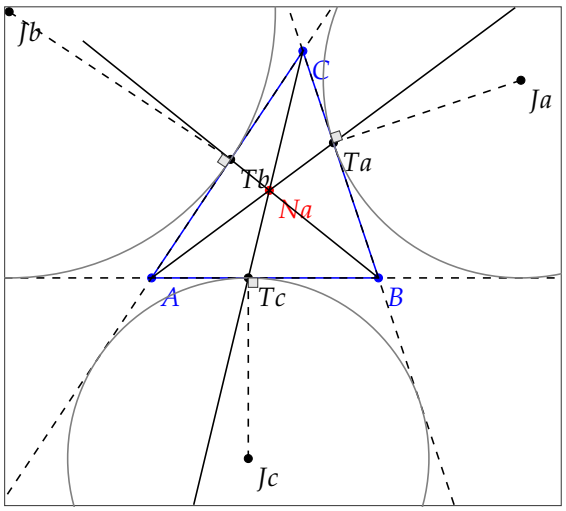
6.1.7 Using option symmedian



```
\begin{tikzpicture}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(5,0){B}
  \tkzDefPoint(1,4){C}
  \tkzDefTriangleCenter[symmedian](A,B,C)\tkzGetPoint{K}
  \tkzDefTriangleCenter[median](A,B,C)\tkzGetPoint{G}
  \tkzDefTriangleCenter[in](A,B,C)\tkzGetPoint{I}
  \tkzDefSpcTriangle[centroid,name=M](A,B,C){a,b,c}
  \tkzDefSpcTriangle[incentral,name=I](A,B,C){a,b,c}
  \tkzDrawPolygon[color=blue](A,B,C)
  \tkzDrawPoints(A,B,C,K)
  \tkzDrawLines[add = 0 and 2/3,blue](A,K B,K C,K)
  \tkzDrawSegments[red,dashed](A,Ma B,Mb C,Mc)
  \tkzDrawSegments[orange,dashed](A,Ia B,Ib C,Ic)
  \tkzDrawLine(G,I)
\end{tikzpicture}
```

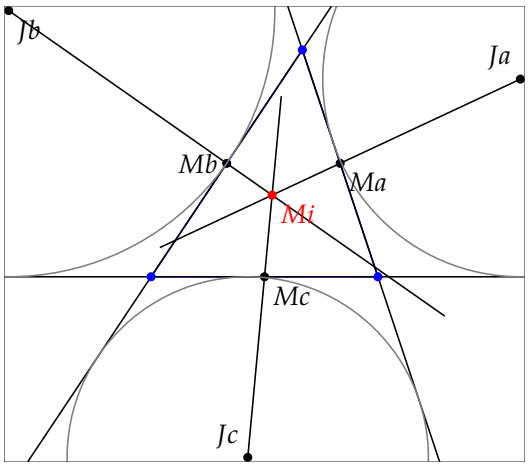
6.1.8 Using option nagel

Let*Ta* be the point at which the *Ja* excircle meets the side BC of a triangle *ABC*, and define Tband Tc similarly. Then the lines *ATa*, *BTb*, and *CTc* concur in the Nagel point *Na*. Weisstein, Eric W. "Nagel point." From MathWorld–A Wolfram Web Resource.




```
\begin{tikzpicture}[scale=.5]
\tkzDefPoints{0/0/A,6/0/B,4/6/C}
\tkzDefSpcTriangle[ex](A,B,C){Ja,Jb,Jc}
\tkzDefSpcTriangle[extouch](A,B,C){Ta,Tb,Tc}
\tkzDrawPoints(Ja,Jb,Jc,Ta,Tb,Tc)
\tkzLabelPoints(Ja,Jb,Jc,Ta,Tb,Tc)
\tkzDrawPolygon[blue](A,B,C)
\tkzDefTriangleCenter[nagel](A,B,C) \tkzGetPoint{Na}
\tkzDrawPoints[blue](B,C,A)
\tkzDrawPoints[red](Na)
\tkzLabelPoints[blue](B,C,A)
\tkzLabelPoints[red](Na)
\tkzDrawLines[add=0 and 1](A,Ta B,Tb C,Tc)
\tkzShowBB\tkzClipBB
\tkzDrawLines[add=1 and 1,dashed](A,B B,C C,A)
\tkzDrawCircles[ex,gray](A,B,C C,A,B B,C,A)
\tkzDrawSegments[dashed](Ja,Ta Jb,Tb Jc,Tc)
\tkzMarkRightAngles[fill=gray!20](Ja,Ta,C Jb,Tb,A Jc,Tc,B)
\end{tikzpicture}
```

6.1.9 Option Triangle "mittenpunkt"




```
\begin{tikzpicture}[scale=.5]
 \tkzDefPoints{0/0/A,6/0/B,4/6/C}
 \tkzDefSpcTriangle[centroid](A,B,C){Ma,Mb,Mc}
 \tkzDefSpcTriangle[ex](A,B,C){Ja,Jb,Jc}
 \tkzDefSpcTriangle[extouch](A,B,C){Ta,Tb,Tc}
 \tkzDefTriangleCenter[mittenpunkt](A,B,C)
 \tkzGetPoint{Mi}
 \tkzDrawPoints(Ma,Mb,Mc,Ja,Jb,Jc)
 \tkzClipBB
 \tkzDrawPolygon[blue](A,B,C)
 \tkzDrawLines[add=0 and 1](Ja,Ma
                Jb,Mb Jc,Mc)
 \tkzDrawLines[add=1 and 1](A,B A,C B,C)
 \tkzDrawCircles[gray](Ja,Ta Jb,Tb Jc,Tc)
 \tkzDrawPoints[blue](B,C,A)
 \tkzDrawPoints[red](Mi)
 \tkzLabelPoints[red](Mi)
 \tkzLabelPoints[left](Mb)
 \tkzLabelPoints(Ma,Mc,Jb,Jc)
 \tkzLabelPoints[above left](Ja,Jc)
 \tkzShowBB
\end{tikzpicture}
```

7 Draw a point

7.0.1 Drawing points \tkzDrawPoint

\tkzDrawPoint[⟨local options⟩](⟨name⟩)

arguments	default	definition
name of point	no default	Only one point name is accepted

The argument is required. The disc takes the color of the circle, but lighter. It is possible to change everything. The point is a node and therefore it is invariant if the drawing is modified by scaling.

options	default	definition
shape	circle	Possible **cross** ou **cross out**
size	6	6× \pgflinewidth
color	black	the default color can be changed

We can create other forms such as **cross**

7.0.2 Example of point drawings

Note that **scale** does not affect the shape of the dots. Which is normal. Most of the time, we are satisfied with a single point shape that we can define from the beginning, either with a macro or by modifying a configuration file.

```
\begin{tikzpicture}[scale=.5]
 \tkzDefPoint(1,3){A}
 \tkzDefPoint(4,1){B}
 \tkzDefPoint(0,0){O}
 \tkzDrawPoint[color=red](A)
 \tkzDrawPoint[fill=blue!20,draw=blue](B)
 \tkzDrawPoint[color=green](O)
\end{tikzpicture}
```

It is possible to draw several points at once but this macro is a little slower than the previous one. Moreover, we have to make do with the same options for all the points.

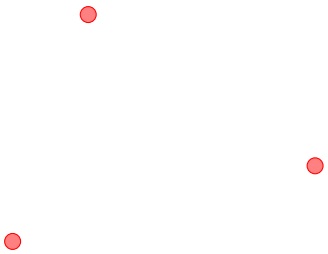
\tkzDrawPoints[⟨local options⟩](⟨liste⟩)

arguments	default	definition
points list	no default	example **\tkzDrawPoints(A,B,C)**

options	default	definition
shape	circle	Possible **cross** ou **cross out**
size	6	6× \pgflinewidth
color	black	the default color can be changed

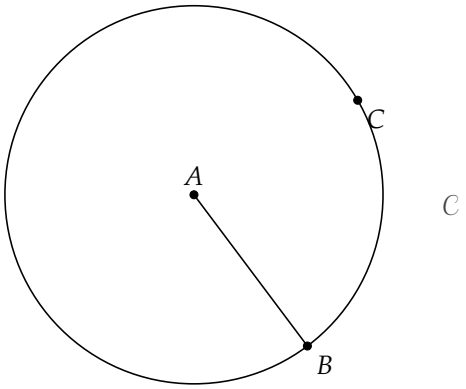
Beware of the final "s", an oversight leads to cascading errors if you try to draw multiple points. The options are the same as for the previous macro.

7.0.3 First example



```
\begin{tikzpicture}
  \tkzDefPoint(1,3){A}
  \tkzDefPoint(4,1){B}
  \tkzDefPoint(0,0){C}
  \tkzDrawPoints[size=6,color=red,
                 fill=red!50](A,B,C)
\end{tikzpicture}
```

7.0.4 Second example




```
\begin{tikzpicture}[scale=.5]
 \tkzDefPoint(2,3){A}  \tkzDefPoint(5,-1){B}
 \tkzDefPoint[label=below:$\mathcal{C}$,
                shift={(2,3)}](-30:5.5){E}
 \begin{scope}[shift=(A)]
    \tkzDefPoint(30:5){C}
 \end{scope}
 \tkzCalcLength[cm](A,B)\tkzGetLength{rAB}
 \tkzDrawCircle[R](A,\rAB cm)
 \tkzDrawSegment(A,B)
 \tkzDrawPoints(A,B,C)
 \tkzLabelPoints(B,C)
 \tkzLabelPoints[above](A)
\end{tikzpicture}
```

8 Point on line or circle

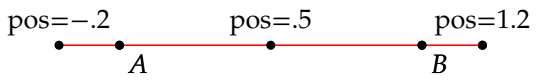
8.1 Point on a line

`\tkzDefPointOnLine[⟨local options⟩](⟨A,B⟩)`

arguments	default	definition
pt1,pt2	no default	Two points to define a line

options	default	definition
pos=nb		nb is a decimal

8.1.1 Use of option pos 1



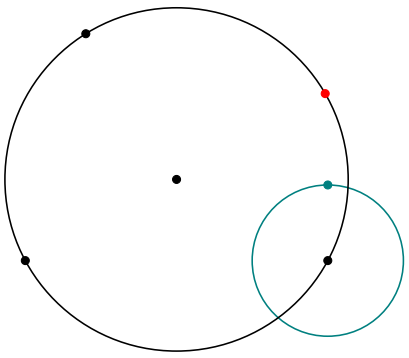

```
\begin{tikzpicture}
\tkzDefPoints{0/0/A,4/0/B}
\tkzDrawLine[red](A,B)
\tkzDefPointOnLine[pos=1.2](A,B)
\tkzGetPoint{P}
\tkzDefPointOnLine[pos=-0.2](A,B)
\tkzGetPoint{R}
\tkzDefPointOnLine[pos=0.5](A,B)
\tkzGetPoint{S}
\tkzDrawPoints(A,B,P)
\tkzLabelPoints(A,B)
\tkzLabelPoint[above](P){pos=$1.2$}
\tkzLabelPoint[above](R){pos=$-.2$}
\tkzLabelPoint[above](S){pos=$.5$}
\tkzDrawPoints(A,B,P,R,S)
\tkzLabelPoints(A,B)
\end{tikzpicture}
```

8.2 Point on a circle

\tkzDefPointOnCircle[⟨local options⟩](⟨A,B⟩)

arguments	default	definition
pt1,pt2	no default	Two points to define a line

options	default	definition
angle	0	angle formed with the abscissa axis
center	tkzPointResult	circle center
radius	142.26321pt	radius circle



```
\begin{tikzpicture}
  \tkzDefPoints{0/0/A,4/0/B,0.8/3/C}
  \tkzDefPointOnCircle[angle=90,center=B,
      radius=1 cm]
  \tkzGetPoint{I}
  \tkzDrawCircle[R,teal](B,1cm)
   \tkzDrawPoint[teal](I)
  \tkzDefCircle[circum](A,B,C)
  \tkzGetPoint{G} \tkzGetLength{rG}
  \tkzDefPointOnCircle[angle=30,center=G,
  radius=\rG pt]
 \tkzGetPoint{J}
  \tkzDrawPoints(A,B,C)
  \tkzDrawCircle(G,J)
  \tkzDrawPoint(G)
  \tkzDrawPoint[red](J)
\end{tikzpicture}
```

9 Definition of points by transformation; \tkzDefPointBy

These transformations are:

1. the translation;
2. l'homothety;
3. orthogonal reflection or symmetry;
4. central symmetry;
5. orthogonal projection;
6. rotation (degrees or radians);
7. inversion with respect to a circle

The choice of transformations is made through the options. There are two macros, one for the transformation of a single point **\tkzDefPointBy** and the other for the transformation of a list of points **\tkzDefPointsBy**. By default the image of A is A'. For example, we'll write :

```
\tkzDefPointBy[translation= from A to A'](B) the result is in \tkzname{tkzPointResult}}
```

\tkzDefPointBy[⟨local options⟩](⟨pt⟩)

The argument is a simple existing point and its image is stored in **tkzPointResult**. If you want to keep this point then the macro **\tkzGetPoint{M}** allows you to assign the name **M** to the point.

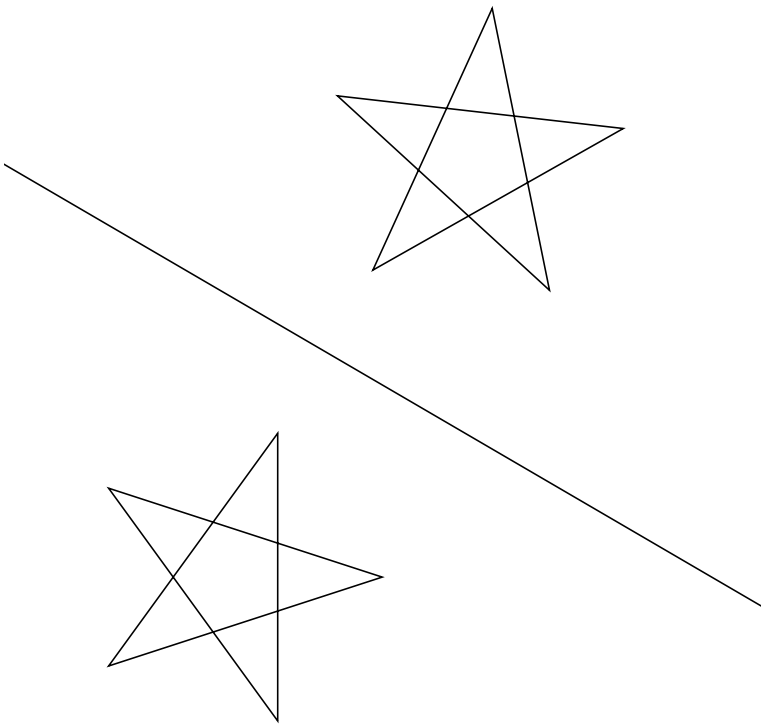
arguments	definition	examples
pt	existing point name	(A)

options		examples
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=center O angle pi/3
inversion	= center #1 through #2	[inversion =center O through A](E)

The image is only defined and not drawn.

9.1 Orthogonal reflection or symmetry

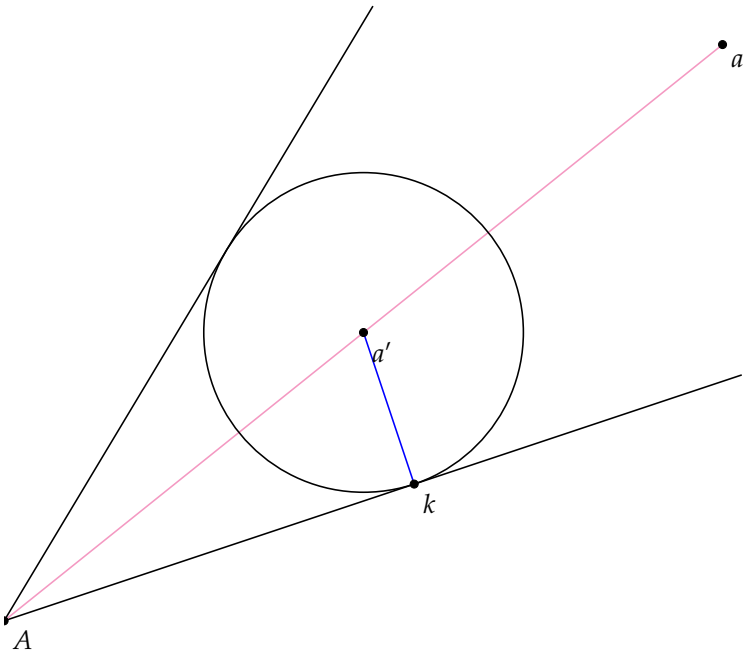
9.1.1 Example of reflection



```
\begin{tikzpicture}[scale=1]
 \tkzInit[ymin=-4,ymax=6,xmin=-7,xmax=3]
 \tkzClip
 \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}
```

9.2 Homothety

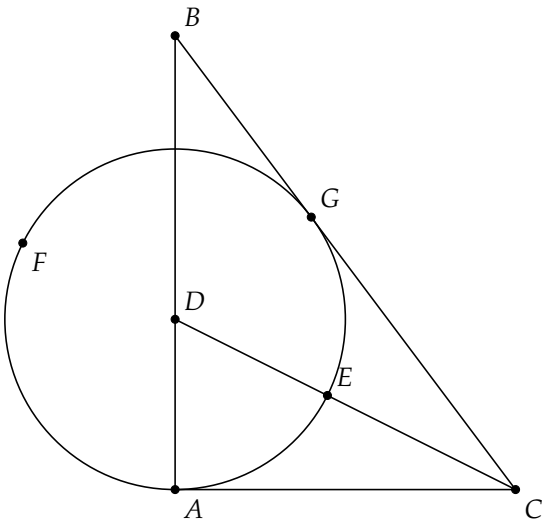
9.2.1 Example of homothety and projection




```
\begin{tikzpicture}[scale=1.25]
  \tkzInit   \tkzClip
  \tkzDefPoint(0,1){A}   \tkzDefPoint(6,3){B}   \tkzDefPoint(3,6){C}
  \tkzDrawLines[add= 0 and .3](A,B A,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}
  \tkzDrawSegment[blue](a',k)
  \tkzDrawPoints(a,a',k,A)
  \tkzDrawCircle(a',k)
  \tkzLabelPoints(a,a',k,A)
\end{tikzpicture}
```

9.3 The projection

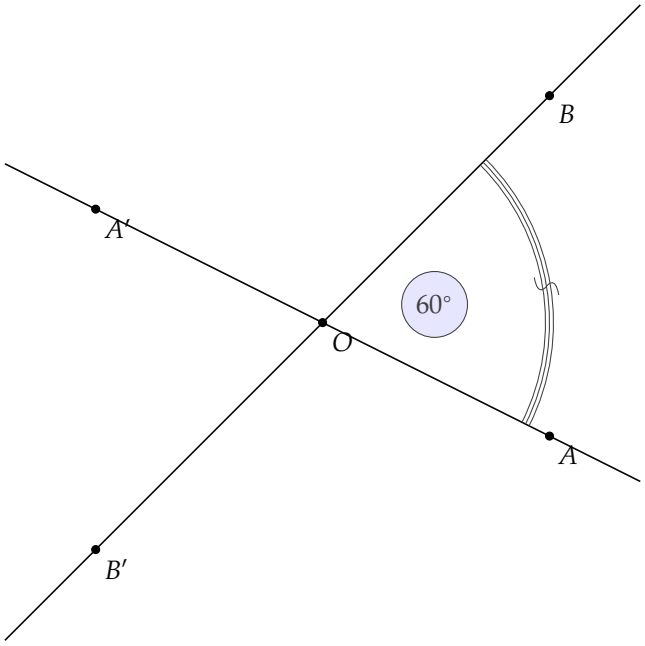
9.3.1 Example of projection




```
\begin{tikzpicture}[scale=1.5]
 \tkzInit[xmin=-3,xmax=5,ymax=4] \tkzClip[space=.5]
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(0,4){B}
 \tkzDrawTriangle[pythagore](B,A) \tkzGetPoint{C}
 \tkzDefLine[bisector](B,C,A) \tkzGetPoint{c}
 \tkzInterLL(C,c)(A,B)        \tkzGetPoint{D}
 \tkzDrawSegment(C,D)
 \tkzDrawCircle(D,A)
 \tkzDefPointBy[projection=onto B--C](D) \tkzGetPoint{G}
 \tkzInterLC(C,D)(D,A) \tkzGetPoints{E}{F}
 \tkzDrawPoints(A,C,F) \tkzLabelPoints(A,C,F)
 \tkzDrawPoints(B,D,E,G)
 \tkzLabelPoints[above right](B,D,E,G)
 \end{tikzpicture}
```

9.4 Symmetry

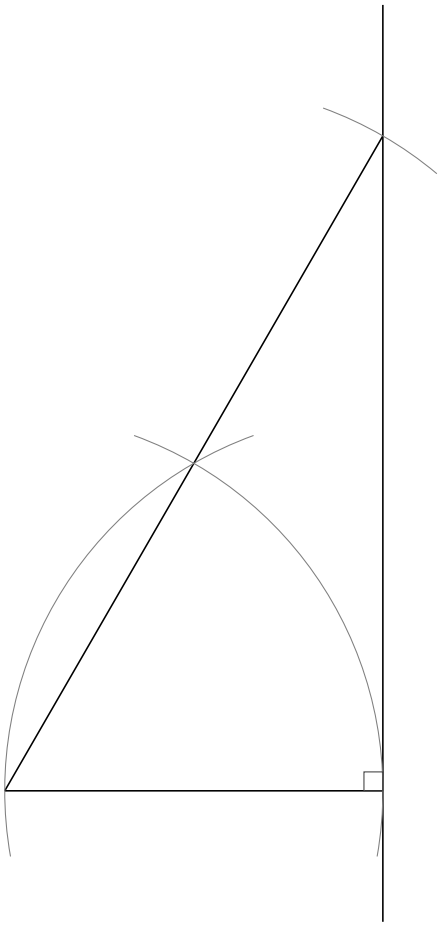
9.4.1 Example of symmetry




```
\begin{tikzpicture}[scale=1.5]
  \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}
```

9.5 Rotation

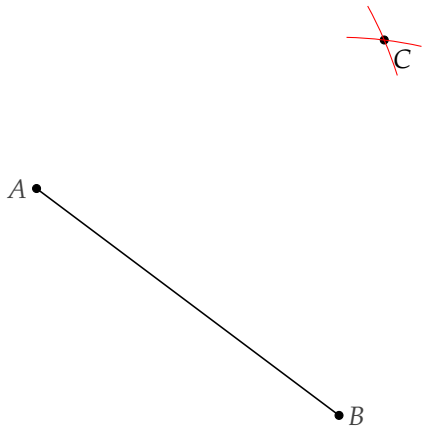
9.5.1 Example of rotation



```
\begin{tikzpicture}[scale=1]
\tkzInit
\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[delta=10](A,B)(C)
\tkzDrawArc[delta=10](B,C)(A)
\tkzDrawArc[delta=10](C,D)(D)
\tkzMarkRightAngle(D,B,A)
\end{tikzpicture}
```

9.6 Rotation in radian

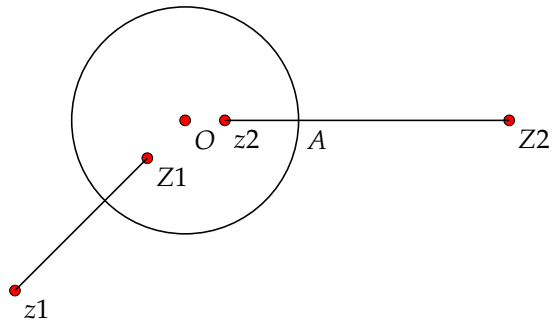
9.6.1 Example of rotation in radian




```
\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}
```

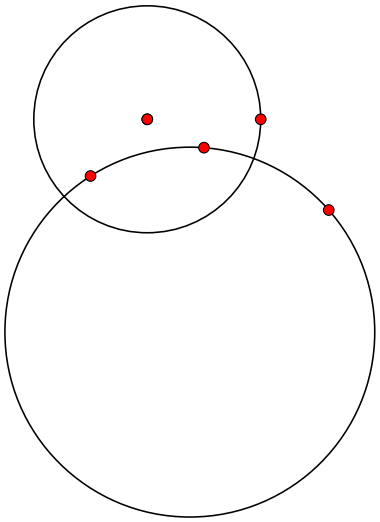
9.7 Inversion with respect to a circle

9.7.1 Inversion of points




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

9.7.2 Point Inversion: Orthogonal Circles



```
\begin{tikzpicture}[scale=1.5]
  \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}
```

10 Transformation of multiple points; \tkzDefPointsBy

Variant of the previous macro for defining multiple images. You must give the names of the images as arguments, or indicate that the names of the images are formed from the names of the antecedents, leaving the argument empty.

```
\tkzDefPointsBy[translation= from A to A'](B,C){} the images are B' and C'.
\tkzDefPointsBy[translation= from A to A'](B,C){D,E} the images are D and E
\tkzDefPointsBy[translation= from A to A'](B) the image is B'.
```

\tkzDefPointsBy[⟨local options⟩](⟨list of points⟩){⟨list of points⟩}

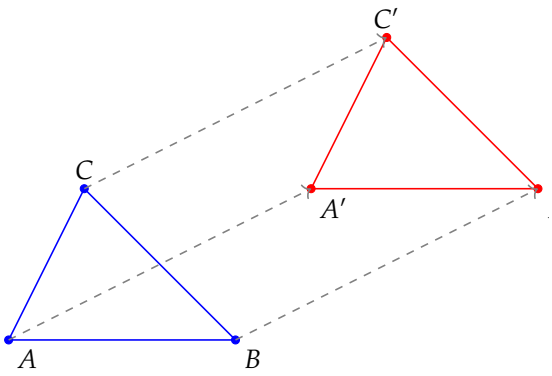
arguments	exemples	
(⟨liste de pts⟩){⟨list of pts⟩}	(A,B){E,F}	E is the image of A and F is the image of B.

If the list of images is empty then the name of the image is the name of the antecedent to which " ' " is added.

options	exemples
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	par exemple angle pi/3

The points are only defined and not drawn.

10.1 Example de translation




```
\begin{tikzpicture}
 \tkzDefPoint(0,0){A}  \tkzDefPoint(4,2){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}
```

11 Defining points using a vector

11.1 \tkzDefPointWith

There are several possibilities to create points that meet certain vector conditions. This can be done with **\tkzDefPointWith**. The general principle is as follows, two points are passed as arguments, i.e. a vector. The different options allow to obtain a new point forming with the first point (with some exceptions) a collinear vector or a vector orthogonal to the first vector. Then the length is either proportional to that of the first one, or proportional to the unit. Since this point is only used temporarily, it does not have to be named immediately. The result is in **\tkzPointResult**. The macro **\tkzGetPoint** allows you to retrieve the point and name it differently.

There are options to define the distance between the given point and the obtained point. In the general case this distance is the distance between the 2 points given as arguments if the option is of the "normed" type then the distance between the given point and the obtained point is 1 cm. Then the *K* option allows to obtain multiples.

\tkzDefPointWith(⟨pt1,pt2⟩)

It is in fact the definition of a point meeting vectorial conditions.

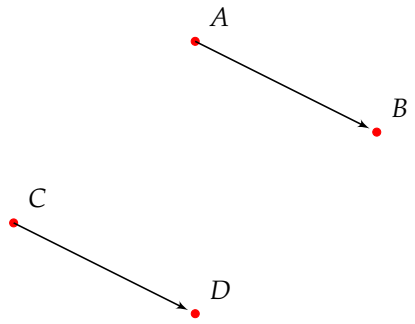
arguments	definition	explication
(pt1,pt2)	point couple	the result is a point in **\tkzPointResult**

In what follows, it is assumed that the point is recovered by **\tkzGetPoint{C}**

options	exemple	explication
orthogonal	[orthogonal](A,B)	$AC = AB$ et $\overrightarrow{AC} \perp \overrightarrow{AB}$
orthogonal normed	[orthogonal normed](A,B)	$AC = 1$ et $\overrightarrow{AC} \perp \overrightarrow{AB}$
linear	[linear](A,B)	$\overrightarrow{AC} = K \times \overrightarrow{AB}$
linear normed	[linear normed](A,B)	$AC = K$ et $\overrightarrow{AC} = k \times \overrightarrow{AB}$
colinear= at #1	[colinear= at C](A,B)	$\overrightarrow{CD} = \overrightarrow{AB}$
colinear normed= at #1	[colinear normed= at C](A,B)	$\overrightarrow{CD} = \overrightarrow{AB}$
K	[linear](A,B),K=2	$\overrightarrow{AC} = 2 \times \overrightarrow{AB}$

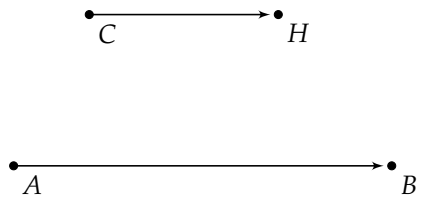
11.1.1 \tkzDefPointWith et colinear at

$(\overrightarrow{AB} = \overrightarrow{CD})$



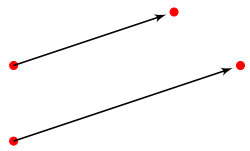

```
\begin{tikzpicture}[scale=1.2,
   vect/.style={->,shorten >=3pt,>=latex'}]
  \tkzDefPoint(2,3){A}   \tkzDefPoint(4,2){B}
  \tkzDefPoint(0,1){C}
  \tkzDefPointWith[colinear=at C](A,B)
  \tkzGetPoint{D}
  \tkzDrawPoints[color=red](A,B,C,D)
  \tkzLabelPoints[above right=3pt](A,B,C,D)
  \tkzDrawSegments[vect](A,B C,D)
\end{tikzpicture}
```

11.1.2 colinear at




```
\begin{tikzpicture}[vect/.style={->,
              shorten >=3pt,>=latex'}]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(5,0){B}
  \tkzDefPoint(1,2){C}
  \tkzDefPointWith[colinear=at C](A,B)
  \tkzGetPoint{G}
  \tkzDefPointWith[colinear=at C,K=0.5](A,B)
  \tkzGetPoint{H}
  \tkzLabelPoints(A,B,C,G,H)
  \tkzDrawPoints(A,B,C,G,H)
\tkzDrawSegments[vect](A,B C,H)
\end{tikzpicture}
```

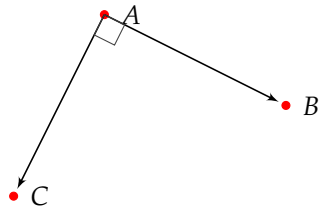
11.1.3 colinear $K = \frac{\sqrt{2}}{2}$



```
\begin{tikzpicture}[vect/.style={->,
        shorten >=3pt,>=latex'}]
 \tkzDefPoint(1,1){A}
 \tkzDefPoint(4,2){B}
 \tkzDefPoint(2,2){CU}
 \tkzDefPointWith[colinear=at C,K=sqrt(2)/2](A,B)
 \tkzGetPoint{D}
 \tkzDrawPoints[color=red](A,B,C,D)
 \tkzDrawSegments[vect](A,B C,D)
\end{tikzpicture}
```

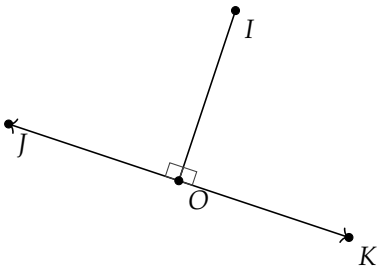
11.1.4 \tkzDefPointWith et orthogonal

$K = -1$ afin que $(\overrightarrow{AC}, \overrightarrow{AB})$ détermine un angle positif. AB=AC puisque K = 1



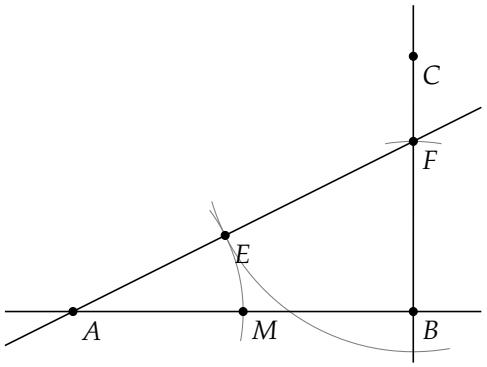

```
\begin{tikzpicture}[scale=1.2,
  vect/.style={->,shorten >=3pt,>=latex'}]
   \tkzDefPoint(2,3){A}
   \tkzDefPoint(4,2){B}
   \tkzDefPointWith[orthogonal,K=-1](A,B)
     \tkzGetPoint{C}
   \tkzDrawPoints[color=red](A,B,C)
   \tkzLabelPoints[right=3pt](A,B,C)
   \tkzDrawSegments[vect](A,B A,C)
   \tkzMarkRightAngle(B,A,C)
\end{tikzpicture}
```

11.1.5 orthogonal simple



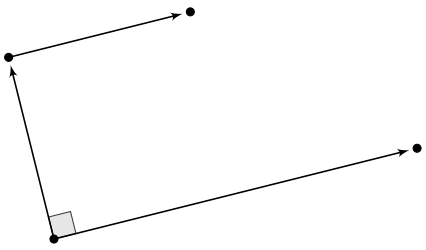

```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoint(1,2){O}
  \tkzDefPoint(2,5){I}
  \tkzDefPointWith[orthogonal](O,I)
  \tkzGetPoint{J}
  \tkzDefPointWith[orthogonal,K=-1](O,I)
  \tkzGetPoint{K}
  \tkzDrawSegment(O,I)
  \tkzDrawSegments[->](O,J O,K)
  \tkzMarkRightAngles(I,O,J I,O,K)
  \tkzDrawPoints(O,I,J,K)
  \tkzLabelPoints(O,I,J,K)
\end{tikzpicture}
```

11.1.6 advanced orthogonal




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoints{0/0/A,6/0/B}
  \tkzDefMidPoint(A,B)
  \tkzGetPoint{I}
  \tkzDefPointWith[orthogonal,K=-.75](B,A)
  \tkzGetPoint{C}
  \tkzInterLC(B,C)(B,I)
   \tkzGetPoints{D}{F}
  \tkzDuplicateSegment(B,F)(A,F)
  \tkzGetPoint{E}
  \tkzDrawArc[delta=10](F,E)(B)
  \tkzInterLC(A,B)(A,E)
  \tkzGetPoints{N}{M}
  \tkzDrawArc[delta=10](A,M)(E)
  \tkzDrawLines(A,B B,C A,F)
  \tkzCompass(B,F)
  \tkzDrawPoints(A,B,C,F,M,E)
  \tkzLabelPoints(A,B,C,F,M,E)
\end{tikzpicture}
```

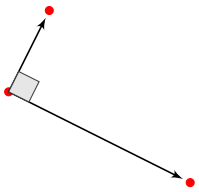
11.1.7 segment colinear and orthogonal



```
\begin{tikzpicture}[scale=1.2,
  vect/.style={->,shorten >=3pt,>=latex'}]
   \tkzDefPoint(2,1){A}
   \tkzDefPoint(6,2){B}
   \tkzDefPointWith[orthogonal,K=.5](A,B)
   \tkzGetPoint{C}
   \tkzDefPointWith[colinear=at C,K=.5](A,B)
   \tkzGetPoint{D}
   \tkzMarkRightAngle[fill=gray!20](B,A,C)
   \tkzDrawSegments[vect](A,B A,C C,D)
   \tkzDrawPoints(A,...,D)
\end{tikzpicture}
```

11.1.8 \tkzDefPointWith orthogonal normed, K=1

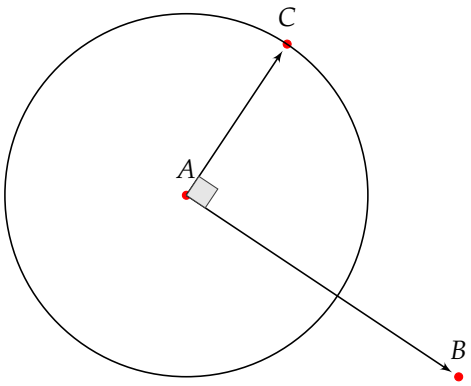
AC=1



```
\begin{tikzpicture}[scale=1.2,
  vect/.style={->,shorten >=3pt,>=latex'}]
  \tkzDefPoint(2,3){A}   \tkzDefPoint(4,2){B}
  \tkzDefPointWith[orthogonal normed](A,B)
  \tkzGetPoint{C}
  \tkzDrawPoints[color=red](A,B,C)
  \tkzDrawSegments[vect](A,B A,C)
  \tkzMarkRightAngle[fill=gray!20](B,A,C)
\end{tikzpicture}
```

11.1.9 \tkzDefPointWith et orthogonal normed K=2

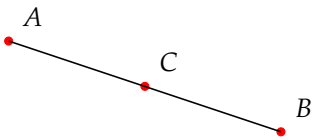
$K = 2$ donc AC=2.




```
\begin{tikzpicture}[scale=1.2,
   vect/.style={->,shorten >=3pt,>=latex'}]
   \tkzDefPoint(2,3){A}   \tkzDefPoint(5,1){B}
   \tkzDefPointWith[orthogonal normed,K=2](A,B)
   \tkzGetPoint{C}
   \tkzDrawPoints[color=red](A,B,C)
   \tkzDrawCircle[R](A,2cm)
   \tkzDrawSegments[vect](A,B A,C)
   \tkzMarkRightAngle[fill=gray!20](B,A,C)
   \tkzLabelPoints[above=3pt](A,B,C)
\end{tikzpicture}
```

11.1.10 \tkzDefPointWith linear

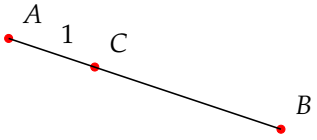
Ici $K = 0.5$ This amounts to applying a homothety or a multiplication of a vector by a real. Here is the middle of $[AB]$.




```
\begin{tikzpicture}[scale=1.2]
   \tkzDefPoint(1,3){A}   \tkzDefPoint(4,2){B}
   \tkzDefPointWith[linear,K=0.5](A,B)
   \tkzGetPoint{C}
   \tkzDrawPoints[color=red](A,B,C)
   \tkzDrawSegment(A,B)
   \tkzLabelPoints[above right=3pt](A,B,C)
\end{tikzpicture}
```

11.1.11 \tkzDefPointWith linear normed

In the following example AC=1 and C belongs to (AB).




```
\begin{tikzpicture}[scale=1.2]
 \tkzDefPoint(1,3){A}   \tkzDefPoint(4,2){B}
 \tkzDefPointWith[linear normed](A,B)
 \tkzGetPoint{C}
 \tkzDrawPoints[color=red](A,B,C)
 \tkzDrawSegment(A,B)
 \tkzLabelSegment(A,C){$1$}
 \tkzLabelPoints[above right=3pt](A,B,C)
\end{tikzpicture}
```

11.2 \tkzGetVectxy

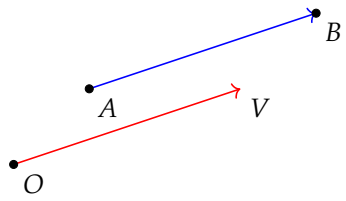
Retrieving the coordinates of a vector

\tkzGetVectxy(⟨A,B⟩){⟨text⟩}

Allows to obtain the coordinates of a vector

arguments	example	explication
(point){name of macro}	\tkzGetVectxy(A,B){V}	\Vx,\Vy : coordinates of $\overrightarrow{AB}$

11.2.1 Coordinate transfer with \tkzGetVectxy




```
\begin{tikzpicture}
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(1,1){A}
 \tkzDefPoint(4,2){B}
 \tkzGetVectxy(A,B){v}
 \tkzDefPoint(\vx,\vy){V}
 \tkzDrawSegment[->,color=red](O,V)
 \tkzDrawSegment[->,color=blue](A,B)
 \tkzDrawPoints(A,B,O)
 \tkzLabelPoints(A,B,O,V)
\end{tikzpicture}
```

12 Random point definition

At the moment there are four possibilities:

1. point in a rectangle,
2. on a segment,
3. on a straight line,
4. on a circle.

12.1 Obtaining random points

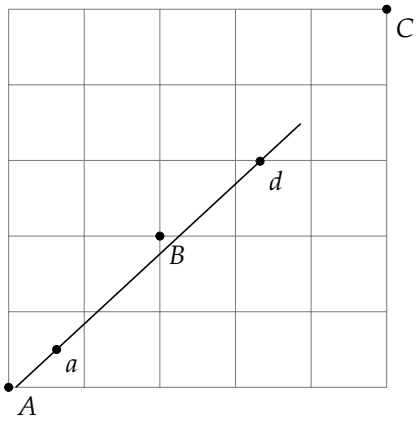
This is the new version that replaces **\tkzGetRandPointOn**

\tkzDefRandPointOn[⟨local options⟩]

The result is a point with a random position that can be named with the macro **\tkzGetPoint**. It is possible to use **tkzPointResult** if it is not necessary to retain the results..

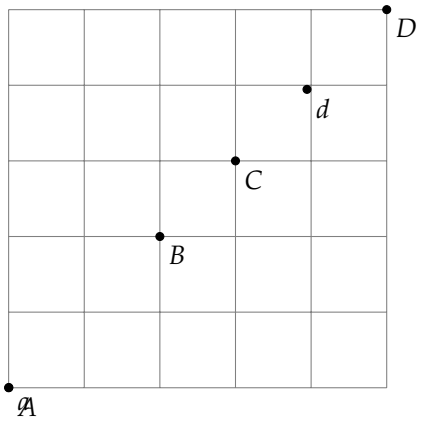
options	default	definition
rectangle=pt1 and pt2		[rectangle=A and B]
segment= pt1--pt2		[segment=A--B]
line=pt1--pt2		[line=A--B]
circle =center pt1 radius dim		[circle = center A radius 2cm]
circle through=center pt1 through pt2		[circle through= center A through B]
disk through=center pt1 through pt2		[disk through=center A through B]

12.2 Random point in a rectangle



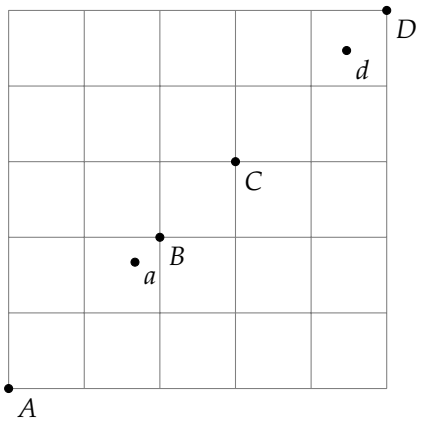

```
\begin{tikzpicture}
  \tkzInit[xmax=5,ymax=5]\tkzGrid
  \tkzDefPoints{0/0/A,2/2/B,5/5/C}
  \tkzDefRandPointOn[rectangle = A and B]
  \tkzGetPoint{a}
  \tkzDefRandPointOn[rectangle = B and C]
  \tkzGetPoint{d}
  \tkzDrawLine(a,d)
  \tkzDrawPoints(A,B,C,a,d)
  \tkzLabelPoints(A,B,C,a,d)
\end{tikzpicture}
```

12.3 Random point on a segment



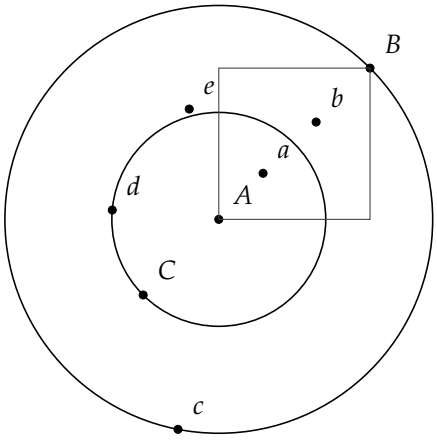

```
\begin{tikzpicture}
  \tkzInit[xmax=5,ymax=5] \tkzGrid
  \tkzDefPoints{0/0/A,2/2/B,3/3/C,5/5/D}
  \tkzDefRandPointOn[segment = A--B]\tkzGetPoint{a}
  \tkzDefRandPointOn[segment = C--D]\tkzGetPoint{d}
  \tkzDrawPoints(A,B,C,D,a,d)
  \tkzLabelPoints(A,B,C,D,a,d)
\end{tikzpicture}
```

12.4 Random point on a straight line



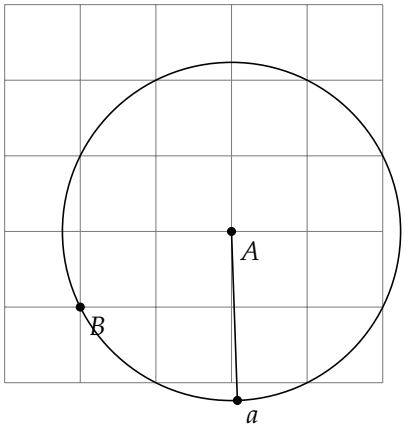

```
\begin{tikzpicture}
  \tkzInit[xmax=5,ymax=5] \tkzGrid
  \tkzDefPoints{0/0/A,2/2/B,3/3/C,5/5/D}
  \tkzDefRandPointOn[line = A--B]\tkzGetPoint{a}
  \tkzDefRandPointOn[line = C--D]\tkzGetPoint{d}
  \tkzDrawPoints(A,B,C,D,a,d)
  \tkzLabelPoints(A,B,C,D,a,d)
\end{tikzpicture}
```

12.4.1 Example of random points



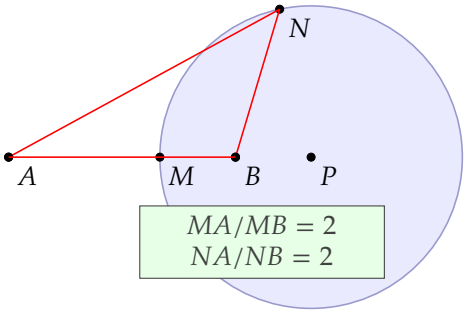

```
\begin{tikzpicture}
 \tkzDefPoints{0/0/A,2/2/B,-1/-1/C}
 \tkzDefCircle[through=](A,C)
 \tkzGetLength{rAC}
 \tkzDrawCircle(A,C)
 \tkzDrawCircle(A,B)
 \tkzDefRandPointOn[rectangle=A and B]
 \tkzGetPoint{a}
 \tkzDefRandPointOn[segment=A--B]
 \tkzGetPoint{b}
 \tkzDefRandPointOn[circle=center A radius \rAC pt]
    \tkzGetPoint{d}
 \tkzDefRandPointOn[circle through= center A through B]
     \tkzGetPoint{c}
 \tkzDefRandPointOn[disk through=center A through B]
     \tkzGetPoint{e}
 \tkzLabelPoints[above right=3pt](A,B,C,a,b,...,e)
 \tkzDrawPoints[](A,B,C,a,b,...,e)
 \tkzDrawRectangle(A,B)
\end{tikzpicture}
```

12.5 Random point on a circle




```
\begin{tikzpicture}
  \tkzInit[xmax=5,ymax=5]  \tkzGrid
  \tkzDefPoints{3/2/A,1/1/B}
  \tkzCalcLength[cm](A,B) \tkzGetLength{rAB}
  \tkzDrawCircle[R](A,\rAB cm)
  \tkzDefRandPointOn[circle = center A radius
   \rAB cm]\tkzGetPoint{a}
  \tkzDrawSegment(A,a)
  \tkzDrawPoints(A,B,a)
  \tkzLabelPoints(A,B,a)
\end{tikzpicture}
```

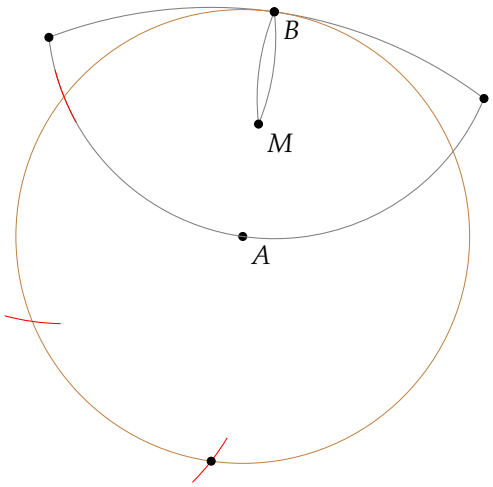
12.5.1 Random example and circle of Apollonius




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/A,3/0/B}
 \def\coeffK{2}
 \tkzApolloniusCenter[K=\coeffK](A,B)
 \tkzGetPoint{P}
 \tkzDefApolloniusPoint[K=\coeffK](A,B)
 \tkzGetPoint{M}
 \tkzDefApolloniusRadius[K=\coeffK](A,B)
 \tkzDrawCircle[R,color = blue!50!black,
     fill=blue!20,
     opacity=.4](tkzPointResult,\tkzLengthResult pt)
 \tkzDefRandPointOn[circle through= center P through M]
 \tkzGetPoint{N}
 \tkzDrawPoints(A,B,P,M,N)
 \tkzLabelPoints(A,B,P,M,N)
 \tkzDrawSegments[red](N,A N,B)
 \tkzDrawPoints(A,B)
 \tkzDrawSegments[red](A,B)
 \tkzLabelCircle[R,draw,fill=green!10,%
     text width=3cm,%
     text centered](P,\tkzLengthResult pt-20pt)(-
120)%
   { $MA/MB=\coeffK$\\$NA/NB=\coeffK$}
\end{tikzpicture}
```

12.6 Middle of a compass segment

To conclude this section, here is a more complex example. It involves determining the middle of a segment, using only a compass.




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoint(0,0){A}
  \tkzDefRandPointOn[circle= center A radius 4cm]
  \tkzGetPoint{B}
  \tkzDrawPoints(A,B)
  \tkzDefPointBy[rotation= center A angle 180](B)
  \tkzGetPoint{C}
  \tkzInterCC[R](A,4 cm)(B,4 cm)
  \tkzGetPoints{I}{I'}
  \tkzInterCC[R](A,4 cm)(I,4 cm)
  \tkzGetPoints{J}{B}
  \tkzInterCC(B,A)(C,B)
  \tkzGetPoints{D}{E}
  \tkzInterCC(D,B)(E,B)
  \tkzGetPoints{M}{M'}
  \tikzset{arc/.style={color=brown,style=dashed,delta=10}}
  \tkzDrawArc[arc](C,D)(E)
  \tkzDrawArc[arc](B,E)(D)
  \tkzDrawCircle[color=brown,line width=.2pt](A,B)
  \tkzDrawArc[arc](D,B)(M)
  \tkzDrawArc[arc](E,M)(B)
  \tkzCompasss[color=red,style=solid](B,I I,J J,C)
  \tkzDrawPoints(B,C,D,E,M)
  \tkzLabelPoints(A,B,M)
 \end{tikzpicture}
```

13 The straight lines

It is of course essential to draw straight lines, but before this can be done, it is necessary to be able to define certain particular lines such as mediators, bisectors, parallels or even perpendiculars. The principle is to determine two points on the straight line.

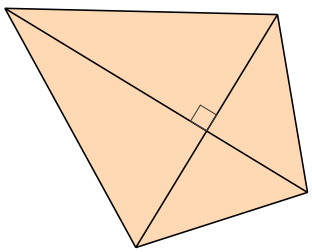
13.1 Definition of straight lines

`\tkzDefLine[⟨local options⟩](⟨pt1,pt2⟩) ou (⟨pt1,pt2,pt3⟩)`

The argument is a list of two or three points. Depending on the case, the macro defines one or two points necessary to obtain the line sought. Either the macro **\tkzGetPoint** or the macro **\tkzGetPoints** must be used.

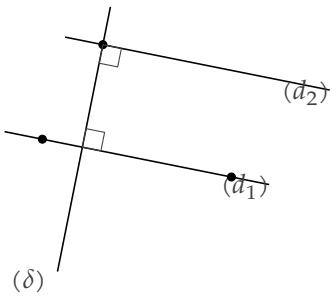
options	default	definition
mediator		mediator. Two points are defined
perpendicular=through…		perpendicular to a straight line passing through a point
orthogonal=through…		see above
parallel=through…		parallel to a straight line passing through a point
bisector		bisector of an angle defined by three points
bisector out		Exterior Angle Bisector
tangent=at…		tangent to a circle at a given point
tangent=from…		tangent to a circle(O,A) passing through a given point
tangent=from with R…		tangent to a circle(O,r) passing through a given point
K	1	Coefficient for the perpendicular line

13.1.1 Example with mediator



```
\begin{tikzpicture}[rotate=25]
  \tkzInit
  \tkzDefPoints{-2/0/A,1/2/B}
  \tkzDefLine[mediator](A,B)           \tkzGetPoints{C}{D}
  \tkzDefPointWith[linear,K=.75](C,D) \tkzGetPoint{D}
  \tkzDefMidPoint(A,B)                 \tkzGetPoint{I}
  \tkzFillPolygon[color=orange!30](A,C,B,D)
  \tkzDrawSegments(A,B C,D)
  \tkzMarkRightAngle(B,I,C)
  \tkzDrawSegments(D,B D,A)
  \tkzDrawSegments(C,B C,A)
\end{tikzpicture}
```

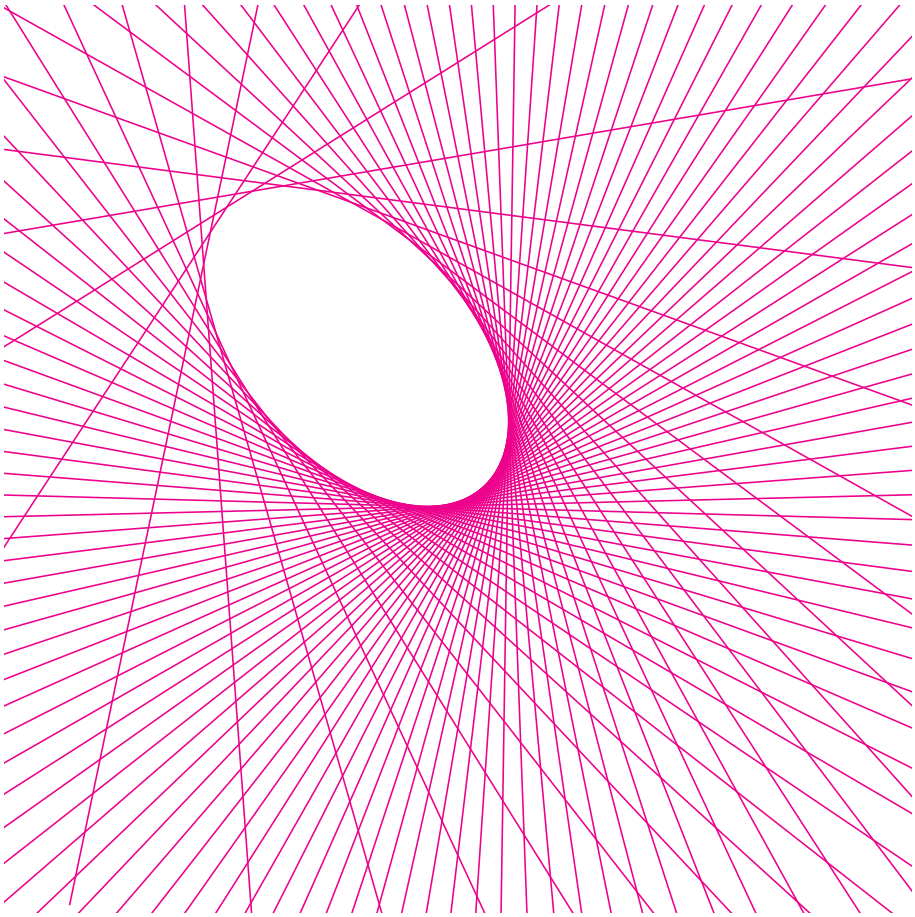
13.1.2 Example avec orthogonal et parallel




```
\begin{tikzpicture}
   \tkzDefPoints{-1.5/-0.25/A,1/-0.75/B,-0.7/1/C}
   \tkzDrawLine(A,B)
   \tkzLabelLine[pos=1.25,left](A,B){$(d_1)$}
   \tkzDrawPoints(A,B,C)
   \tkzDefLine[orthogonal=through C](B,A) \tkzGetPoint{c}
   \tkzDrawLine(C,c)
   \tkzLabelLine[pos=1.25,left](C,c){$(\delta)$}
   \tkzInterLL(A,B)(C,c) \tkzGetPoint{I}
   \tkzMarkRightAngle(C,I,B)
   \tkzDefLine[parallel=through C](A,B) \tkzGetPoint{c'}
   \tkzDrawLine(C,c')
   \tkzLabelLine[pos=1.25,left](C,c'){$(d_2)$}
   \tkzMarkRightAngle(I,C,c')
\end{tikzpicture}
```

13.1.3 An envelope

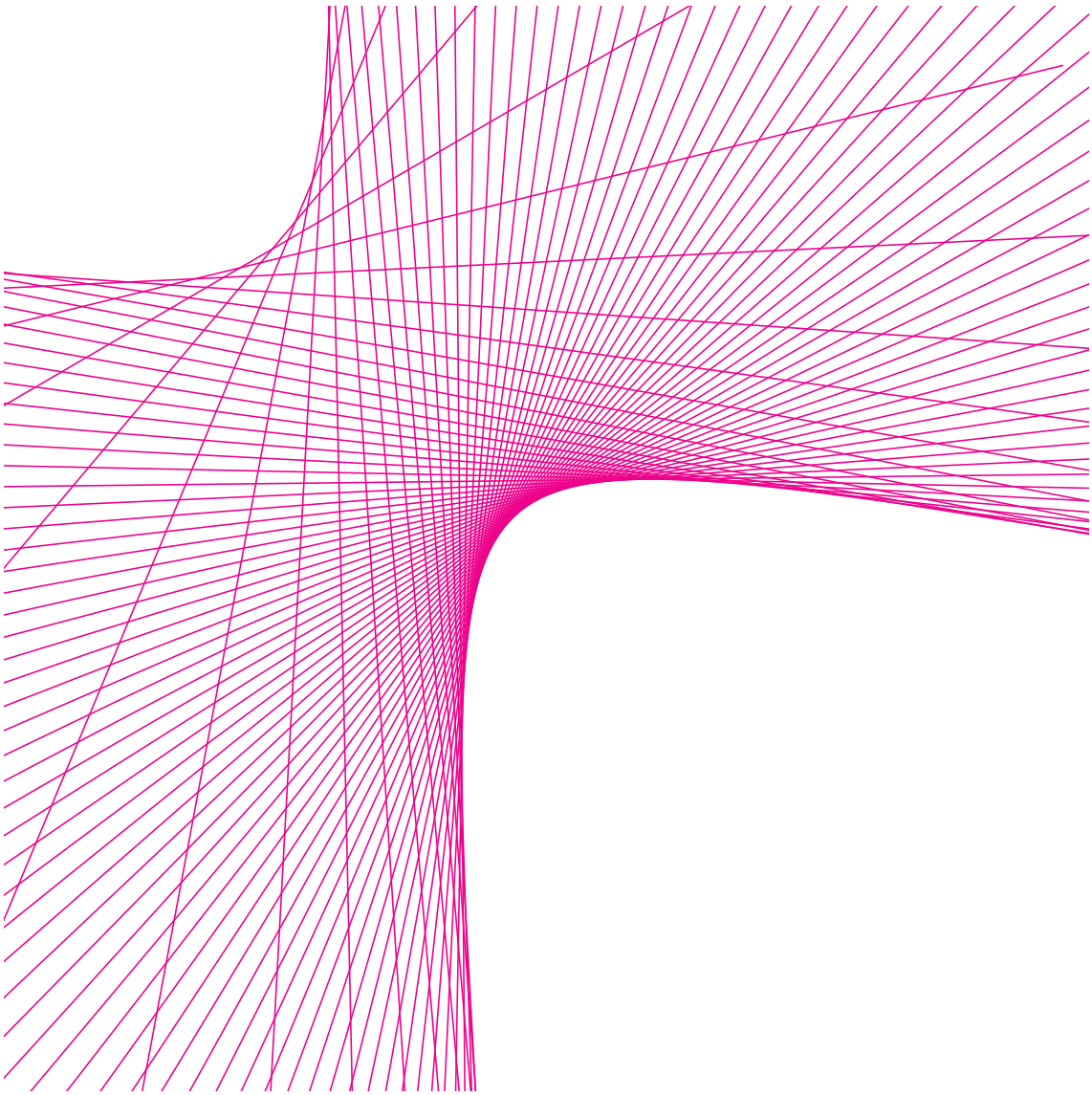
Based on a figure from O. Reboux with pst-eucl by D Rodriguez.



```
\begin{tikzpicture}[scale=1]
  \tkzInit[xmin=-6,ymin=-6,xmax=6,ymax=6]
  \tkzClip
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(132:4){A}
  \tkzDefPoint(5,0){B}
  \foreach \ang in {5,10,...,360}{%
    \tkzDefPoint(\ang:5){M}
    \tkzDefLine[mediator](A,M)
    \tkzDrawLine[color=magenta,add= 4 and 4](tkzFirstPointResult,tkzSecondPointResult)}
\end{tikzpicture}
```

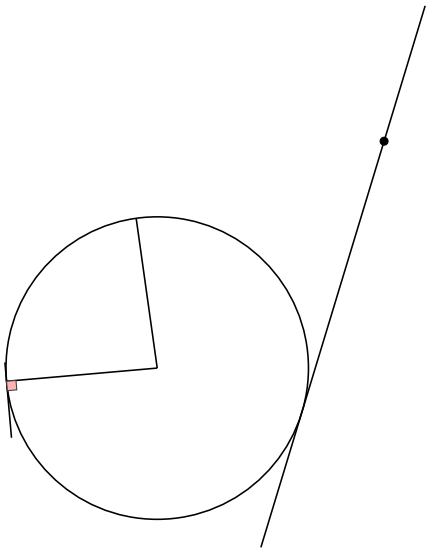
13.1.4 A parable

Based on a figure from O. Reboux with pst-eucl by D Rodriguez. It is not necessary to name the two points that define the mediator.



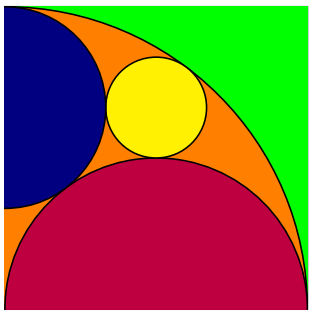
```
\begin{tikzpicture}[scale=1.25]
  \tkzInit[xmin=-6,ymin=-6,xmax=6,ymax=6]
  \tkzClip
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(132:5){A}
  \tkzDefPoint(4,0){B}
  \foreach \ang in {5,10,...,360}{%
    \tkzDefPoint(\ang:4){M}
    \tkzDefLine[mediator](A,M)
    \tkzDrawLine[color=magenta,
              add= 4 and 4](tkzFirstPointResult,tkzSecondPointResult)}
   \end{tikzpicture}
```

13.1.5 Drawing a tangent option from with R and at



```
\begin{tikzpicture}[scale=.5]
\tkzDefPoint(0,0){O}
\tkzDefPoint(6,6){E}
\tkzDefRandPointOn[circle=center O radius 4cm]
\tkzGetPoint{A}
\tkzDefRandPointOn[circle=center O radius 4cm]
\tkzGetPoint{B}
\tkzDrawSegments(O,A O,B)
\tkzDrawCircle(O,A)
\tkzDefTangent[from with R=E](O,4cm)
\tkzGetSecondPoint{k}
\tkzDefTangent[at=A](O)
\tkzGetPoint{h}
\tkzDrawPoints(E)
\tkzDrawLine[add = .5 and .5](A,h)
\tkzDrawLine[add = .5 and .5](E,k)
\tkzMarkRightAngle[fill=red!30](O,A,h)
\end{tikzpicture}
```

13.1.6 Drawing a tangent option from



```
\begin{tikzpicture}[scale=.5]
 \tkzDefPoint(0,0){B}
 \tkzDefPoint(0,8){A}
 \tkzDefSquare(A,B)
 \tkzGetPoints{C}{D}
 \tkzDrawSquare(A,B)
 \tkzClipPolygon(A,B,C,D)
 \tkzDefPoint(4,8){F}
 \tkzDefPoint(4,0){E}
 \tkzDefPoint(4,4){Q}
 \tkzFillPolygon[color = green](A,B,C,D)
 \tkzDrawCircle[fill = orange](B,A)
 \tkzDrawCircle[fill = purple](E,B)
 \tkzDefTangent[from=B](F,A)
 \tkzInterLL(F,tkzFirstPointResult)(C,D)
 \tkzInterLL(A,tkzPointResult)(F,E)
 \tkzDrawCircle[fill = yellow](tkzPointResult,Q)
 \tkzDefPointBy[projection= onto B--
A](tkzPointResult)
 \tkzDrawCircle[fill = blue!50!black](tkzPointResult,A)
\end{tikzpicture}
```

14 Drawing, naming the lines

The following macros are simply used to draw, name lines

14.1 Draw a straight line

To draw a normal straight line, just give a couple of points. You can use the **add** option to extend the line.(This option is due to **Mark Wibrow**).

In the special case of lines defined in a triangle, the number of arguments is a list of three points (the vertices of the triangle). The second point is where the line will come from. The first and last points determine the

target segment. The old method has therefore been slightly modified. So for **\tkzDrawMedian**, instead of (A,B)(C) you have to write (B,C,A) where C is the point that will be linked to the middle of the segment [A,B].

```
\tikzset{%
  add/.style args={#1 and #2}{
      to path={%
($(\tikztostart)!-#1!(\tikztotarget)$)--($(\tikztotarget)!-#2!(\tikztostart)$)%
 \tikztonodes}}}
```

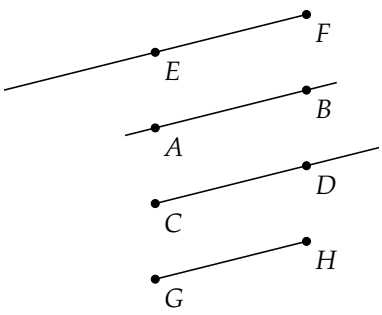
\tkzDrawLine[⟨local options⟩](⟨pt1,pt2⟩) ou (⟨pt1,pt2,pt3⟩)

The arguments are a list of two points or three points.

options	default	definition
median	none	[median](A,B,C) median from B
altitude	none	[altitude](C,A,B) altitude from A
bisector	none	[bisector](B,C,A) bisector from C
none	none	draw the straight line A,B
add= nb1 and nb2	.2 and .2	Extends the segment

add defines the length of the line passing through the points pt1 and pt2. Both numbers are percentages. The styles of TikZ are accessible for plots

14.1.1 Examples of right-hand plots with add



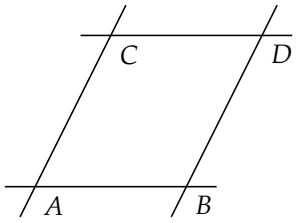

```
\begin{tikzpicture}
 \tkzInit[xmin=-2,xmax=3,ymin=-2.25,ymax=2.25]
 \tkzClip[space=.25]
 \tkzDefPoint(0,0){A} \tkzDefPoint(2,0.5){B}
 \tkzDefPoint(0,-1){C}\tkzDefPoint(2,-0.5){D}
 \tkzDefPoint(0,1){E} \tkzDefPoint(2,1.5){F}
 \tkzDefPoint(0,-2){G} \tkzDefPoint(2,-1.5){H}
 \tkzDrawLine(A,B)    \tkzDrawLine[add = 0 and .5](C,D)
 \tkzDrawLine[add = 1 and 0](E,F)
 \tkzDrawLine[add = 0 and 0](G,H)
 \tkzDrawPoints(A,B,C,D,E,F,G,H)
 \tkzLabelPoints(A,B,C,D,E,F,G,H)
\end{tikzpicture}
```

It is possible to draw several lines, but with the same options.

`\tkzDrawLines[⟨local options⟩](⟨pt1,pt2 pt3,pt4 ...⟩)`

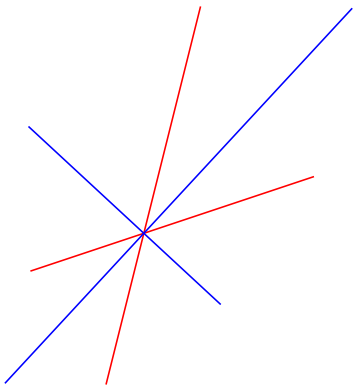
Arguments are a list of pairs of points separated by spaces. The styles of TikZ are available for the draws.

14.1.2 Example with \tkzDrawLines



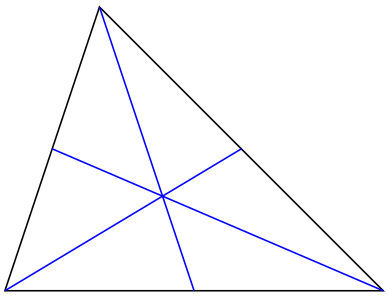

```
\begin{tikzpicture}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(2,0){B}
  \tkzDefPoint(1,2){C}
  \tkzDefPoint(3,2){D}
  \tkzDrawLines(A,B C,D A,C B,D)
  \tkzLabelPoints(A,B,C,D)
\end{tikzpicture}
```

14.1.3 Example with the option add



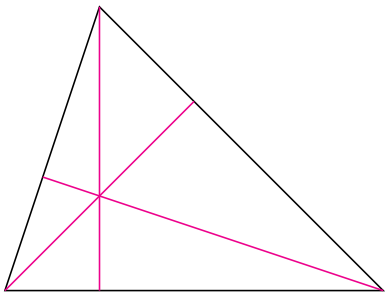
```
\begin{tikzpicture}[scale=.5]
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(3,1){I}
 \tkzDefPoint(1,4){J}
 \tkzDefLine[bisector](I,O,J)
   \tkzGetPoint{i}
 \tkzDefLine[bisector out](I,O,J)
   \tkzGetPoint{j}
 \tkzDrawLines[add = 1 and .5,color=red](O,I O,J)
 \tkzDrawLines[add = 1 and .5,color=blue](O,i O,j)
\end{tikzpicture}
```

14.1.4 Medians in a triangle



```
\begin{tikzpicture}[scale=1.25]
  \tkzDefPoint(0,0){A} \tkzDefPoint(4,0){B}
  \tkzDefPoint(1,3){C} \tkzDrawPolygon(A,B,C)
  \tkzSetUpLine[color=blue]
  \tkzDrawLine[median](B,C,A)
  \tkzDrawLine[median](C,A,B)
  \tkzDrawLine[median](A,B,C)
\end{tikzpicture}
```

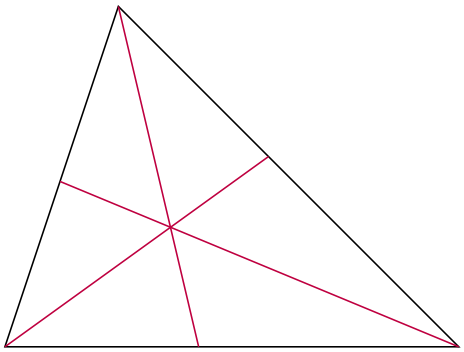
14.1.5 Altitudes in a triangle



```
\begin{tikzpicture}[scale=1.25]
 \tkzDefPoint(0,0){A} \tkzDefPoint(4,0){B}
 \tkzDefPoint(1,3){C} \tkzDrawPolygon(A,B,C)
 \tkzSetUpLine[color=magenta]
 \tkzDrawLine[altitude](B,C,A)
 \tkzDrawLine[altitude](C,A,B)
 \tkzDrawLine[altitude](A,B,C)
\end{tikzpicture}
```

14.1.6 Bisectors in a triangle

You have to give the angles in a straight line.



```
\begin{tikzpicture}[scale=1.5]
 \tkzDefPoint(0,0){A} \tkzDefPoint(4,0){B}
 \tkzDefPoint(1,3){C} \tkzDrawPolygon(A,B,C)
 \tkzSetUpLine[color=purple]
 \tkzDrawLine[bisector](B,C,A)
 \tkzDrawLine[bisector](C,A,B)
 \tkzDrawLine[bisector](A,B,C)
\end{tikzpicture}
```

14.2 Add labels on a straight line \tkzLabelLine

\tkzLabelLine[⟨local options⟩](⟨pt1,pt2⟩){⟨label⟩}

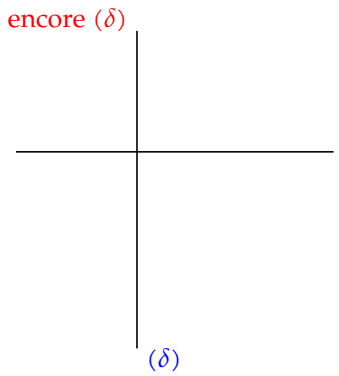
arguments	default	definition
label		example **\tkzLabelLine(A,B){δ}**

options	default	definition
pos	.5	pos est une option de TikZ mais essentielle dans ce cas

As an option, and in addition to the **pos**, you can use all styles of TikZ , especially the placement with **above**, **right**, ...

14.2.1 Example with \tkzLabelLine

An important option is **pos**, it's the one that allows you to place the label along the right. The value of **pos** can be greater than 1 or negative.




```
\begin{tikzpicture}
   \tkzDefPoints{0/0/A,3/0/B,1/1/C}
   \tkzDefLine[perpendicular=through C,K=-1](A,B)
   \tkzGetPoint{c}
   \tkzDrawLines(A,B C,c)
   \tkzLabelLine[pos=1.25,blue,right](C,c){$(\delta)$}
   \tkzLabelLine[pos=-0.25,red,left](C,c){encore $(\delta)$}
\end{tikzpicture}
```

15 Draw, Mark segments

There is, of course, a macro to simply draw a segment (it would be possible, as for a half line, to create a style with **\add**) .

15.1 Draw a segment \tkzDrawSegment

\tkzDrawSegment[⟨local options⟩](⟨pt1,pt2⟩)

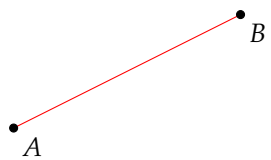
The arguments are a list of two points. The styles of TikZare available for the drawings

argument	example	definition
(pt1,pt2)	(A,B)	draw the segment $[A,B]$

options	exemple	définition
options de TikZ		all TikZ options are valid.
add		add = kl and kr ; allows the segment to be extended to the left and right
dim		dim = label,dim,option ; allows you to add dimensions to a figure.

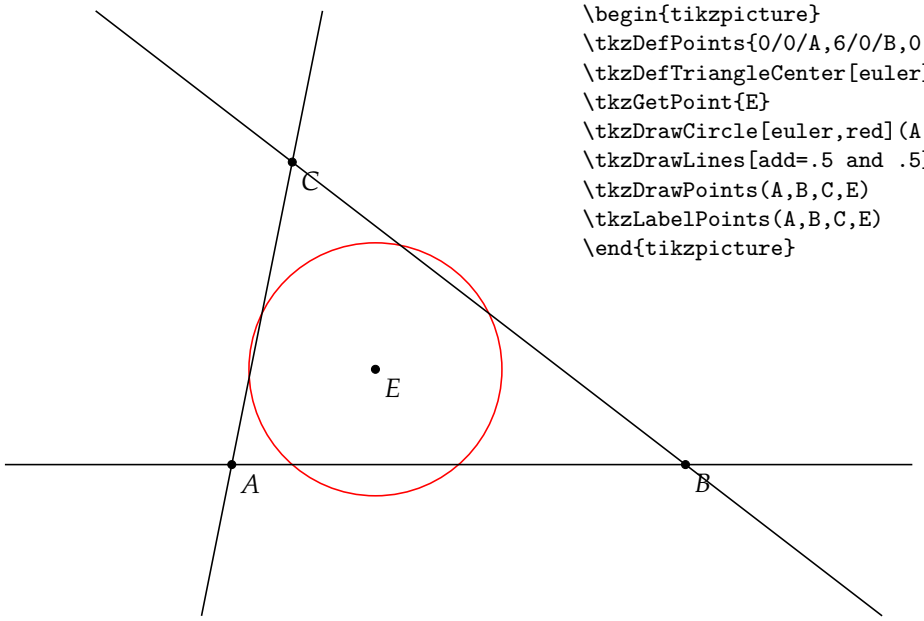
This is of course equivalent to **\draw (A)--(B);**

15.1.1 Example with point references



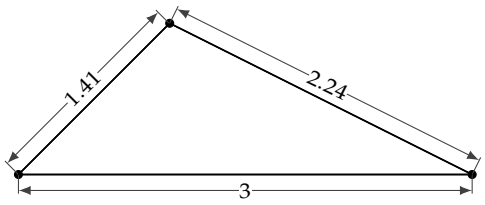

```
\begin{tikzpicture}[scale=1.5]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(2,1){B}
  \tkzDrawSegment[color=red,thin](A,B)
  \tkzDrawPoints(A,B)
  \tkzLabelPoints(A,B)
\end{tikzpicture}
```

15.1.2 Example of extending an option segment add




```
\begin{tikzpicture}
\tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
\tkzDefTriangleCenter[euler](A,B,C)
\tkzGetPoint{E}
\tkzDrawCircle[euler,red](A,B,C)
\tkzDrawLines[add=.5 and .5](A,B A,C B,C)
\tkzDrawPoints(A,B,C,E)
\tkzLabelPoints(A,B,C,E)
\end{tikzpicture}
```

15.1.3 Example of adding dimensions (technical figure) option dim



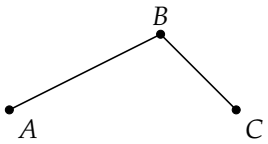

```
 \begin{tikzpicture}[scale=2]
\pgfkeys{/pgf/number format/.cd,fixed,precision=2}
% Define the first two points
\tkzDefPoint(0,0){A}
\tkzDefPoint(3,0){B}
\tkzDefPoint(1,1){C}
% Draw the triangle and the points
\tkzDrawPolygon(A,B,C)
\tkzDrawPoints(A,B,C)
% Label the sides
\tkzCalcLength[cm](A,B)\tkzGetLength{ABl}
\tkzCalcLength[cm](B,C)\tkzGetLength{BCl}
\tkzCalcLength[cm](A,C)\tkzGetLength{ACl}
% add dim
\tkzDrawSegment[dim={\pgfmathprintnumber\BCl,
                6pt,transform shape}](C,B)
\tkzDrawSegment[dim={\pgfmathprintnumber\ACl,
                6pt,transform shape}](A,C)
\tkzDrawSegment[dim={\pgfmathprintnumber\ABl,
                -6pt,transform shape}](A,B)
\end{tikzpicture}
```

If the options are the same we can plot several segments with the same macro.

15.2 Drawing segments \tkzDrawSegments

\tkzDrawSegments[⟨local options⟩](⟨pt1,pt2 pt3,pt4 ...⟩)

The arguments are a two-point couple list. The styles of TikZare available for the plots




```
\begin{tikzpicture}
  \tkzInit[xmin=-1,xmax=3,ymin=-1,ymax=2]
  \tkzClip[space=1]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(2,1){B}
  \tkzDefPoint(3,0){C}
  \tkzDrawSegments(A,B B,C)
  \tkzDrawPoints(A,B,C)
  \tkzLabelPoints(A,C)
  \tkzLabelPoints[above](B)
\end{tikzpicture}
```

15.2.1 Place an arrow on segment


```
\begin{tikzpicture}
  \tikzset{
    arr/.style={postaction=decorate,
    decoration={markings,
    mark=at position .5 with {\arrow[thick]{#1}}
      }}}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(4,0){B}
  \tkzDrawSegments[arr=stealth](A,B)
  \tkzDrawPoints(A,B)
\end{tikzpicture}
```

15.3 Mark a segment \tkzMarkSegment

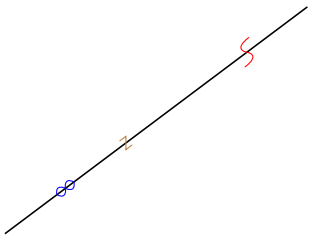
\tkzMarkSegment[⟨local options⟩](⟨pt1,pt2⟩)

The macro allows you to place a mark on a segment.

options	default	definition
pos	.5	position of the mark
color	black	color of the mark
mark	none	choice of the mark
size	4pt	size of the mark

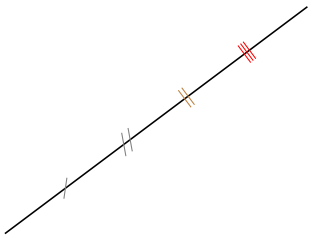
Possible marks are those provided by TikZ, but other marks have been created based on an idea by Yves Combe.

15.3.1 Several marks



```
\begin{tikzpicture}
  \tkzDefPoint(2,1){A}
  \tkzDefPoint(6,4){B}
  \tkzDrawSegment(A,B)
  \tkzMarkSegment[color=brown,size=2pt,
        pos=0.4, mark=z](A,B)
  \tkzMarkSegment[color=blue,
        pos=0.2, mark=oo](A,B)
  \tkzMarkSegment[pos=0.8,
        mark=s,color=red](A,B)
\end{tikzpicture}
```

15.3.2 Use of mark



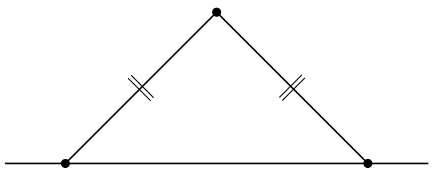
```
\begin{tikzpicture}
  \tkzDefPoint(2,1){A}
  \tkzDefPoint(6,4){B}
  \tkzDrawSegment(A,B)
  \tkzMarkSegment[color=gray,
                  pos=0.2,mark=s|](A,B)
  \tkzMarkSegment[color=gray,
                  pos=0.4,mark=s||](A,B)
  \tkzMarkSegment[color=brown,
                  pos=0.6,mark=||](A,B)
  \tkzMarkSegment[color=red,
                  pos=0.8,mark=|||](A,B)
\end{tikzpicture}
```

15.4 Marking segments \tkzMarkSegments

\tkzMarkSegments[⟨local options⟩](⟨pt1,pt2 pt3,pt4 ...⟩)

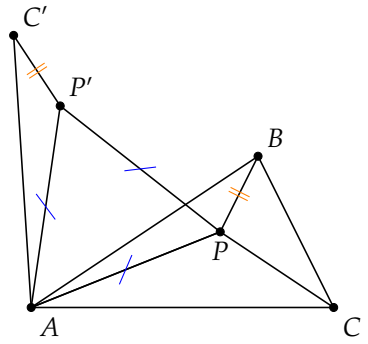
Arguments are a list of pairs of points separated by spaces. The styles of TikZ are available for plots.

15.4.1 Marques pour un triangle isocèle



```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/O,2/2/A,4/0/B,6/2/C}
 \tkzDrawSegments(O,A A,B)
 \tkzDrawPoints(O,A,B)
 \tkzDrawLine(O,B)
 \tkzMarkSegments[mark=||,size=6pt](O,A A,B)
\end{tikzpicture}
```

15.5 Another marking




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoint(0,0){A}\tkzDefPoint(3,2){B}
 \tkzDefPoint(4,0){C}\tkzDefPoint(2.5,1){P}
 \tkzDrawPolygon(A,B,C)
 \tkzDefEquilateral(A,P) \tkzGetPoint{P'}
 \tkzDefPointsBy[rotation=center A angle 60](P,B){P',C'}
 \tkzDrawPolygon(A,P,P')
 \tkzDrawPolySeg(P',C',A,P,B)
 \tkzDrawSegment(C,P)
 \tkzDrawPoints(A,B,C,C',P,P')
 \tkzMarkSegments[mark=s|,size=6pt,
 color=blue](A,P P,P' P',A)
 \tkzMarkSegments[mark=||,color=orange](B,P P',C')
 \tkzLabelPoints(A,C) \tkzLabelPoints[below](P)
 \tkzLabelPoints[above right](P',C',B)
\end{tikzpicture}
```

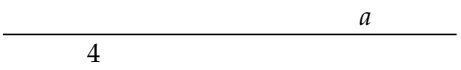
\tkzLabelSegment[⟨local options⟩](⟨pt1,pt2⟩){⟨label⟩}

This macro allows you to place a label along a segment or a line. The options are those of TikZ for example **pos**

argument	example	definition
label	\tkzLabelSegment(A,B){5}	label text
(pt1,pt2)	(A,B)	label along [*A,B*]

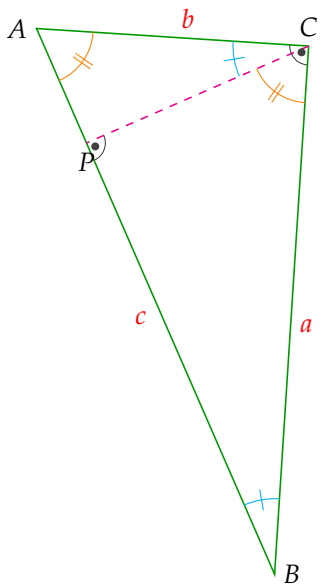
options	default	definition
pos	.5	label's position

15.5.1 Labels multiples




```
\begin{tikzpicture}
\tkzInit
\tkzDefPoint(0,0){A}
\tkzDefPoint(6,0){B}
\tkzDrawSegment(A,B)
\tkzLabelSegment[above,pos=.8](A,B){$a$}
\tkzLabelSegment[below,pos=.2](A,B){$4$}
\end{tikzpicture}
```

15.5.2 Labels and right-angled triangle

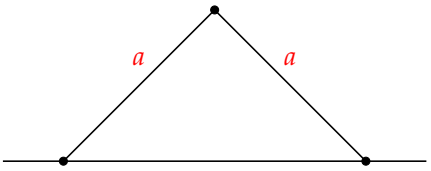



```
\begin{tikzpicture}[rotate=-60]
\tikzset{label seg style/.append style = {%
        color      = red,
        }}
\tkzDefPoint(0,1){A}
\tkzDefPoint(2,4){C}
\tkzDefPointWith[orthogonal normed,K=7](C,A)
\tkzGetPoint{B}
\tkzDrawPolygon[green!60!black](A,B,C)
\tkzDrawLine[altitude,dashed,color=magenta](B,C,A)
\tkzGetPoint{P}
\tkzLabelPoint[left](A){$A$}
\tkzLabelPoint[right](B){$B$}
\tkzLabelPoint[above](C){$C$}
\tkzLabelPoint[below](P){$P$}
\tkzLabelSegment[](B,A){$c$}
\tkzLabelSegment[swap](B,C){$a$}
\tkzLabelSegment[swap](C,A){$b$}
\tkzMarkAngles[size=1cm,
     color=cyan,mark=|](C,B,A A,C,P)
\tkzMarkAngle[size=0.75cm,
     color=orange,mark=||](P,C,B)
\tkzMarkAngle[size=0.75cm,
      color=orange,mark=||](B,A,C)
\tkzMarkRightAngles[german](A,C,B B,P,C)
\end{tikzpicture}
```

\tkzLabelSegments[⟨local options⟩](⟨pt1,pt2 pt3,pt4 ...⟩)

The arguments are a two-point couple list. The styles of TikZ are available for plotting.

15.5.3 Labels for an isosceles triangle




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/O,2/2/A,4/0/B,6/2/C}
 \tkzDrawSegments(O,A A,B)
 \tkzDrawPoints(O,A,B)
 \tkzDrawLine(O,B)
 \tkzLabelSegments[color=red,above=4pt](O,A A,B){$a$}
\end{tikzpicture}
```

16 Les triangles

16.1 Définition des triangles \tkzDefTriangle

Les macros suivantes vont permettre de définir ou de construire un triangle à partir **au moins** de deux points.

Pour le moment, il est possible de définir les triangles suivants :

- **two angles** détermine un triangle connaissant deux angles,
- **equilateral** détermine un triangle équilatéral,
- **half** détermine un triangle rectangle tel que le rapport des mesures des deux côtés adjacents à l'angle droit soit égal à 2,
- **pythagore** détermine un triangle rectangle dont les mesures des côtés sont proportionnelles à 3, 4 et 5,
- **school** détermine un triangle rectangle dont les angles sont 30, 60 et 90 degrés,
- **golden** détermine un triangle rectangle tel que le rapport des mesures des deux côtés adjacents à l'angle droit soit égal $\Phi = 1,618034$, J'ai choisi comme dénomination « triangle doré » car il rpovient du rectangle d'or et j'ai conservé la dénomination « triangle d'or » ou encore « triangle d'Euclide » pour le triangle isocèle dont les angles à la base sont de 72 degrés,
- **gold** ou **euclide** pour le triangle d'or,
- **cheops** détermine un troisième point tel que le triangle soit isocèle dont les mesures des côtés sont proportionnelles à 2, Φ et Φ.

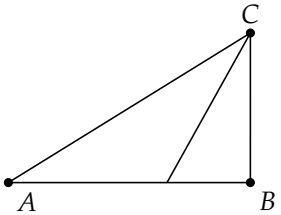
\tkzDefTriangle[⟨local options⟩](⟨A,B⟩)

les points sont ordonnés car le triangle est construit en suivant le sens direct du cercle trigonométrique. Cette macro est soit utilisée en partenariat avec **\tkzGetPoint** soit en utilisant **tkzPointResult** s'il n'est pas nécessaire de conserver le nom.

options	default	definition
two angles= #1 and #2	no defaut	triangle connaissant deux angles
equilateral	no defaut	triangle équilatéral
pythagore	no defaut	proportionnel au triangle de pythagore 3-4-5
school	no defaut	angles de 30, 60 et 90 degrés
gold	no defaut	angles de 72, 72 et 36 degrés, A est le sommet
euclide	no defaut	identique au précédent mais $[AB]$ est la base
golden	no defaut	rectangle en B et $AB/AC = \Phi$
cheops	no defaut	AC=BC, AC et BC sont proportionnels à 2 et Φ.

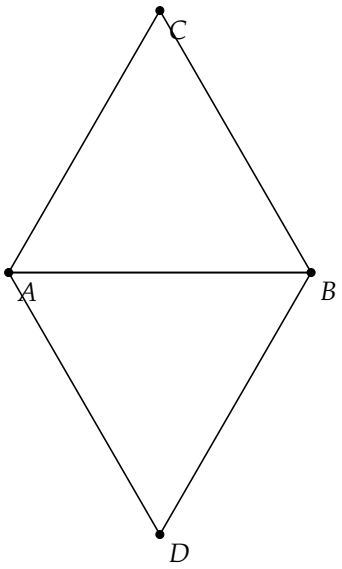
\tkzGetPoint permet de stocker le point sinon **tkzPointResult** permet une utilisation immédiate.

16.1.1 triangle doré (golden)



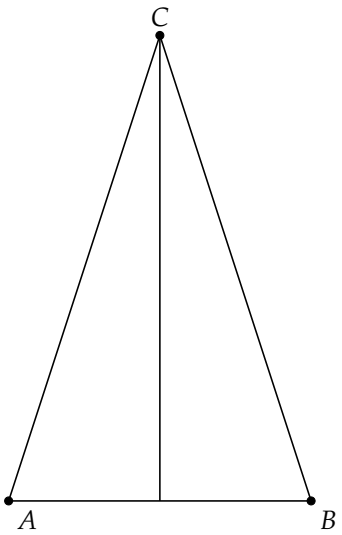

```
\begin{tikzpicture}[scale=.8]
\tkzInit[xmax=5,ymax=3] \tkzClip[space=.5]
  \tkzDefPoint(0,0){A}      \tkzDefPoint(4,0){B}
  \tkzDefTriangle[golden](A,B)\tkzGetPoint{C}
  \tkzDrawPolygon(A,B,C) \tkzDrawPoints(A,B,C)
  \tkzLabelPoints(A,B) \tkzDrawBisector(A,C,B)
  \tkzLabelPoints[above](C)
\end{tikzpicture}
```

16.1.2 triangle équilatéral




```
\begin{tikzpicture}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(4,0){B}
  \tkzDefTriangle[equilateral](A,B)
  \tkzGetPoint{C}
  \tkzDrawPolygon(A,B,C)
  \tkzDefTriangle[equilateral](B,A)
  \tkzGetPoint{D}
  \tkzDrawPolygon(B,A,D)
  \tkzDrawPoints(A,B,C,D)
  \tkzLabelPoints(A,B,C,D)
\end{tikzpicture}
```

16.1.3 triangle d'or (euclide)




```
\begin{tikzpicture}
 \tkzDefPoint(0,0){A} \tkzDefPoint(4,0){B}
 \tkzDefTriangle[euclide](A,B)\tkzGetPoint{C}
 \tkzDrawPolygon(A,B,C)
 \tkzDrawPoints(A,B,C)
 \tkzLabelPoints(A,B)
 \tkzLabelPoints[above](C)
 \tkzDrawBisector(A,C,B)
\end{tikzpicture}
```

16.2 Tracé des triangles

\tkzDrawTriangle[⟨local options⟩](⟨A,B⟩)

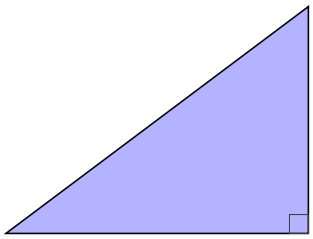
Macro semblable à la macro précédente mais les côtés sont tracés.

options	default	definition
two angles= #1 and #2	no defaut	triangle connaissant deux angles
equilateral	no defaut	triangle équilatéral
pythagore	no defaut	proportionnel au triangle de pythagore 3-4-5
school	no defaut	les angles sont 30, 60 et 90 degrés
gold	no defaut	les angles sont 72, 72 et 36 degrés, A est le sommet
euclide	no defaut	identique au précédent mais $[AB]$ est la base
golden	no defaut	rectangle en B et $AB/AC = \Phi$
cheops	no defaut	isocèle en C et $AC/AB = \frac{\Phi}{2}$

Dans toutes ses définitions, les dimensions du triangle dépendent des deux points de départ.

16.2.1 triangle de Pythagore

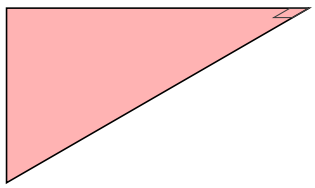
Ce triangle a des côtés dont les longueurs sont proportionnelles à 3, 4 et 5.



```
\begin{tikzpicture}
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(4,0){B}
 \tkzDrawTriangle[pythagore,fill=blue!30](A,B)
 \tkzMarkRightAngles(A,B,tkzPointResult)
\end{tikzpicture}
```

16.2.2 triangle 30 60 90 (school)

Les angles font 30, 60 et 90 degrés.



```
\begin{tikzpicture}
\tkzInit[ymin=-2.5,ymax=0,xmin=-5,xmax=0]
\tkzClip[space=.5]
\begin{scope}[rotate=-180]
  \tkzDefPoint(0,0){A} \tkzDefPoint(4,0){B}
  \tkzDrawTriangle[school,fill=red!30](A,B)
  \tkzMarkRightAngles(B,A,tkzPointResult)
\end{scope}
\end{tikzpicture}
```

17 Triangles spécifiques avec \tkzDefSpcTriangle

Les centres de certains triangles ont été définis dans la section "points", ici il s'agit de déterminer les trois sommets de triangles spécifiques.

\tkzDefSpcTriangle[⟨local options⟩](⟨A,B,C⟩)

The order of the points is important!

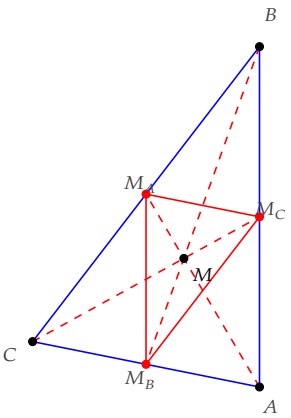
options	default	definition
in or incentral	centroid	triangle connaissant deux angles
ex or excentral	centroid	triangle équilatéral
extouch	centroid	proportionnel au triangle de pythagore 3-4-5
intouch or contact	centroid	angles de 30, 60 et 90 degrés
centroid or medial	centroid	angles de 72, 72 et 36 degrés, A est le sommet
orthic	centroid	identique au précédent mais $[AB]$ est la base
feuerbach	centroid	rectangle en B et $AB/AC = \Phi$
euler	centroid	AC=BC, AC et BC sont proportionnels à 2 et Φ.
tangential	centroid	AC=BC, AC et BC sont proportionnels à 2 et Φ.
name	no defaut	AC=BC, AC et BC sont proportionnels à 2 et Φ.

\tkzGetPoint permet de stocker le point sinon **tkzPointResult** permet une utilisation immédiate.

17.0.1 \tkzDefSpcTriangle option "medial" ou "centroid"

The geometric centroid of the polygon vertices of a triangle is the point G (sometimes also denoted M) which is also the intersection of the triangle's three triangle medians. The point is therefore sometimes called the median point. The centroid is always in the interior of the triangle.
Weisstein, Eric W. "Centroid triangle" From MathWorld–A Wolfram Web Resource.

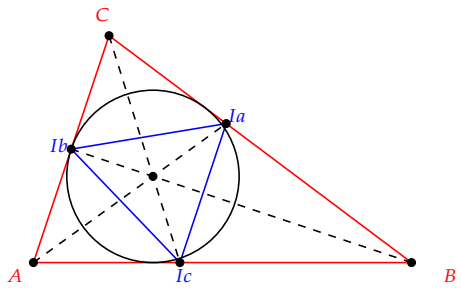
In the following example, we obtain the Euler circle which passes through the previously defined points.




```
\begin{tikzpicture}[rotate=90,scale=.75]
 \tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
 \tkzDefTriangleCenter[centroid](A,B,C)
        \tkzGetPoint{M}
 \tkzDefSpcTriangle[medial,name=M](A,B,C){_A,_B,_C}
 \tkzDrawPolygon[color=blue](A,B,C)
 \tkzDrawSegments[dashed,red](A,M_A B,M_B C,M_C)
 \tkzDrawPolygon[color=red](M_A,M_B,M_C)
 \tkzDrawPoints(A,B,C,M)
 \tkzDrawPoints[red](M_A,M_B,M_C)
\tkzAutoLabelPoints[center=M,font=\scriptsize]%
(A,B,C,M_A,M_B,M_C)
 \tkzLabelPoints[font=\scriptsize](M)
\end{tikzpicture}
```

17.0.2 Option : "in" ou "incentral"

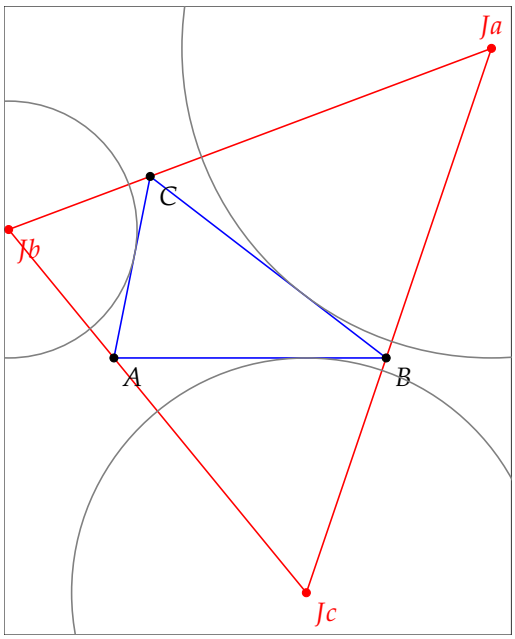
The Incentral triangle is the triangle whose vertices are determined by the intersections of the reference triangle's angle bisectors with the respective opposite sides.
Weisstein, Eric W. "Incentral triangle" From MathWorld–A Wolfram Web Resource.




```
\begin{tikzpicture}[scale=1]
  \tkzDefPoints{ 0/0/A,5/0/B,1/3/C}
  \tkzDefSpcTriangle[in,name=I](A,B,C){a,b,c}
  \tkzInCenter(A,B,C)\tkzGetPoint{I}
  \tkzDrawPolygon[red](A,B,C)
  \tkzDrawPolygon[blue](Ia,Ib,Ic)
  \tkzDrawPoints(A,B,C,I,Ia,Ib,Ic)
  \tkzDrawCircle[in](A,B,C)
  \tkzDrawSegments[dashed](A,Ia B,Ib C,Ic)
 \tkzAutoLabelPoints[center=I,blue,font=\scriptsize]%
(Ia,Ib,Ic)
 \tkzAutoLabelPoints[center=I,red,font=\scriptsize]%
(A,B,C)
(A,B,C,Ia,Ib,Ic)
\end{tikzpicture}
```

17.0.3 Option : "ex" ou "Excentral"

The excentral triangle of a triangle *ABC* is the triangle *JaJbJc* with vertices corresponding to the excenters of *ABC*.

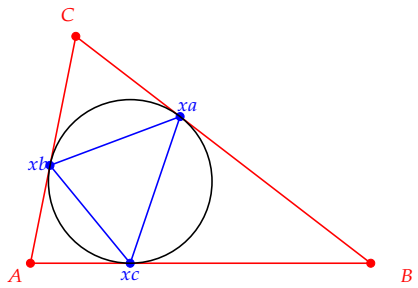



```
\begin{tikzpicture}[scale=.6]
 \tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
 \tkzDefSpcTriangle[excentral,name=J](A,B,C){a,b,c}
 \tkzDefSpcTriangle[extouch,name=T](A,B,C){a,b,c}
 \tkzDrawPolygon[blue](A,B,C)
 \tkzDrawPolygon[red](Ja,Jb,Jc)
 \tkzDrawPoints(A,B,C)
 \tkzDrawPoints[red](Ja,Jb,Jc)
 \tkzLabelPoints(A,B,C)
 \tkzLabelPoints[red](Jb,Jc)
 \tkzLabelPoints[red,above](Ja)
 \tkzClipBB \tkzShowBB
 \tkzDrawCircles[gray](Ja,Ta Jb,Tb Jc,Tc)
\end{tikzpicture}
```

17.0.4 Option : "intouch"

The contact triangle of a triangle ABC, also called the intouch triangle, is the triangle formed by the points of tangency of the incircle of *ABC* with *ABC*.
Weisstein, Eric W. "Contact triangle" From MathWorld–A Wolfram Web Resource.

We obtain the intersections of the bisectors with the sides.

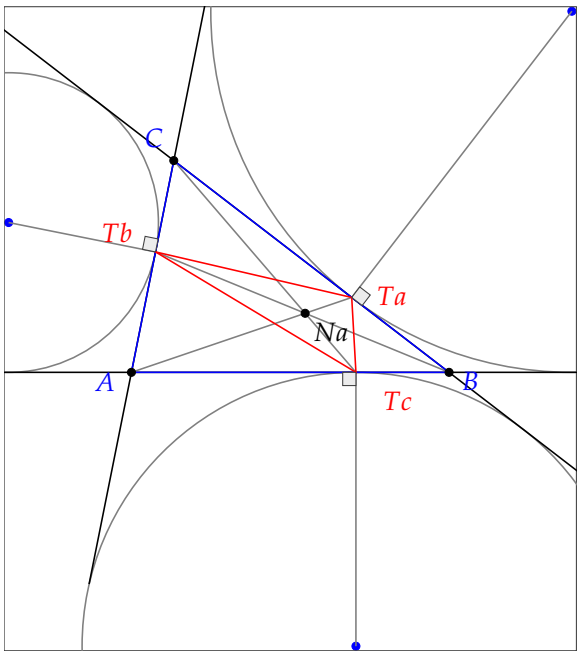



```
\begin{tikzpicture}[scale=.75]
 \tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
 \tkzDefSpcTriangle[intouch,name=x](A,B,C){a,b,c}
 \tkzInCenter(A,B,C)\tkzGetPoint{I}
 \tkzDrawPolygon[red](A,B,C)
 \tkzDrawPolygon[blue](xa,xb,xc)
 \tkzDrawPoints[red](A,B,C)
 \tkzDrawPoints[blue](xa,xb,xc)
 \tkzDrawCircle[in](A,B,C)
 \tkzAutoLabelPoints[center=I,blue,font=\scriptsize]%
(xa,xb,xc)
 \tkzAutoLabelPoints[center=I,red,font=\scriptsize]%
(A,B,C)
\end{tikzpicture}
```

17.0.5 Option : "extouch"

The extouch triangle $TaTbTc$ is the triangle formed by the points of tangency of a triangle ABC with its excircles Ja, Jb, and Jc. The points Ta, Tb, and Tc can also be constructed as the points which bisect the perimeter of $A_1A_2A_3$ starting at A, B, and C.
Weisstein, Eric W. "Extouch triangle" From MathWorld–A Wolfram Web Resource.

We obtain the points of contact of the exinscribed circles as well as the triangle formed by the centres of the exinscribed circles.

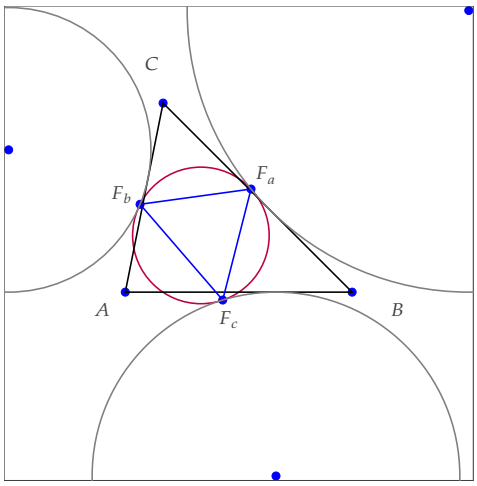



```
\begin{tikzpicture}[scale=.7]
\tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
\tkzDefSpcTriangle[excentral,
                   name=J](A,B,C){a,b,c}
\tkzDefSpcTriangle[extouch,
                    name=T](A,B,C){a,b,c}
\tkzDefTriangleCenter[nagel](A,B,C)
\tkzGetPoint{Na}
\tkzDefTriangleCenter[centroid](A,B,C)
\tkzGetPoint{G}
\tkzDrawPoints[blue](Ja,Jb,Jc)
\tkzClipBB \tkzShowBB
\tkzDrawCircles[gray](Ja,Ta Jb,Tb Jc,Tc)
\tkzDrawLines[add=1 and 1](A,B B,C C,A)
\tkzDrawSegments[gray](A,Ta B,Tb C,Tc)
\tkzDrawSegments[gray](Ja,Ta Jb,Tb Jc,Tc)
\tkzDrawPolygon[blue](A,B,C)
\tkzDrawPolygon[red](Ta,Tb,Tc)
\tkzDrawPoints(A,B,C,Na)
\tkzLabelPoints(Na)
\tkzAutoLabelPoints[center=Na,blue](A,B,C)
\tkzAutoLabelPoints[center=G,red,
                           dist=.4](Ta,Tb,Tc)
\tkzMarkRightAngles[fill=gray!15](Ja,Ta,B
 Jb,Tb,C Jc,Tc,A)
\end{tikzpicture}
```

17.0.6 Option : "feuerbach"

The Feuerbach triangle is the triangle formed by the three points of tangency of the nine-point circle with the excircles.
Weisstein, Eric W. "Feuerbach triangle" From MathWorld–A Wolfram Web Resource.

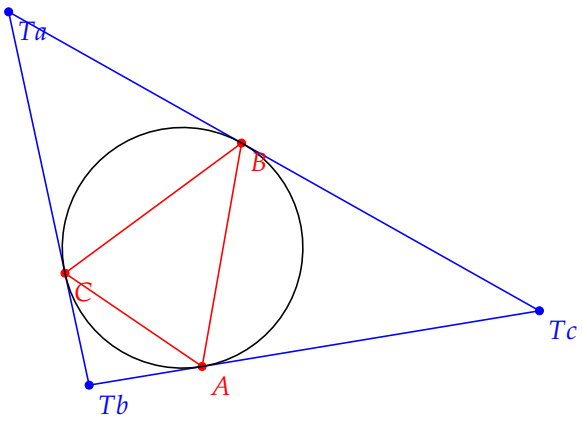
The points of tangency define the Feuerbach triangle.




```
\begin{tikzpicture}[scale=1]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(3,0){B}
  \tkzDefPoint(0.5,2.5){C}
  \tkzDefCircle[euler](A,B,C) \tkzGetPoint{N}
  \tkzDefSpcTriangle[feuerbach,
                     name=F](A,B,C){_a,_b,_c}
  \tkzDefSpcTriangle[excentral,
                     name=J](A,B,C){_a,_b,_c}
  \tkzDefSpcTriangle[extouch,
                      name=T](A,B,C){_a,_b,_c}
  \tkzDrawPoints[blue](J_a,J_b,J_c,F_a,F_b,F_c,A,B,C)
  \tkzClipBB \tkzShowBB
  \tkzDrawCircle[purple](N,F_a)
  \tkzDrawPolygon(A,B,C)
  \tkzDrawPolygon[blue](F_a,F_b,F_c)
  \tkzDrawCircles[gray](J_a,F_a J_b,F_b J_c,F_c)
  \tkzAutoLabelPoints[center=N,dist=.3,
   font=\scriptsize](A,B,C,F_a,F_b,F_c,J_a,J_b,J_c)
\end{tikzpicture}
```

17.0.7 Option Triangle "tangential"

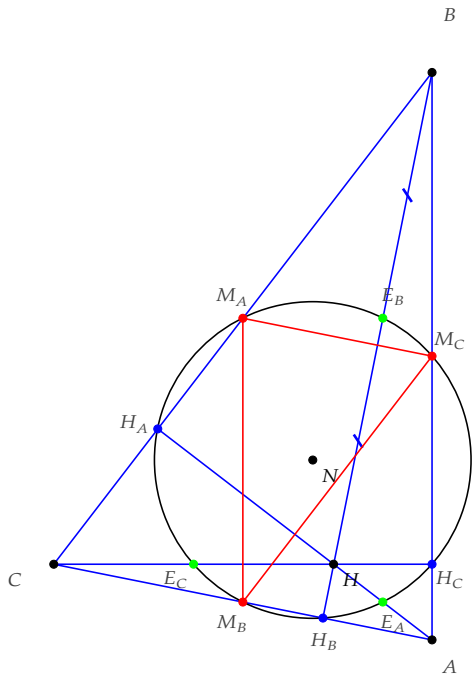
The tangential triangle is the triangle $T_AT_BT_C$formed by the lines tangent to the circumcircle of a given triangle ABC at its vertices. It is therefore antipedal triangle of ABC with respect to the circumcenter O. Weisstein, Eric W. "Tangential Triangle." From MathWorld–A Wolfram Web Resource.




```
\begin{tikzpicture}[scale=.5,rotate=80]
  \tkzDefPoints{0/0/A,6/0/B,1.8/4/C}
  \tkzDefSpcTriangle[tangential,
    name=T](A,B,C){a,b,c}
  \tkzDrawPolygon[red](A,B,C)
  \tkzDrawPolygon[blue](Ta,Tb,Tc)
  \tkzDrawPoints[red](A,B,C)
  \tkzDrawPoints[blue](Ta,Tb,Tc)
  \tkzDefCircle[circum](A,B,C)
  \tkzGetPoint{O}
  \tkzDrawCircle(O,A)
  \tkzLabelPoints[red](A,B,C)
  \tkzLabelPoints[blue](Ta,Tb,Tc)
\end{tikzpicture}
```

17.0.8 Option Triangle "euler"

The Euler triangle of a triangle ABC is the triangle $E_AE_BE_C$ whose vertices are the midpoints of the segments joining the orthocenter H with the respective vertices. The vertices of the triangle are known as the Euler points, and lie on the nine-point circle.




```
\begin{tikzpicture}[rotate=90,scale=1.25]
 \tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
 \tkzDefSpcTriangle[medial,
     name=M](A,B,C){_A,_B,_C}
 \tkzDefTriangleCenter[euler](A,B,C)
     \tkzGetPoint{N} % I= N nine points
 \tkzDefTriangleCenter[ortho](A,B,C)
        \tkzGetPoint{H}
 \tkzDefMidPoint(A,H) \tkzGetPoint{E_A}
 \tkzDefMidPoint(C,H) \tkzGetPoint{E_C}
 \tkzDefMidPoint(B,H) \tkzGetPoint{E_B}
 \tkzDefSpcTriangle[ortho,name=H](A,B,C){_A,_B,_C}
 \tkzDrawPolygon[color=blue](A,B,C)
 \tkzDrawCircle(N,E_A)
 \tkzDrawSegments[blue](A,H_A B,H_B C,H_C)
 \tkzDrawPoints(A,B,C,N,H)
 \tkzDrawPoints[red](M_A,M_B,M_C)
 \tkzDrawPoints[blue]( H_A,H_B,H_C)
 \tkzDrawPoints[green](E_A,E_B,E_C)
 \tkzAutoLabelPoints[center=N,font=\scriptsize]%
(A,B,C,M_A,M_B,M_C,H_A,H_B,H_C,E_A,E_B,E_C)
\tkzLabelPoints[font=\scriptsize](H,N)
\tkzMarkSegments[mark=s|,size=3pt,
  color=blue,line width=1pt](B,E_B E_B,H)
   \tkzDrawPolygon[color=red](M_A,M_B,M_C)
\end{tikzpicture}
```

18 Definition of polygons

18.1 Defining the points of a square

We have seen the definitions of some triangles. Let us look at the definitions of some quadrilaterals and regular polygons.

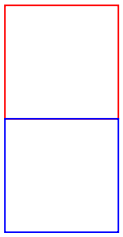
\tkzDefSquare(⟨pt1,pt2⟩)

The square is defined in the forward direction. From two points, two more points are obtained such that the four taken in order form a square. The square is defined in the forward direction. The results are in **tkzFirstPointResult** and **tkzSecondPointResult**.
We can rename them with **\tkzGetPoints**

Arguments	example	explication
⟨pt1,pt2⟩	**\tkzDefSquare**(⟨A,B⟩)	The square is defined in the direct direction

18.1.1 Using \tkzDefSquare with two points

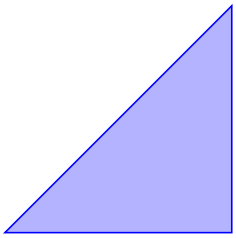
Note the inversion of the first two points and the result.



```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoint(0,0){A} \tkzDefPoint(3,0){B}
  \tkzDefSquare(A,B)
  \tkzDrawPolygon[color=red](A,B,tkzFirstPointResult,%
                tkzSecondPointResult)
  \tkzDefSquare(B,A)
  \tkzDrawPolygon[color=blue](B,A,tkzFirstPointResult,%
                tkzSecondPointResult)
\end{tikzpicture}
```

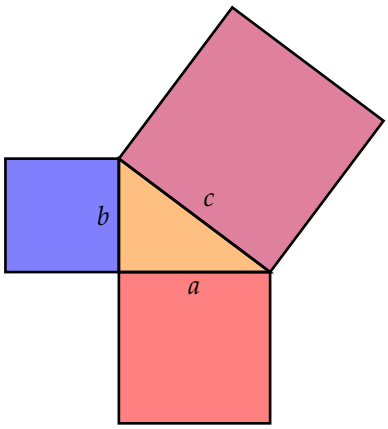
We may only need one point to draw an isosceles right-angled triangle so we use **\tkzGetFirstPoint** or **\tkzGetSecondPoint**

18.1.2 Use of \tkzDefSquare to obtain an isosceles right-angled triangle



```
\begin{tikzpicture}[scale=1]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(3,0){B}
  \tkzDefSquare(A,B) \tkzGetFirstPoint{C}
  \tkzDrawPolygon[color=blue,fill=blue!30](A,B,C)
\end{tikzpicture}
```

18.1.3 Pythagorean Theorem and \tkzDefSquare




```
\begin{tikzpicture}[scale=.5]
\tkzInit
\tkzDefPoint(0,0){C}
\tkzDefPoint(4,0){A}
\tkzDefPoint(0,3){B}
\tkzDefSquare(B,A)\tkzGetPoints{E}{F}
\tkzDefSquare(A,C)\tkzGetPoints{G}{H}
\tkzDefSquare(C,B)\tkzGetPoints{I}{J}
\tkzFillPolygon[fill = red!50 ](A,C,G,H)
\tkzFillPolygon[fill = blue!50 ](C,B,I,J)
\tkzFillPolygon[fill = purple!50](B,A,E,F)
\tkzFillPolygon[fill = orange,opacity=.5](A,B,C)
\tkzDrawPolygon[line width = 1pt](A,B,C)
\tkzDrawPolygon[line width = 1pt](A,C,G,H)
\tkzDrawPolygon[line width = 1pt](C,B,I,J)
\tkzDrawPolygon[line width = 1pt](B,A,E,F)
\tkzLabelSegment[](A,C){$a$}
\tkzLabelSegment[](C,B){$b$}
\tkzLabelSegment[swap](A,B){$c$}
\end{tikzpicture}
```

18.2 Definition of parallelogram

18.3 Defining the points of a parallelogram

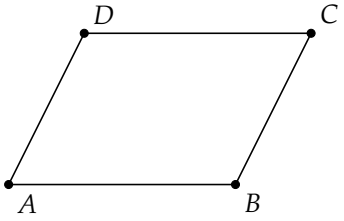
It is a matter of completing three points in order to obtain a parallelogram.

\tkzDefParallelogram(⟨pt1,pt2,pt3⟩)

From three points, another point is obtained such that the four taken in order form a parallelogram. The result is in **tkzPointResult**.
We can rename it with the name **\tkzGetPoint**...

arguments	default	definition
⟨pt1,pt2,pt3⟩	no default	Three points are necessary

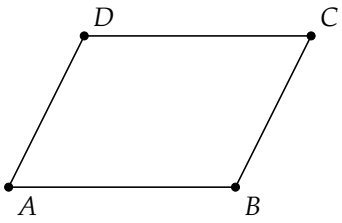
18.3.1 Example of a parallelogram definition




```
\begin{tikzpicture}[scale=1]
 \tkzDefPoints{0/0/A,3/0/B,4/2/C}
 \tkzDefParallelogram(A,B,C)
 \tkzGetPoint{D}
 \tkzDrawPolygon(A,B,C,D)
 \tkzLabelPoints(A,B)
 \tkzLabelPoints[above right](C,D)
 \tkzDrawPoints(A,...,D)
\end{tikzpicture}
```

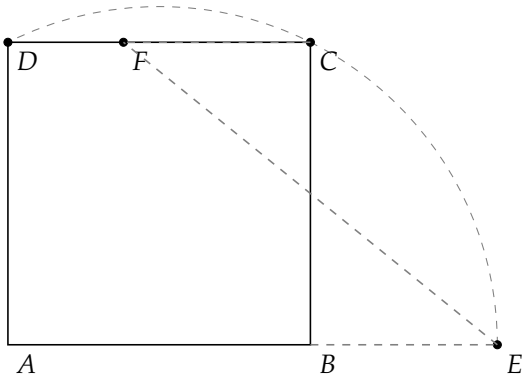
18.3.2 Simple example

Explanation of the definition of a parallelogram




```
\begin{tikzpicture}[scale=1]
  \tkzDefPoints{0/0/A,3/0/B,4/2/C}
  \tkzDefPointWith[colinear= at C](B,A)
  \tkzGetPoint{D}
  \tkzDrawPolygon(A,B,C,D)
  \tkzLabelPoints(A,B)
  \tkzLabelPoints[above right](C,D)
  \tkzDrawPoints(A,...,D)
\end{tikzpicture}
```

18.3.3 Construction of the golden rectangle




```
\begin{tikzpicture}[scale=.5]
  \tkzInit[xmax=14,ymax=10]
  \tkzClip[space=1]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(8,0){B}
  \tkzDefMidPoint(A,B)\tkzGetPoint{I}
  \tkzDefSquare(A,B)\tkzGetPoints{C}{D}
  \tkzDrawSquare(A,B)
  \tkzInterLC(A,B)(I,C)\tkzGetPoints{G}{E}
  \tkzDrawArc[style=dashed,color=gray](I,E)(D)
  \tkzDefPointWith[colinear= at C](E,B)
  \tkzGetPoint{F}
  \tkzDrawPoints(C,D,E,F)
  \tkzLabelPoints(A,B,C,D,E,F)
  \tkzDrawSegments[style=dashed,color=gray]%
(E,F C,F B,E)
\end{tikzpicture}
```

18.4 Drawing a square

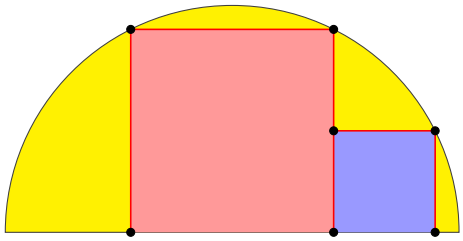
\tkzDrawSquare[⟨local options⟩](⟨pt1,pt2⟩)

The macro draws a square but not the vertices. It is possible to color the inside. The order of the points is that of the direct direction of the trigonometric circle.

arguments	example	explication
(⟨pt1,pt2⟩)	**\tkzDrawSquare**(⟨A,B⟩)	**\tkzGetPoints{C}{D}**

options	example	explication
Options TikZ	red,line width=1pt	

18.4.1 The idea is to inscribe two squares in a semi-circle.



```
\begin{tikzpicture}[scale=.75]
   \tkzInit[ymax=8,xmax=8]
 \tkzClip[space=.25]     \tkzDefPoint(0,0){A}
 \tkzDefPoint(8,0){B}  \tkzDefPoint(4,0){I}
 \tkzDefSquare(A,B)     \tkzGetPoints{C}{D}
 \tkzInterLC(I,C)(I,B) \tkzGetPoints{E'}{E}
 \tkzInterLC(I,D)(I,B) \tkzGetPoints{F'}{F}
 \tkzDefPointsBy[projection=onto A--B](E,F){H,G}
 \tkzDefPointsBy[symmetry    = center H](I){J}
 \tkzDefSquare(H,J)     \tkzGetPoints{K}{L}
 \tkzDrawSector[fill=yellow](I,B)(A)
 \tkzFillPolygon[color=red!40](H,E,F,G)
 \tkzFillPolygon[color=blue!40](H,J,K,L)
 \tkzDrawPolySeg[color=red](H,E,F,G)
 \tkzDrawPolySeg[color=red](J,K,L)
 \tkzDrawPoints(E,G,H,F,J,K,L)
\end{tikzpicture}
```

18.5 The golden rectangle

\tkzDefGoldRectangle(⟨point,point⟩)

The macro determines a rectangle whose size ratio is the number Φ. The created points are in **tkzFirstPointResult** and **tkzSecondPointResult**. They can be obtained with the macro **\tkzGetPoints**. The following macro is used to draw the rectangle.

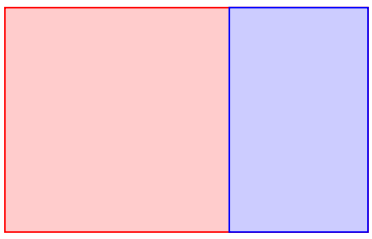
arguments	example	explication
⟨pt1,pt2⟩	⟨A,B⟩	Si C et D sont créés alors $AB/BC = \Phi$

\tkzDrawGoldRectangle[⟨local options⟩](⟨point,point⟩)

arguments	example	explication
⟨pt1,pt2⟩	⟨A,B⟩	Draws the golden rectangle based on the segment $[AB]$

options	example	explication
Options TikZ	red,line width=1pt	

18.5.1 Golden Rectangles



```
\begin{tikzpicture}[scale=.6]
 \tkzDefPoint(0,0){A}      \tkzDefPoint(8,0){B}
 \tkzDefGoldRectangle(A,B) \tkzGetPoints{C}{D}
 \tkzDefGoldRectangle(B,C) \tkzGetPoints{E}{F}
 \tkzDrawPolygon[color=red,fill=red!20](A,B,C,D)
 \tkzDrawPolygon[color=blue,fill=blue!20](B,C,E,F)
\end{tikzpicture}
```

18.6 Drawing a polygon

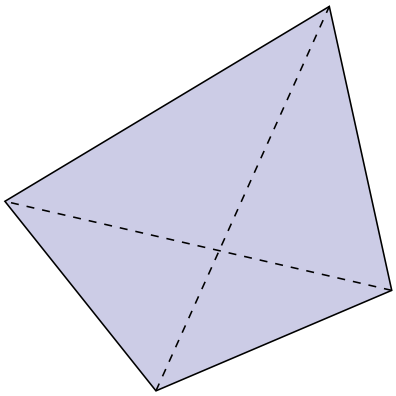
\tkzDrawPolygon[⟨local options⟩](⟨liste de points⟩)

Just give a list of points and the macro plots the polygon using the TikZ options present.

arguments	example	explication
(⟨pt1,pt2,pt3,...⟩)	\tkzDrawPolygon[gray,dashed](A,B,C)	Drawing a triangle

options	default	example
Options TikZ	...	\tkzDrawPolygon[red,line width=2pt](A,B,C)

18.6.1 Draw a polygon 1



```
\begin{tikzpicture} [rotate=18,scale=1.5]
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(2.25,0.2){B}
 \tkzDefPoint(2.5,2.75){C}
 \tkzDefPoint(-0.75,2){D}
 \tkzDrawPolygon[fill=black!50!blue!20!](A,B,C,D)
 \tkzDrawSegments[style=dashed](A,C B,D)
\end{tikzpicture}
```

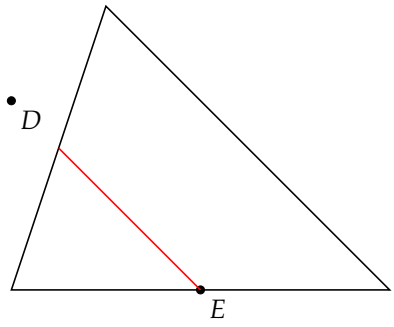
18.7 Clip a polygon

\tkzClipPolygon[⟨local options⟩](⟨points list⟩)

This macro makes it possible to contain the different plots in the designated polygon.

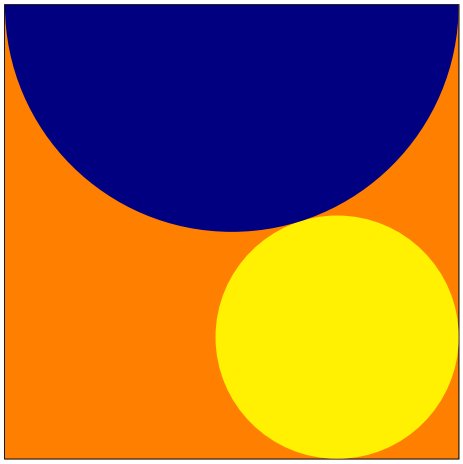
options	example	explication
(⟨pt1,pt2⟩)	(⟨A,B⟩)	

18.7.1 Simple Example




```
\begin{tikzpicture}[scale=1.25]
 \tkzInit[xmin=0,xmax=4,ymin=0,ymax=3]
 \tkzClip[space=.5]
 \tkzDefPoint(0,0){A} \tkzDefPoint(4,0){B}
 \tkzDefPoint(1,3){C} \tkzDrawPolygon(A,B,C)
 \tkzDefPoint(0,2){D}  \tkzDefPoint(2,0){E}
 \tkzDrawPoints(D,E) \tkzLabelPoints(D,E)
 \tkzClipPolygon(A,B,C)
 \tkzDrawLine[color=red](D,E)
\end{tikzpicture}
```

18.7.2 Example Sangaku in a square



```
\begin{tikzpicture}[scale=.75]
 \tkzDefPoint(0,0){A} \tkzDefPoint(8,0){B}
 \tkzDefSquare(A,B) \tkzGetPoints{C}{D}
 \tkzDrawPolygon(B,C,D,A)
 \tkzClipPolygon(B,C,D,A)
 \tkzDefPoint(4,8){F}
 \tkzDefTriangle[equilateral](C,D)
 \tkzGetPoint{I}
 \tkzDrawPoint(I)
 \tkzDefPointBy[projection=onto B--C](I)
 \tkzGetPoint{J}
 \tkzInterLL(D,B)(I,J)  \tkzGetPoint{K}
 \tkzDefPointBy[symmetry=center K](B)
 \tkzGetPoint{M}
 \tkzDrawCircle(M,I)
 \tkzCalcLength(M,I)   \tkzGetLength{dMI}
 \tkzFillPolygon[color = orange](A,B,C,D)
 \tkzFillCircle[R,color = yellow](M,\dMI pt)
 \tkzFillCircle[R,color = blue!50!black](F,4 cm)%
\end{tikzpicture}
```

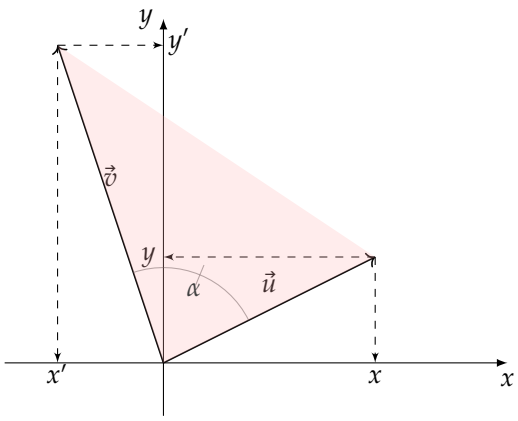
18.8 Color a polygon

\tkzFillPolygon[⟨local options⟩](⟨points list⟩)

You can color by drawing the polygon, but in this case you color the inside of the polygon without drawing it.

options	example	explication
(⟨pt1,pt2,…⟩)	(⟨A,B,…⟩)	

18.8.1 Color a polygon




```
\begin{tikzpicture}[scale=0.7]
\tkzInit[xmin=-3,xmax=6,ymin=-1,ymax=6]
\tkzDrawX[noticks]
\tkzDrawY[noticks]
\tkzDefPoint(0,0){O}  \tkzDefPoint(4,2){A}
\tkzDefPoint(-2,6){B}
\tkzPointShowCoord[xlabel=$x$,ylabel=$y$](A)
\tkzPointShowCoord[xlabel=$x'$,ylabel=$y'$,%
                   ystyle={right=2pt}](B)
\tkzDrawSegments[->](O,A O,B)
\tkzLabelSegment[above=3pt](O,A){$\vec{u}$}
\tkzLabelSegment[above=3pt](O,B){$\vec{v}$}
\tkzMarkAngle[fill= yellow,size=1.8cm,%
              opacity=.5](A,O,B)
\tkzFillPolygon[red!30,opacity=0.25](A,B,O)
\tkzLabelAngle[pos = 1.5](A,O,B){$\alpha$}
\end{tikzpicture}
```

19 The Circles

Among the following macros, one will allow you to draw a circle, which is not a real feat. To do this, you will need to know the center of the circle and either the radius of the circle or a point on the circumference. It seemed to me that the most frequent use was to draw a circle with a given centre passing through a given point. This will be the default method, otherwise you will have to use the **R** option. There are a large number of special circles, for example the circle circumscribed by a triangle.

- I have created a first macro **\tkzDefCircle** which allows, according to a particular circle, to retrieve its center and the measurement of the radius in cm. This recovery is done with the macros **\tkzGetPoint** and **\tkzGetLength**,
- then a macro **\tkzDrawCircle**
- then a macro that allows you to color in a disc, but without drawing the circle **\tkzFillCircle**
- sometimes, it is necessary for a drawing to be contained in a disk this is the role assigned to **\tkzClipCircle**,
- It finally remains to be able to give a label to designate a circle and if several possibilities are offered, we will see here **\tkzLabelCircle**.

19.1 Characteristics of a circle : \tkzDefCircle

This macro allows you to retrieve the characteristics (center and radius) of certain circles.

\tkzDefCircle[⟨local options⟩](⟨A,B⟩) ou (⟨A,B,C⟩)

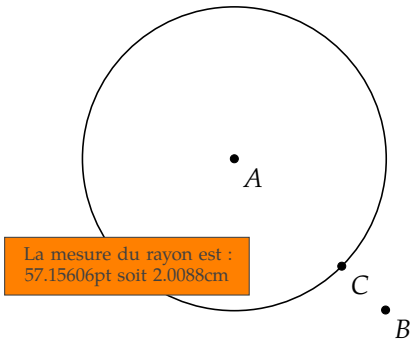
Attention the arguments are lists of two or three points. This macro is either used in partnership with **\tkzGetPoint** and/or **\tkzGetLength** to obtain the center and the radius of the circle, or by using **tkzPointResult** and **tkzLengthResult** if it is not necessary to keep the results.

arguments	exemple	explication
(⟨pt1,pt2⟩) or (⟨pt1,pt2,pt3⟩)	(⟨A,B⟩)	[AB] is radius A is the center

options	derror	definition
through	through	circle characterized by two points defining a radius
diameter	through	circle characterized by two points defining a diameter
circum	through	circle circumscribed of a triangle
in	through	incircle a triangle
ex	through	excircle of a triangle
euler or nine	through	Euler's Circle
spieker	through	Spieker Circle
apollonius	through	circle of Apollonius
orthogonal	through	circle of given centre orthogonal to another circle
orthogonal through	through	circle orthogonal circle passing through 2 points
K	1	coefficient used for a circle of Apollonius

In the following examples, I draw the circles with a macro not yet presented, but this is not necessary. In some cases you may only need the center or the radius.

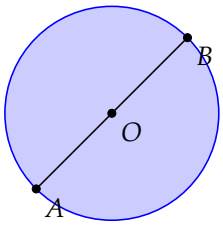
19.1.1 Example with a random point and the option through




```
\begin{tikzpicture}[scale=1]
\tkzDefPoint(0,4){A}
\tkzDefPoint(2,2){B}
\tkzDefMidPoint(A,B) \tkzGetPoint{I}
\tkzDefRandPointOn[segment = I--B]
 \tkzGetPoint{C}
\tkzDefCircle[through](A,C)
\tkzGetLength{rACpt}
\tkzpttocm(\rACpt){rACcm}
\tkzDrawCircle(A,C)
\tkzDrawPoints(A,B,C)
\tkzLabelPoints(A,B,C)
\tkzLabelCircle[draw,fill=orange,
         text width=3cm,text centered,
         font=\scriptsize](A,C)(-90)%
{La mesure du rayon est :
 \rACpt pt soit \rACcm cm}
\end{tikzpicture}
```

19.1.2 Example with the option diameter

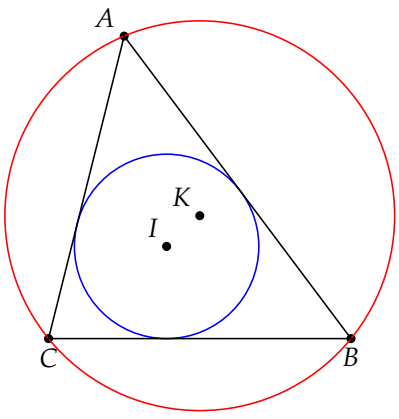
It is simpler here to search directly for the middle of AB




```
\begin{tikzpicture}[scale=1]
   \tkzDefPoint(0,0){A}
   \tkzDefPoint(2,2){B}
   \tkzDefCircle[diameter](A,B)
   \tkzGetPoint{O}
   \tkzDrawCircle[blue,fill=blue!20](O,B)
   \tkzDrawSegment(A,B)
   \tkzDrawPoints(A,B,O)
   \tkzLabelPoints(A,B,O)
\end{tikzpicture}
```

19.1.3 Circles inscribed and circumscribed for a given triangle

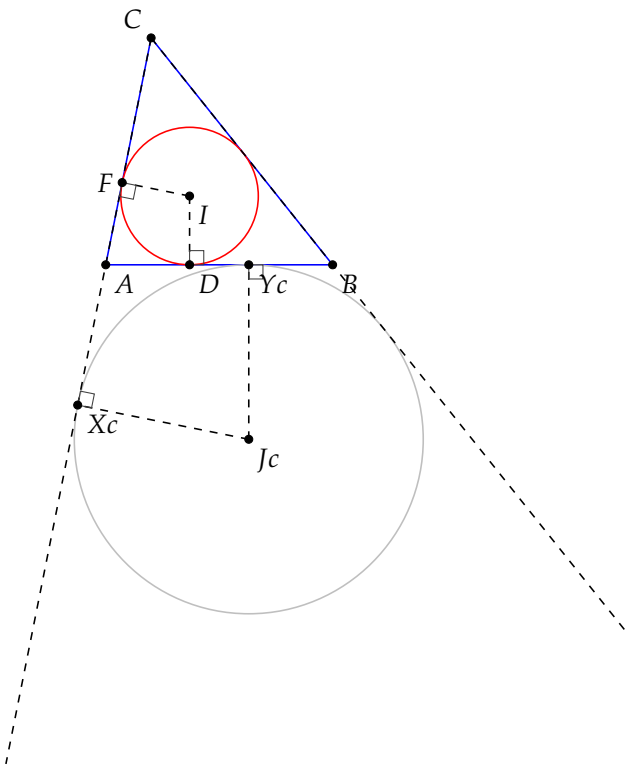
You can also obtain the center of the inscribed circle and its projection on one side of the triangle with **\tkzGetFirstPointI** et **\tkzGetSecondPointIb**.




```
\begin{tikzpicture}[scale=1]
   \tkzDefPoint(2,2){A}
   \tkzDefPoint(5,-2){B}
   \tkzDefPoint(1,-2){C}
   \tkzDefCircle[in](A,B,C)
   \tkzGetPoint{I}    \tkzGetLength{rIN}
   \tkzDefCircle[circum](A,B,C)
   \tkzGetPoint{K}   \tkzGetLength{rCI}
   \tkzDrawPoints(A,B,C,I,K)
   \tkzDrawCircle[R,blue](I,\rIN pt)
   \tkzDrawCircle[R,red](K,\rCI pt)
   \tkzLabelPoints[below](B,C)
   \tkzLabelPoints[above left](A,I,K)
   \tkzDrawPolygon(A,B,C)
\end{tikzpicture}
```

19.1.4 Example with the option ex

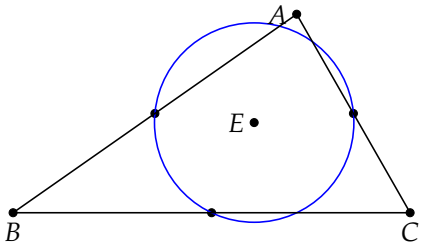
We want to define an excircle of a triangle relativement au point C




```
\begin{tikzpicture}[scale=.75]
\tkzDefPoints{ 0/0/A,4/0/B,0.8/4/C}
\tkzDefCircle[ex](B,C,A)
  \tkzGetPoint{Jc} \tkzGetLength{rc}
\tkzDefPointBy[projection=onto A--C ](Jc)
  \tkzGetPoint{Xc}
  \tkzDefPointBy[projection=onto A--B ](Jc)
  \tkzGetPoint{Yc}
  \tkzGetPoint{I}
  \tkzDrawPolygon[color=blue](A,B,C)
  \tkzDrawCircle[R,color=lightgray](Jc,\rc pt)
  % possible  \tkzDrawCircle[ex](A,B,C)
  \tkzDrawCircle[in,color=red](A,B,C)    \tkzGetPoint{I}
\tkzDefPointBy[projection=onto A--C ](I)
  \tkzGetPoint{F}
\tkzDefPointBy[projection=onto A--B ](I)
  \tkzGetPoint{D}
\tkzDrawLines[add=0 and 2.2,dashed](C,A C,B)
\tkzDrawSegments[dashed](Jc,Xc I,D  I,F Jc,Yc)
\tkzMarkRightAngles(A,F,I B,D,I Jc,Xc,A Jc,Yc,B)
\tkzDrawPoints(B,C,A,I,D,F,Xc,Jc,Yc)
  \tkzLabelPoints(B,A,Jc,I,D,Xc,Yc)
  \tkzLabelPoints[above left](C)
\tkzLabelPoints[left](F)
\end{tikzpicture}
```

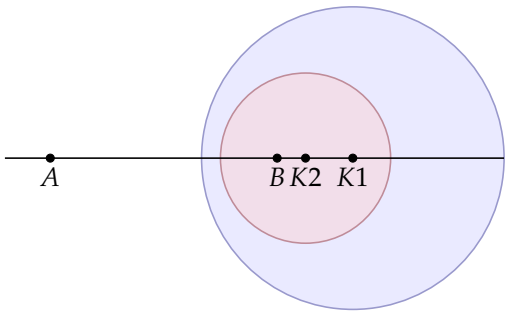
19.1.5 Euler's circle for a given triangle

We verify that this circle passes through the middle of each side.




```
\begin{tikzpicture}[scale=.75]
   \tkzDefPoint(5,3.5){A}
   \tkzDefPoint(0,0){B} \tkzDefPoint(7,0){C}
   \tkzDefCircle[euler](A,B,C)
   \tkzGetPoint{E}  \tkzGetLength{rEuler}
   \tkzDefSpcTriangle[medial](A,B,C){Ma,Mb,Mc}
   \tkzDrawPoints(A,B,C,E,Ma,Mb,Mc)
   \tkzDrawCircle[R,blue](E,\rEuler pt)
   \tkzDrawPolygon(A,B,C)
   \tkzLabelPoints[below](B,C)
   \tkzLabelPoints[left](A,E)
\end{tikzpicture}
```

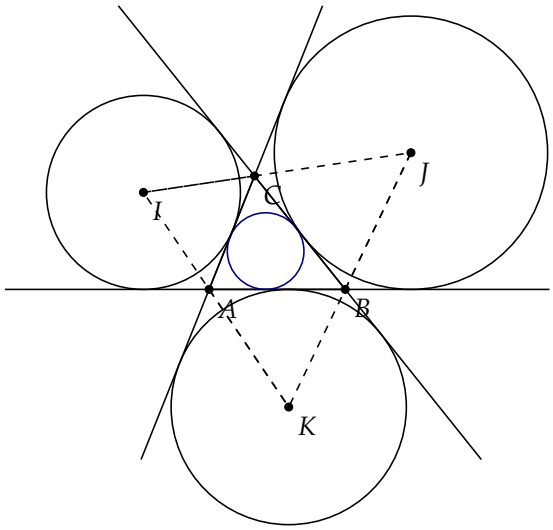
19.1.6 Coloured Apollonius circles for a given segment




```
\begin{tikzpicture}[scale=0.75]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(4,0){B}
  \tkzDefCircle[apollonius,K=2](A,B)
  \tkzGetPoint{K1}
  \tkzGetLength{rAp}
  \tkzDrawCircle[R,color = blue!50!black,
      fill=blue!20,opacity=.4](K1,\rAp pt)
  \tkzDefCircle[apollonius,K=3](A,B)
  \tkzGetPoint{K2}   \tkzGetLength{rAp}
  \tkzDrawCircle[R,color=red!50!black,
   fill=red!20,opacity=.4](K2,\rAp pt)
  \tkzLabelPoints[below](A,B,K1,K2)
  \tkzDrawPoints(A,B,K1,K2)
  \tkzDrawLine[add=.2 and 1](A,B)
\end{tikzpicture}
```

19.1.7 Circles exinscribed to a given triangle

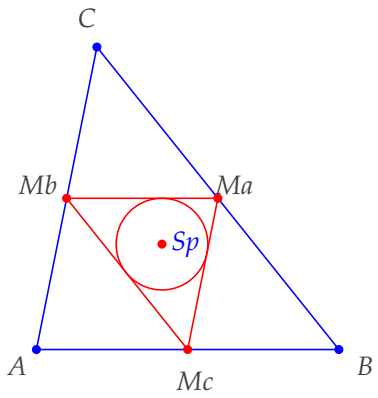
You can also get the center and the projection of it on one side of the triangle.
with **\tkzGetFirstPoint{Jb}** and **\tkzGetSecondPoint{Tb}**.




```
\begin{tikzpicture}[scale=.6]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(3,0){B}
  \tkzDefPoint(1,2.5){C}
  \tkzDefCircle[ex](A,B,C) \tkzGetPoint{I}
    \tkzGetLength{rI}
  \tkzDefCircle[ex](C,A,B) \tkzGetPoint{J}
    \tkzGetLength{rJ}
  \tkzDefCircle[ex](B,C,A) \tkzGetPoint{K}
    \tkzGetLength{rK}
   \tkzDefCircle[in](B,C,A) \tkzGetPoint{O}
     \tkzGetLength{rO}
  \tkzDrawLines[add=1.5 and 1.5](A,B A,C B,C)
  \tkzDrawPoints(I,J,K)
  \tkzDrawPolygon(A,B,C)
  \tkzDrawPolygon[dashed](I,J,K)
  \tkzDrawCircle[R,blue!50!black](O,\rO)
  \tkzDrawSegments[dashed](A,K B,J C,I)
  \tkzDrawPoints(A,B,C)
  \tkzDrawCircles[R](J,{\rJ} I,{\rI} K,{\rK})
  \tkzLabelPoints(A,B,C,I,J,K)
\end{tikzpicture}
```

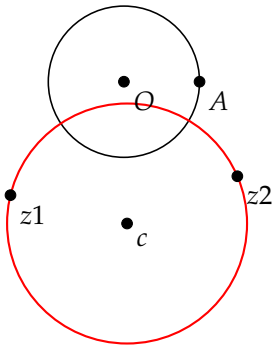
19.1.8 Spieker circle

The incircle of the medial triangle $M_AM_BM_C$ is the Spieker circle



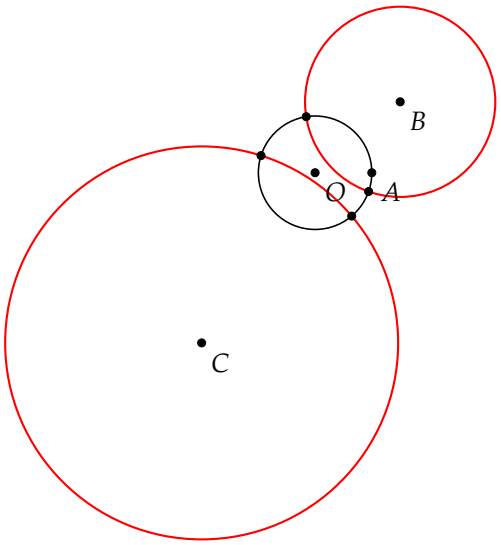

```
\begin{tikzpicture}[scale=1]
  \tkzDefPoints{ 0/0/A,4/0/B,0.8/4/C}
   \tkzDefSpcTriangle[medial](A,B,C){Ma,Mb,Mc}
   \tkzDefTriangleCenter[spieker](A,B,C)
   \tkzGetPoint{Sp}
   \tkzDrawPolygon[blue](A,B,C)
   \tkzDrawPolygon[red](Ma,Mb,Mc)
   \tkzDrawPoints[blue](B,C,A)
   \tkzDrawPoints[red](Ma,Mb,Mc,Sp)
   \tkzDrawCircle[in,red](Ma,Mb,Mc)
   \tkzAutoLabelPoints[center=Sp,dist=.3](Ma,Mb,Mc)
   \tkzLabelPoints[blue,right](Sp)
   \tkzAutoLabelPoints[center=Sp](A,B,C)
\end{tikzpicture}
```

19.1.9 Orthogonal circle passing through two given points




```
\begin{tikzpicture}[scale=1]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(1,0){A}
  \tkzDrawCircle(O,A)
  \tkzDefPoint(-1.5,-1.5){z1}
  \tkzDefPoint(1.5,-1.25){z2}
  \tkzDefCircle[orthogonal through=z1 and z2](O,A)
   \tkzGetPoint{c}
  \tkzDrawCircle[thick,color=red](tkzPointResult,z1)
  \tkzDrawPoints[fill=red,color=black,
  size=4](O,A,z1,z2,c)
  \tkzLabelPoints(O,A,z1,z2,c)
\end{tikzpicture}
```

19.1.10 Orthogonal circle of given center




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoints{0/0/O,1/0/A}
  \tkzDefPoints{1.5/1.25/B,-2/-3/C}
  \tkzDefCircle[orthogonal from=B](O,A)
  \tkzGetPoints{z1}{z2}
  \tkzDefCircle[orthogonal from=C](O,A)
  \tkzGetPoints{t1}{t2}
  \tkzDrawCircle(O,A)
  \tkzDrawCircle[thick,color=red](B,z1)
  \tkzDrawCircle[thick,color=red](C,t1)
  \tkzDrawPoints(t1,t2,C)
  \tkzDrawPoints(z1,z2,O,A,B)
  \tkzLabelPoints(O,A,B,C)
\end{tikzpicture}
```

19.2 Tangent to a circle

Two constructions are proposed. The first one is the construction of a tangent to a circle at a given point of this circle and the second one is the construction of a tangent to a circle passing through a given point

outside a disc.

\tkzDefTangent[⟨local options⟩](⟨pt1,pt2⟩) ou (⟨pt1,dim⟩)

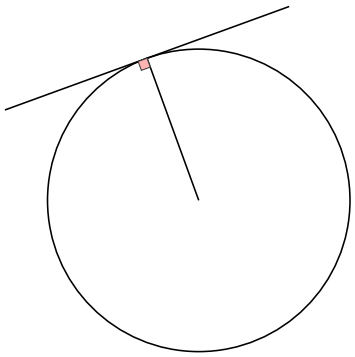
The parameter in brackets is the center of the circle or the center of the circle and a point on the circle or the center and the radius.

arguments	exemple	explication
(⟨pt1,pt2 or (⟨pt1,dim⟩)⟩)	(⟨A,B⟩) or (⟨A,2cm⟩)	$[AB]$ is radius A is the center

options	default	definition
at=pt	at	tangent to a point on the circle
from=pt	at	tangent to a circle passing through a point
from with R=pt	at	idem, but the circle is defined by center = radius

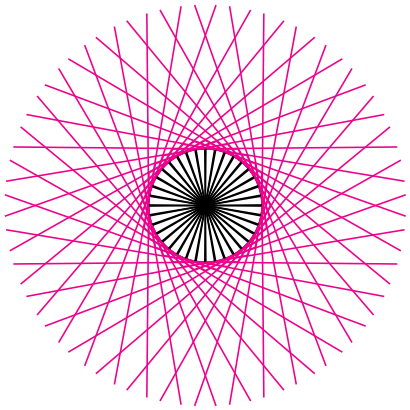
The tangent is not drawn. A second point of the tangent is given by **tkzPointResult**.

19.2.1 Example of a tangent passing through a point on the circle



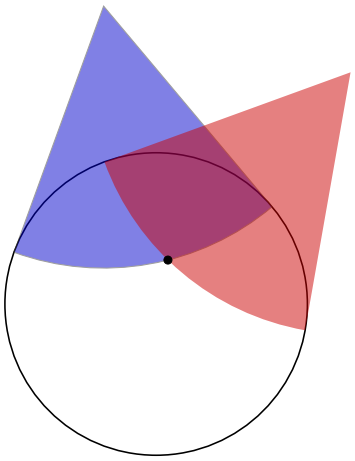
```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(6,6){E}
  \tkzDefRandPointOn[circle=center O radius 4cm]
  \tkzGetPoint{A}
  \tkzDrawSegment(O,A)
  \tkzDrawCircle(O,A)
  \tkzDefTangent[at=A](O)
  \tkzGetPoint{h}
  \tkzDrawLine[add = 4 and 3](A,h)
  \tkzMarkRightAngle[fill=red!30](O,A,h)
\end{tikzpicture}
```

19.2.2 Example of tangents passing through an external point



```
\begin{tikzpicture}[scale=0.75]
  \tkzDefPoint(3,3){c}
  \tkzDefPoint(6,3){a0}
  \tkzRadius=1 cm
  \tkzDrawCircle[R](c,\tkzRadius)
  \foreach \an in {0,10,...,350}{
     \tkzDefPointBy[rotation=center c angle \an](a0)
     \tkzGetPoint{a}
     \tkzDefTangent[from with R = a](c,\tkzRadius)
     \tkzGetPoints{e}{f}
     \tkzDrawLines[color=magenta](a,f a,e)
      \tkzDrawSegments(c,e c,f)
      }%
\end{tikzpicture}
```

19.2.3 Example of Andrew Mertz



```
\begin{tikzpicture}[scale=.5]
\tkzDefPoint(100:8){A}\tkzDefPoint(50:8){B}
\tkzDefPoint(0,0){C} \tkzDefPoint(0,4){R}
\tkzDrawCircle(C,R)
\tkzDefTangent[from = A](C,R)  \tkzGetPoints{D}{E}
\tkzDefTangent[from = B](C,R)  \tkzGetPoints{F}{G}
\tkzDrawSector[fill=blue!80!black,opacity=0.5](A,D)(E)
\tkzFillSector[color=red!80!black,opacity=0.5](B,F)(G)
\tkzInterCC(A,D)(B,F) \tkzGetSecondPoint{I}
\tkzDrawPoint[color=black](I)
\end{tikzpicture}
```

http://www.texample.net/tikz/examples/

20 Draw, Label The Circles

Among the following macros, one will allow you to draw a circle, which is not a real feat. To do this, you will need to know the center of the circle and either the radius of the circle or a point on the circumference. It seemed to me that the most frequent use was to draw a circle with a given centre passing through a given point. This will be the default method, otherwise you will have to use the **R** option.

- ☞ I created a first macro **\tkzDrawCircle**,
- ☞ then a macro that allows you to color a disc, but without drawing the circle. **\tkzFillCircle**,
- ☞ sometimes, it is necessary for a drawing to be contained in a disc is the role assigned to **\tkzClipCircle**,
- ☞ It finally remains to be able to give a label to designate a circle and if several possibilities are offered, we will see here **\tkzLabelCircle**.

20.1 Draw a circle

\tkzDrawCircle[⟨local options⟩](⟨A,B⟩)

☞ Attention the arguments are lists of two points. The circles that can be drawn are the same as in the previous macro. An additional option **R** to give directly a measure.

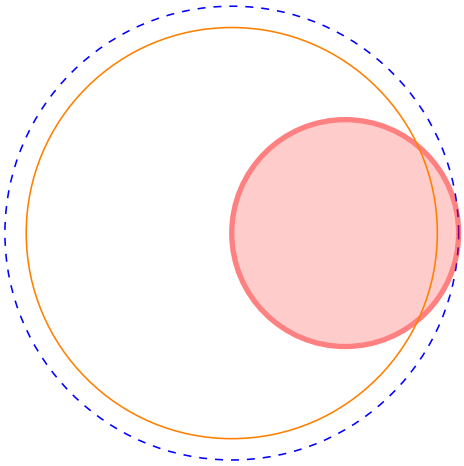
arguments	exemple	explication
(⟨pt1,pt2 pt3,pt4 ...⟩)	(⟨A,B C,D⟩)	List of two points

options	default	definition
through	through	circle with two points defining a radius
diameter	through	circle with two points defining a diameter
R	through	circle characterized by a point and the measurement of a radius

Of course, you have to add all the styles of TikZfor the tracings...

20.1.1 Circles and styles, draw a circle and color the disc

We'll see that it's possible to colour in a disc while tracing the circle.



```
\begin{tikzpicture}
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(3,0){A}
 % cercle de centre O et passant par A
  \tkzDrawCircle[color=blue,style=dashed](O,A)
 % cercle de diamètre $[OA]$
  \tkzDrawCircle[diameter,color=red,%
                 line width=2pt,fill=red!40,%
                 opacity=.5](O,A)
 % cercle de centre O et de rayon = exp(1) cm
  \edef\rayon{\fpeval{exp(1)}}
  \tkzDrawCircle[R,color=orange](O,\rayon cm)
\end{tikzpicture}
```

20.2 Drawing circles

`\tkzDrawCircles[⟨local options⟩](⟨A,B C,D⟩)`

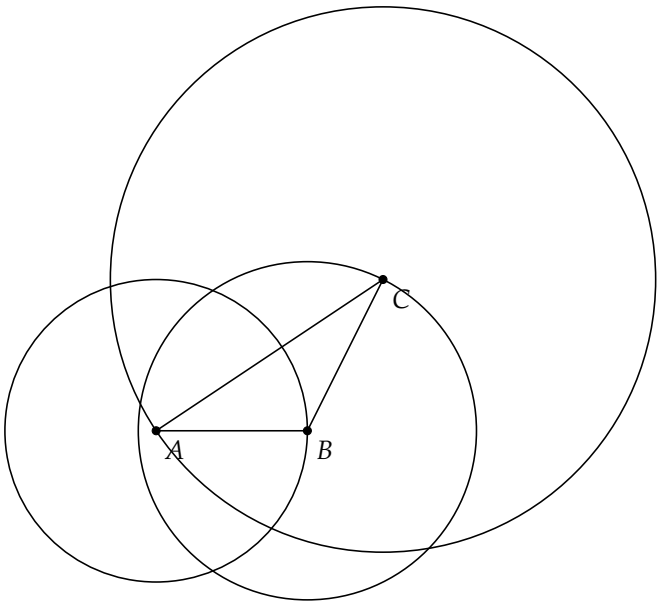
Attention, the arguments are lists of two points. The circles that can be drawn are the same as in the previous macro. An additional option `R` to give directly a measure.

arguments	exemple	explication
(⟨pt1,pt2 pt3,pt4 ...⟩)	(⟨A,B C,D⟩)	List of two points

options	default	definition
through	through	circle with two points defining a radius
diameter	through	circle with two points defining a diameter
R	through	circle characterized by a point and the measurement of a radius

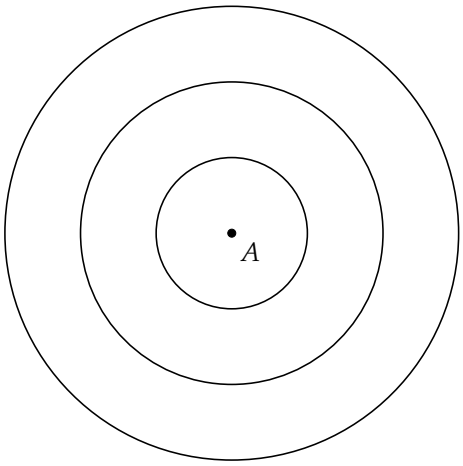
Of course, you have to add all the styles of TikZfor the tracings...

20.2.1 Circles defined by a triangle.



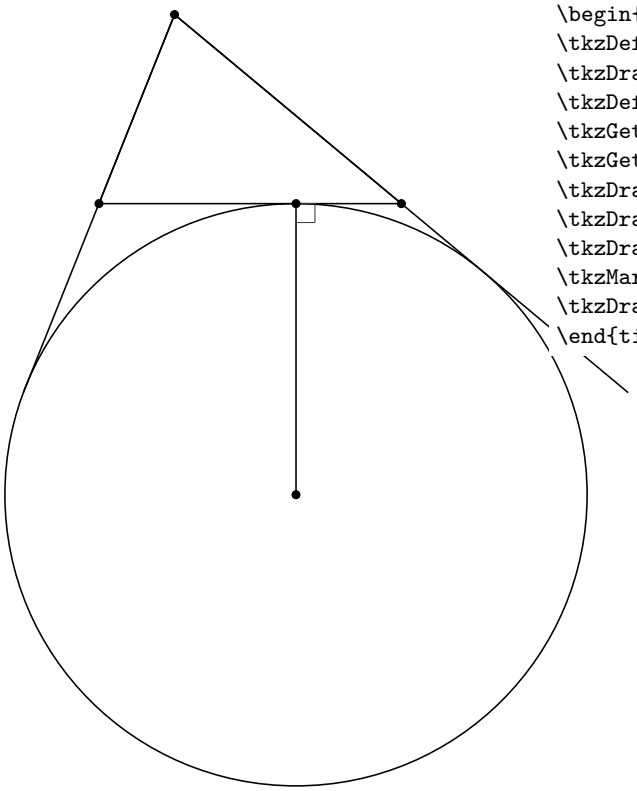

```
\begin{tikzpicture}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(2,0){B}
  \tkzDefPoint(3,2){C}
  \tkzDrawPolygon(A,B,C)
  \tkzDrawCircles(A,B B,C C,A)
  \tkzDrawPoints(A,B,C)
  \tkzLabelPoints(A,B,C)
\end{tikzpicture}
```

20.2.2 Concentric circles.




```
\begin{tikzpicture}
   \tkzDefPoint(0,0){A}
   \tkzDrawCircles[R](A,1cm A,2cm A,3cm)
   \tkzDrawPoint(A)
   \tkzLabelPoints(A)
\end{tikzpicture}
```

20.2.3 Exinscribed circles.

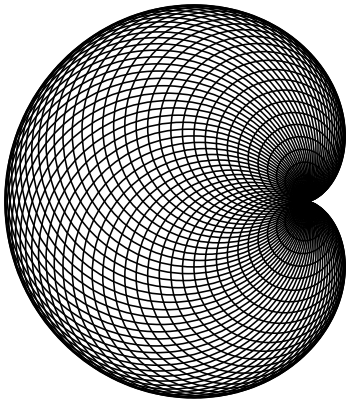


```
\begin{tikzpicture}[scale=1]
\tkzDefPoints{0/0/A,4/0/B,1/2.5/C}
\tkzDrawPolygon(A,B,C)
\tkzDefCircle[ex](B,C,A)
\tkzGetPoint{Jc} \tkzGetSecondPoint{Tc}
\tkzGetLength{rJc}
\tkzDrawCircle[R](Jc,{\rJc pt})
\tkzDrawLines[add=0 and 1](C,A C,B)
\tkzDrawSegment(Jc,Tc)
\tkzMarkRightAngle(Jc,Tc,B)
\tkzDrawPoints(A,B,C,Jc,Tc)
\end{tikzpicture}
```

20.2.4 Cardioid

Based on an idea by O. Reboux made with pst-eucl (Pstricks module) by D. Rodriguez.

Its name comes from the Greek kardia (heart), in reference to its shape, and was given to it by Johan Castillon. Wikipedia



```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,0){A}
  \foreach \ang in {5,10,...,360}{%
     \tkzDefPoint(\ang:2){M}
     \tkzDrawCircle(M,A)
   }
\end{tikzpicture}
```

20.3 Draw a semicircle

`\tkzDrawSemiCircle[⟨local options⟩](⟨A,B⟩) ou (⟨A,B,C⟩)`

Attention the arguments are lists of two or three points. This macro is either used in partnership with

\tkzGetPoint and/or **\tkzGetLength** to obtain the center and the radius of the circle, or by using **tkzPointResult** and **tkzLengthResult** if it is not necessary to keep the results.

options	default	definition
through	through	circle characterized by two points defining a radius
diameter	through	circle characterized by two points defining a diameter

20.4 Colouring a disc

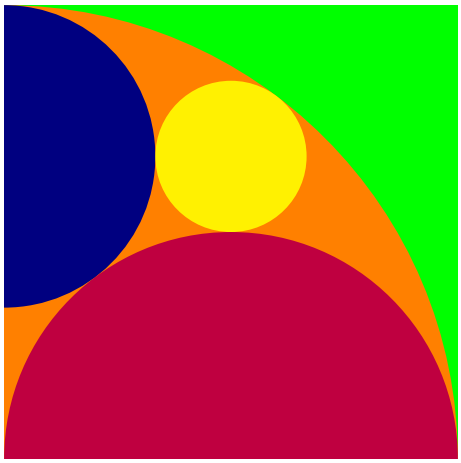
This was possible with the previous macro, but disk tracing was mandatory, this is no longer the case.

\tkzFillCircle[⟨local options⟩](⟨A,B⟩)

options	default	definition
radius	radius	two points define a radius
R	radius	a point and the measurement of a radius

You don't need to put **radius** because that's the default option. Of course, you have to add all the styles of TikZfor the plots.

20.4.1 Example from a sangaku



```
\begin{tikzpicture}
   \tkzInit[xmin=0,xmax = 6,ymin=0,ymax=6]
   \tkzDefPoint(0,0){B}  \tkzDefPoint(6,0){C}%
   \tkzDefSquare(B,C)    \tkzGetPoints{D}{A}
   \tkzClipPolygon(B,C,D,A)
   \tkzDefMidPoint(A,D)  \tkzGetPoint{F}
   \tkzDefMidPoint(B,C)  \tkzGetPoint{E}
   \tkzDefMidPoint(B,D)  \tkzGetPoint{Q}
   \tkzDefTangent[from = B](F,A) \tkzGetPoints{G}{H}
   \tkzInterLL(F,G)(C,D) \tkzGetPoint{J}
   \tkzInterLL(A,J)(F,E) \tkzGetPoint{K}
   \tkzDefPointBy[projection=onto B--A](K)
 \tkzGetPoint{M}
   \tkzFillPolygon[color = green](A,B,C,D)
   \tkzFillCircle[color = orange](B,A)
   \tkzFillCircle[color = blue!50!black](M,A)
   \tkzFillCircle[color = purple](E,B)
   \tkzFillCircle[color = yellow](K,Q)
\end{tikzpicture}
```

20.5 Clipping a disc

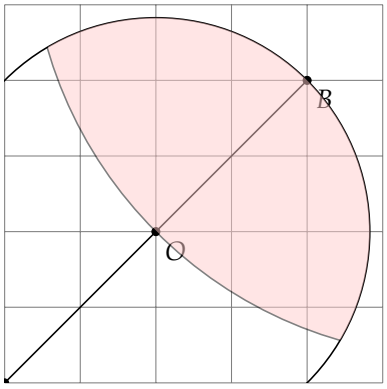
`\tkzClipCircle[⟨local options⟩](⟨A,B⟩) or (⟨A,r⟩)`

arguments	exemple	explication
(⟨A,B⟩) or (⟨A,r⟩)	(⟨A,B⟩) or (⟨A,2cm⟩)	AB radius or diameter

options	default	definition
radius	radius	circle characterized by two points defining a radius
R	radius	circle characterized by a point and the measurement of a radius

It is not necessary to put **radius** because that is the default option.

20.5.1 Example




```
\begin{tikzpicture}
\tkzInit[xmax=5,ymax=5]
\tkzGrid \tkzClip
\tkzDefPoint(0,0){A}
\tkzDefPoint(2,2){O}
\tkzDefPoint(4,4){B}
\tkzDefPoint(6,6){C}
\tkzDrawPoints(O,A,B,C)
\tkzLabelPoints(O,A,B,C)
\tkzDrawCircle(O,A)
\tkzClipCircle(O,A)
\tkzDrawLine(A,C)
\tkzDrawCircle[fill=red!20,opacity=.5](C,O)
\end{tikzpicture}
```

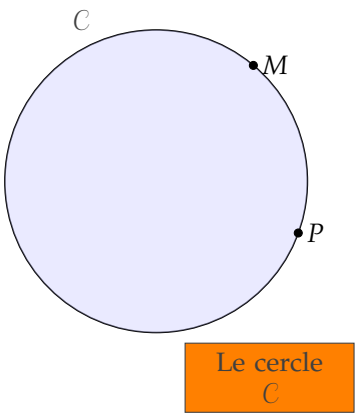
20.6 Giving a label to a circle

`\tkzLabelCircle[⟨local options⟩](⟨A,B⟩)(⟨angle⟩){⟨label⟩}`

options	default	definition
radius	radius	circle characterized by two points defining a radius
R	radius	circle characterized by a point and the measurement of a radius

You don't need to put **radius** because that's the default option. We can use the styles from TikZ. The label is created and therefore "passed" between braces.

20.6.1 Example




```
\begin{tikzpicture}
 \tkzDefPoint(0,0){O} \tkzDefPoint(2,0){N}
 \tkzDefPointBy[rotation=center O angle 50](N)
     \tkzGetPoint{M}
 \tkzDefPointBy[rotation=center O angle -20](N)
      \tkzGetPoint{P}
 \tkzDefPointBy[rotation=center O angle 125](N)
      \tkzGetPoint{P'}
 \tkzLabelCircle[above=4pt](O,N)(120){$\mathcal{C}$}
 \tkzDrawCircle(O,M)
 \tkzFillCircle[color=blue!20,opacity=.4](O,M)
 \tkzLabelCircle[R,draw,fill=orange,%
       text width=2cm,text centered](O,3 cm)(-60)%
          {Le cercle\\ $\mathcal{C}$}
 \tkzDrawPoints(M,P)\tkzLabelPoints[right](M,P)
\end{tikzpicture}
```

21 Intersections

It is possible to determine the coordinates of the points of intersection between two straight lines, a straight line and a circle, and two circles.

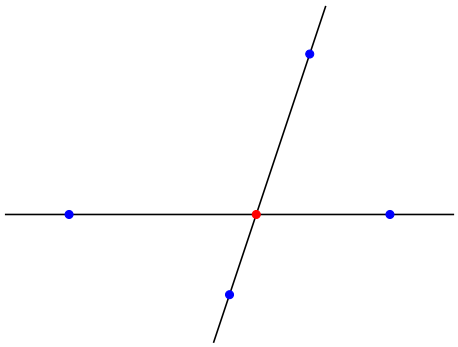
The associated commands have no optional arguments and the user must determine the existence of the intersection points himself.

21.1 Intersection de deux droites

`\tkzInterLL(⟨A,B⟩)(⟨C,D⟩)`

Defines the intersection point `tkzPointResult` of the two lines (AB) and (CD). The known points are given in pairs (two per line) in brackets, and the resulting point can be retrieved with the macro `\tkzDefPoint`.

21.1.1 Example of intersection between two straight lines



```
\begin{tikzpicture}[rotate=-45,scale=.75]
  \tkzDefPoint(2,1){A}
     \tkzDefPoint(6,5){B}
  \tkzDefPoint(3,6){C}
     \tkzDefPoint(5,2){D}
  \tkzDrawLines(A,B C,D)
  \tkzInterLL(A,B)(C,D)
     \tkzGetPoint{I}
  \tkzDrawPoints[color=blue](A,B,C,D)
   \tkzDrawPoint[color=red](I)
\end{tikzpicture}
```

21.2 Intersection of a straight line and a circle

As before, the line is defined by a couple of points. The circle is also defined by a couple:

- (O,C) which is a pair of points, the first is the centre and the second is any point on the circle.
- (O,r) The r measure is the shelf measure. It is expressed soint en cm, that is to say in pt.

`\tkzInterLC[⟨options⟩](⟨A,B⟩)(⟨O,C⟩) or (⟨O,r⟩) or (⟨O,C,D⟩)`

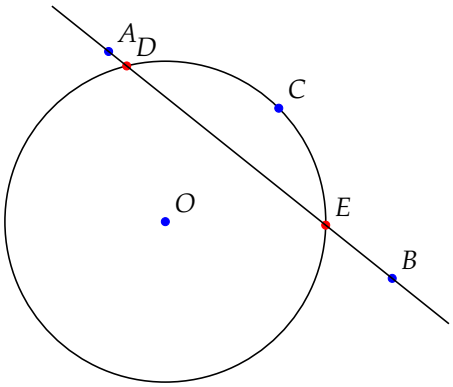
So the arguments are two couples.

options	default	definition
N	N	(O,C) determines the circle
R	N	(O, 1 cm) ou (O, 120 pt)
with nodes	N	(O,C,D) CD is a radius

The macro defines the intersection points I and J of the line (AB) and the center circle O with radius r if they exist; otherwise, an error will be reported in the .log file.

21.2.1 Simple example of a line-circle intersection

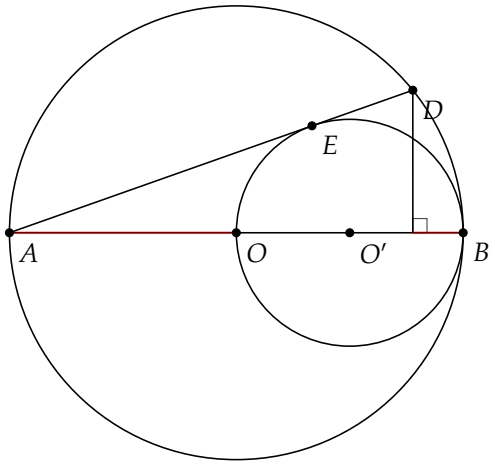
In the following example, the drawing of the circle uses two points and the intersection of the straight line and the circle uses two pairs of points




```
\begin{tikzpicture}[scale=.75]
 \tkzInit[xmax=5,ymax=4]
 \tkzDefPoint(1,1){O}
 \tkzDefPoint(0,4){A}
 \tkzDefPoint(5,0){B}
 \tkzDefPoint(3,3){C}
 \tkzInterLC(A,B)(O,C)  \tkzGetPoints{D}{E}
 \tkzDrawCircle(O,C)
 \tkzDrawPoints[color=blue](O,A,B,C)
 \tkzDrawPoints[color=red](D,E)
 \tkzDrawLine(A,B)
 \tkzLabelPoints[above right](O,A,B,C,D,E)
\end{tikzpicture}
```

21.2.2 More complex example of a line-circle intersection

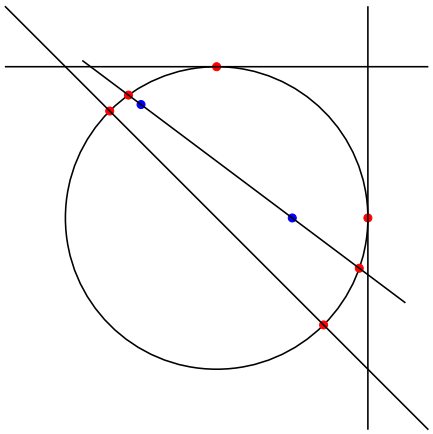
http://gogeometry.com/problem/p190_tangent_circle




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(8,0){B}
  \tkzDefMidPoint(A,B)
  \tkzGetPoint{O}
  \tkzDrawCircle(O,B)
  \tkzDefMidPoint(O,B)
  \tkzGetPoint{O'}
  \tkzDrawCircle(O',B)
  \tkzDefTangent[from=A](O',B)
  \tkzGetSecondPoint{E}
  \tkzInterLC(A,E)(O,B)
  \tkzGetSecondPoint{D}
  \tkzDefPointBy[projection=onto A--B](D)
   \tkzGetPoint{F}
  \tkzMarkRightAngle(D,F,B)
  \tkzDrawSegments(A,D A,B D,F)
  \tkzDrawSegments[color=red,line width=1pt,
      opacity=.4](A,O F,B)
  \tkzDrawPoints(A,B,O,O',E,D)
  \tkzLabelPoints(A,B,O,O',E,D)
\end{tikzpicture}
```

21.2.3 Circle defined by a center and a measure, and special cases

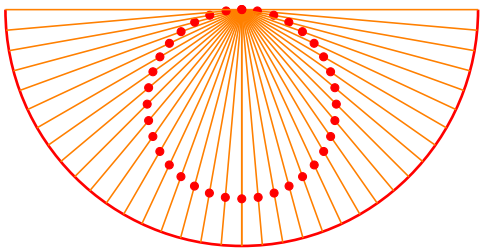
Let's look at some special cases like straight lines tangent to the circle.



```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoint(0,8){A}  \tkzDefPoint(8,0){B}
  \tkzDefPoint(8,8){C}  \tkzDefPoint(4,4){I}
  \tkzDefPoint(2,7){E}  \tkzDefPoint(6,4){F}
  \tkzDrawCircle[R](I,4 cm)
  \tkzInterLC[R](A,C)(I,4 cm)  \tkzGetPoints{I1}{I2}
  \tkzInterLC[R](B,C)(I,4 cm)  \tkzGetPoints{J1}{J2}
  \tkzInterLC[R](A,B)(I,4 cm)  \tkzGetPoints{K1}{K2}
  \tkzDrawPoints[color=red](I1,J1,K1,K2)
  \tkzDrawLines(A,B B,C A,C)
  \tkzInterLC[R](E,F)(I,4 cm)  \tkzGetPoints{I2}{J2}
  \tkzDrawPoints[color=blue](E,F)
  \tkzDrawPoints[color=red](I2,J2)
  \tkzDrawLine(I2,J2)
\end{tikzpicture}
```

21.2.4 More complex example

☞ Be careful with the syntax. First of all, calculations for the points can be done during the passage of the arguments, but the syntax of **xfp** must be respected. You can see that I use the term **pi** because works in radians!. Furthermore, when calculations require the use of parentheses, they must be inserted in a group... TEX{ ...}.



```
\begin{tikzpicture}[scale=1.25]
  \tkzDefPoint(0,1){J}
  \tkzDefPoint(0,0){O}
  \tkzDrawArc[R,line width=1pt,color=red](J,2.5 cm)(180,0)
  \foreach \i in {0,-5,-10,...,-85,-90}{
    \tkzDefPoint({2.5*cosd(\i)},{1+2.5*sind(\i)}){P}
     \tkzDrawSegment[color=orange](J,P)
     \tkzInterLC[R](P,J)(O,1 cm)
     \tkzGetPoints{M}{N}
     \tkzDrawPoints[red](N)
     }
  \foreach \i in {-90,-95,...,-175,-180}{
     \tkzDefPoint({2.5*cosd(\i)},{1+2.5*sind(\i)}){P}
     \tkzDrawSegment[color=orange](J,P)
     \tkzInterLC[R](P,J)(O,1 cm)
     \tkzGetPoints{M}{N}
     \tkzDrawPoints[red](M)
     }
\end{tikzpicture}
```

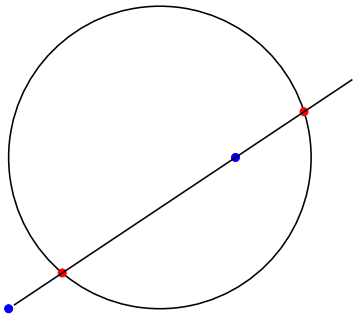
21.2.5 Calculation of radius dimension

With **pgfmath** and **\pgfmathsetmacro**

The radius measurement may be the result of a calculation that is not done within the intersection macro, but before. A length can be calculated in several ways. It is possible of course, to use the module **pgfmath** and the macro **\pgfmathsetmacro**. In some cases, the results obtained are not precise enough, so the following calculation $0.0002 \div 0.0001$ gives 1.98 with pgfmath while xfp will give 2.

21.2.6 Calculation of radius dimension 1

With **xfp** and **\fpeval**

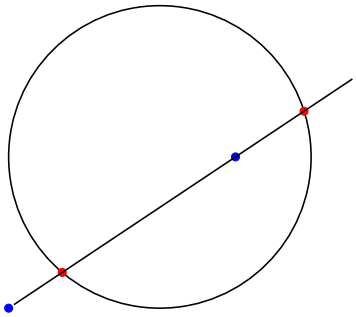


```
\begin{tikzpicture}
\tkzDefPoint(2,2){A}
\tkzDefPoint(5,4){B}
\tkzDefPoint(4,4){O}
\edef\tkzLen{\fpeval{0.0002/0.0001}}
\tkzDrawCircle[R](O,\tkzLen cm)
\tkzInterLC[R](A,B)(O, \tkzLen cm)
\tkzGetPoints{I}{J}
\tkzDrawPoints[color=blue](A,B)
\tkzDrawPoints[color=red](I,J)
\tkzDrawLine(I,J)
\end{tikzpicture}
```

21.2.7 Calculation of radius dimension 2

With TEX and **\tkzLength**.

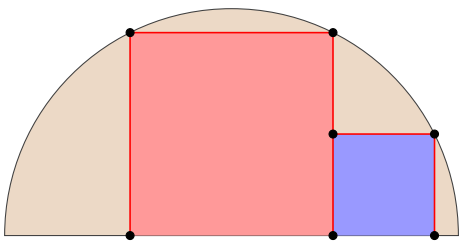
This dimension was created with **\newdimen**. 2 cm has been transformed into points. It is of course possible to use TEXto calculate.



```
\begin{tikzpicture}
\tkzDefPoints{2/2/A,5/4/B,4/4/O}
  \tkzLength=2cm
  \tkzDrawCircle[R](O,\tkzLength)
  \tkzInterLC[R](A,B)(O,\tkzLength)
  \tkzGetPoints{I}{J}
  \tkzDrawPoints[color=blue](A,B)
  \tkzDrawPoints[color=red](I,J)
  \tkzDrawLine(I,J)
\end{tikzpicture}
```

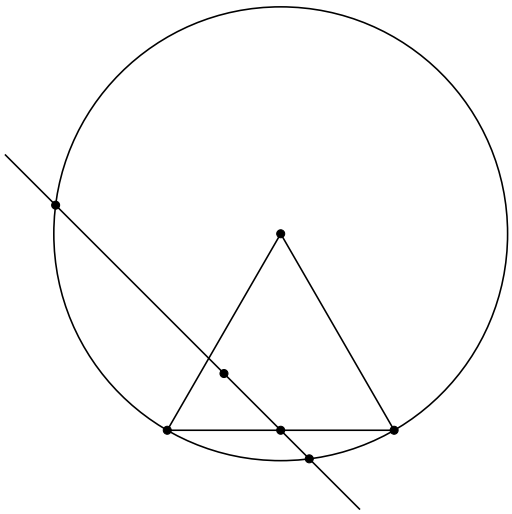
21.2.8 Squares in half a disc

A Sangaku look! It is a question of proving that one can inscribe in a half-disc, two squares, and to determine the length of their respective sides according to the radius.



```
\begin{tikzpicture}[scale=.75]
 \tkzDefPoints{0/0/A,8/0/B,4/0/I}
 \tkzDefSquare(A,B) \tkzGetPoints{C}{D}
 \tkzInterLC(I,C)(I,B)\tkzGetPoints{E'}{E}
 \tkzInterLC(I,D)(I,B)\tkzGetPoints{F'}{F}
 \tkzDefPointsBy[projection = onto A--B](E,F){H,G}
 \tkzDefPointsBy[symmetry   = center H](I){J}
 \tkzDefSquare(H,J)\tkzGetPoints{K}{L}
 \tkzDrawSector[fill=brown!30](I,B)(A)
 \tkzFillPolygon[color=red!40](H,E,F,G)
 \tkzFillPolygon[color=blue!40](H,J,K,L)
 \tkzDrawPolySeg[color=red](H,E,F,G)
 \tkzDrawPolySeg[color=red](J,K,L)
 \tkzDrawPoints(E,G,H,F,J,K,L)
\end{tikzpicture}
```

21.2.9 Option "with nodes"



```
\begin{tikzpicture}[scale=.75]
\tkzDefPoints{0/0/A,4/0/B,1/1/D,2/0/E}
\tkzDefTriangle[equilateral](A,B)
\tkzGetPoint{C}
\tkzDrawCircle(C,A)
\tkzInterLC[with nodes](D,E)(C,A,B)
\tkzGetPoints{F}{G}
\tkzDrawPolygon(A,B,C)
\tkzDrawPoints(A,...,G)
\tkzDrawLine(F,G)
\end{tikzpicture}
```

21.3 Intersection of two circles

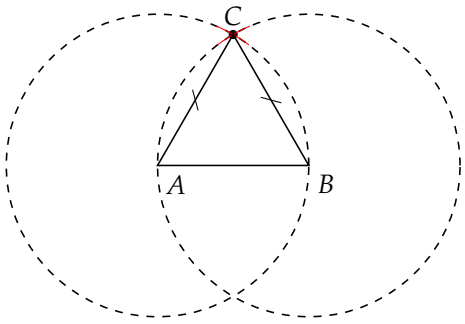
The most frequent case is that of two circles defined by their center and a point, but as before the option **R** allows to use the radius measurements.

\tkzInterCC[⟨options⟩](⟨O,A/r⟩)(⟨O′,A′/r′⟩){⟨I⟩}{⟨J⟩}

options	defect	definition
N	N	OA and O'A' are radii, O and O' are the centres
R	N	r et r' shave dimensions and measure the radii
with nodes	N	r et r' are dimensions and measure the radii

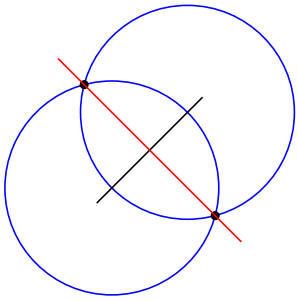
This macro defines the intersection point(s) I and J of the two center circles O and O'. If the two circles do not have a common point then the macro ends with an error that is not handled.
It is also possible to use directly **\tkzInterCCN** and **\tkzInterCCR**.

21.3.1 Construction of an equilateral triangle



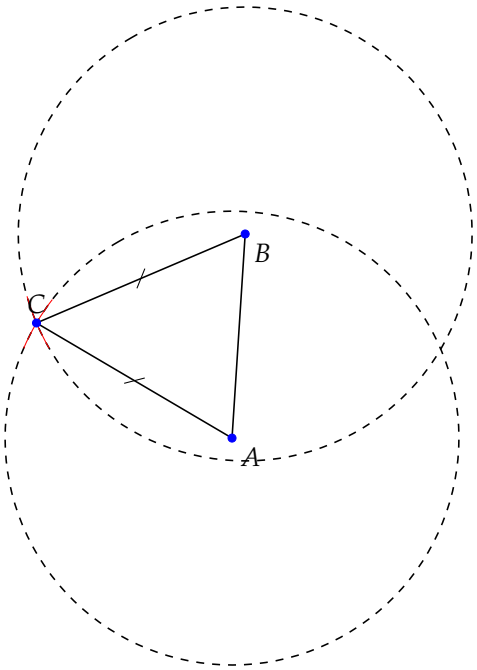

```
\begin{tikzpicture}[trim left=-1cm,scale=.5]
 \tkzDefPoint(1,1){A}
 \tkzDefPoint(5,1){B}
 \tkzInterCC(A,B)(B,A)\tkzGetPoints{C}{D}
 \tkzDrawPoint[color=black](C)
 \tkzDrawCircle[dashed](A,B)
 \tkzDrawCircle[dashed](B,A)
 \tkzCompass[color=red](A,C)
 \tkzCompass[color=red](B,C)
 \tkzDrawPolygon(A,B,C)
 \tkzMarkSegments[mark=s|](A,C B,C)
 \tkzLabelPoints[](A,B)
 \tkzLabelPoint[above](C){$C$}
\end{tikzpicture}
```

21.3.2 Example a mediator



```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(2,2){B}
  \tkzDrawCircle[color=blue](B,A)
  \tkzDrawCircle[color=blue](A,B)
  \tkzInterCC(B,A)(A,B)\tkzGetPoints{M}{N}
  \tkzDrawLine(A,B)
  \tkzDrawPoints(M,N)
  \tkzDrawLine[color=red](M,N)
\end{tikzpicture}
```

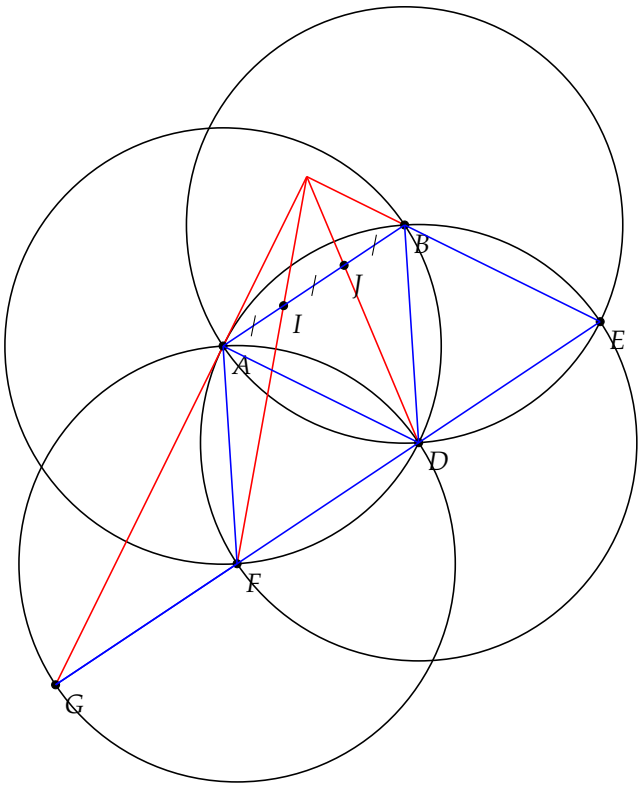
21.3.3 An isosceles triangle.




```
\begin{tikzpicture}[rotate=120,scale=.75]
 \tkzDefPoint(1,2){A}
 \tkzDefPoint(4,0){B}
 \tkzInterCC[R](A,4cm)(B,4cm)
 \tkzGetPoints{C}{D}
 \tkzDrawCircle[R,dashed](A,4 cm)
 \tkzDrawCircle[R,dashed](B,4 cm)
 \tkzCompass[color=red](A,C)
 \tkzCompass[color=red](B,C)
 \tkzDrawPolygon(A,B,C)
 \tkzDrawPoints[color=blue](A,B,C)
 \tkzMarkSegments[mark=s|](A,C B,C)
 \tkzLabelPoints[](A,B)
 \tkzLabelPoint[above](C){$C$}
\end{tikzpicture}
```

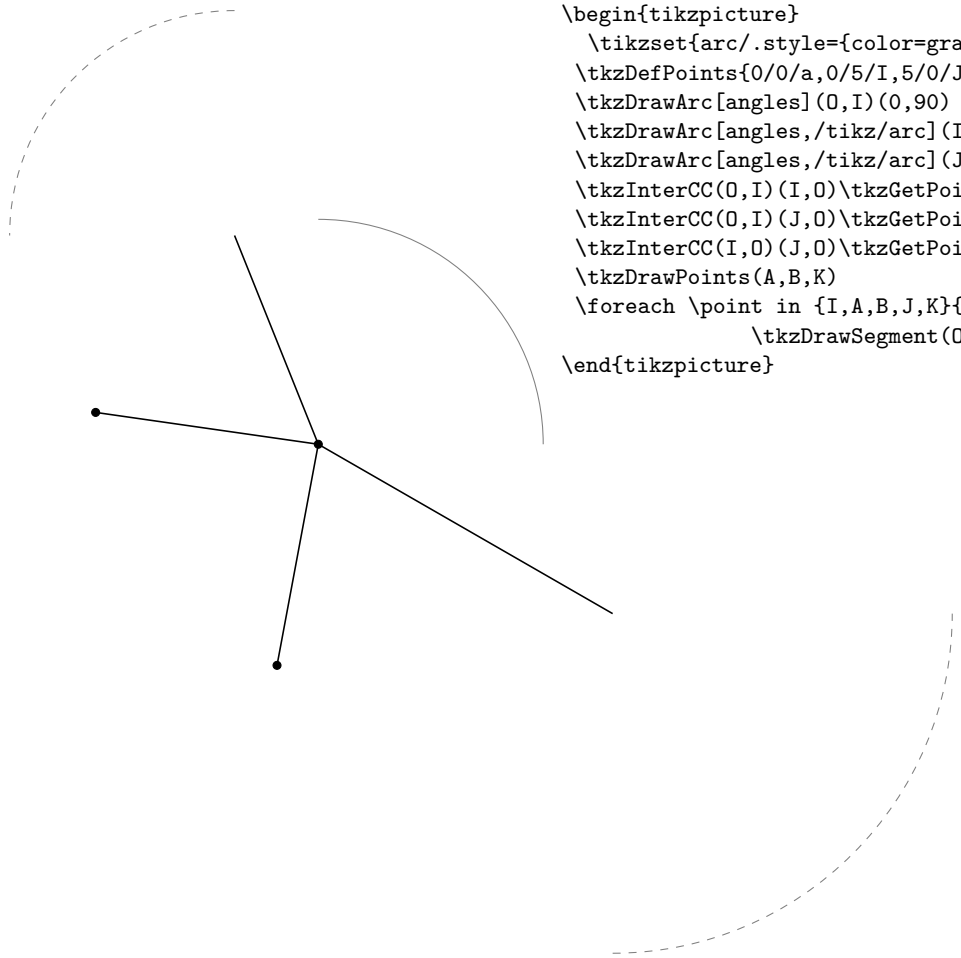
21.3.4 Segment trisection

The idea here is to divide a segment with a ruler and a compass into three segments of equal length.



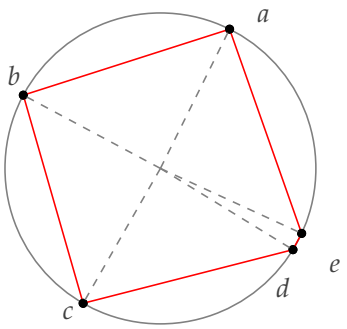

```
\begin{tikzpicture}[scale=.8]
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(3,2){B}
 \tkzInterCC(A,B)(B,A)
 \tkzGetPoints{C}{D}
 \tkzInterCC(D,B)(B,A)
 \tkzGetPoints{A}{E}
 \tkzInterCC(D,B)(A,B)
 \tkzGetPoints{F}{B}
 \tkzInterLC(E,F)(F,A)
 \tkzGetPoints{D}{G}
 \tkzInterLL(A,G)(B,E)
 \tkzGetPoint{O}
 \tkzInterLL(O,D)(A,B)
 \tkzGetPoint{J}
 \tkzInterLL(O,F)(A,B)
 \tkzGetPoint{I}
 \tkzDrawCircle(D,A)
 \tkzDrawCircle(A,B)
 \tkzDrawCircle(B,A)
 \tkzDrawCircle(F,A)
 \tkzDrawSegments[color=red](O,G
  O,B O,D O,F)
 \tkzDrawPoints(A,B,D,E,F,G,I,J)
 \tkzLabelPoints(A,B,D,E,F,G,I,J)
 \tkzDrawSegments[blue](A,B B,D A,D%
  A,F F,G E,G B,E)
 \tkzMarkSegments[mark=s|](A,I I,J J,B)
\end{tikzpicture}
```

21.3.5 Angle trisection



```
\begin{tikzpicture}
  \tikzset{arc/.style={color=gray,style=dashed}}
 \tkzDefPoints{0/0/a,0/5/I,5/0/J}
 \tkzDrawArc[angles](O,I)(0,90)
 \tkzDrawArc[angles,/tikz/arc](I,O)(90,180)
 \tkzDrawArc[angles,/tikz/arc](J,O)(-90,0)
 \tkzInterCC(O,I)(I,O)\tkzGetPoints{B}{C}
 \tkzInterCC(O,I)(J,O)\tkzGetPoints{D}{A}
 \tkzInterCC(I,O)(J,O)\tkzGetPoints{L}{K}
 \tkzDrawPoints(A,B,K)
 \foreach \point in {I,A,B,J,K}{%
                \tkzDrawSegment(O,\point)}
\end{tikzpicture}
```

21.3.6 with the option with nodes




```
\begin{tikzpicture}[scale=.5]
 \tkzDefPoints{0/0/a,0/5/B,5/0/C}
 \tkzDefPoint(54:5){F}
 \tkzDrawCircle[color=gray](A,C)
 \tkzInterCC[with nodes](A,A,C)(C,B,F)
 \tkzGetPoints{a}{e}
 \tkzInterCC(A,C)(a,e) \tkzGetFirstPoint{b}
 \tkzInterCC(A,C)(b,a) \tkzGetFirstPoint{c}
 \tkzInterCC(A,C)(c,b) \tkzGetFirstPoint{d}
 \tkzDrawPoints(a,b,c,d,e)
 \tkzDrawPolygon[color=red](a,b,c,d,e)
 \foreach \vertex/\num in {a/36,b/108,c/180,
                           d/252,e/324}{%
 \tkzDrawPoint(\vertex)
 \tkzLabelPoint[label=\num:$\vertex$](\vertex){}
 \tkzDrawSegment[color=gray,style=dashed](A,\vertex)
 }
\end{tikzpicture}
```

22 Les angles

22.1 Colorier un angle : fill

L'opération la plus simple

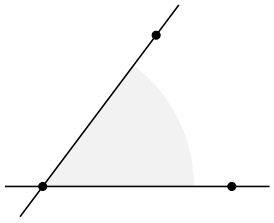
\tkzFillAngle[⟨local options⟩](⟨A,O,B⟩)

O est le sommet de l'angle. OA et OB sont les côtés. Attention l'angle est déterminé avec l'ordre des points.

options	default	definition
size	1 cm	cette option détermine le rayon du secteur angulaire colorié

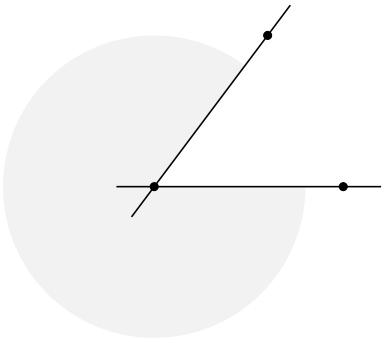
Il faut ajouter bien sûr tous les styles de TikZ comme par exemple l'usage de fill ou encore shade

22.1.1 Exemple avec size

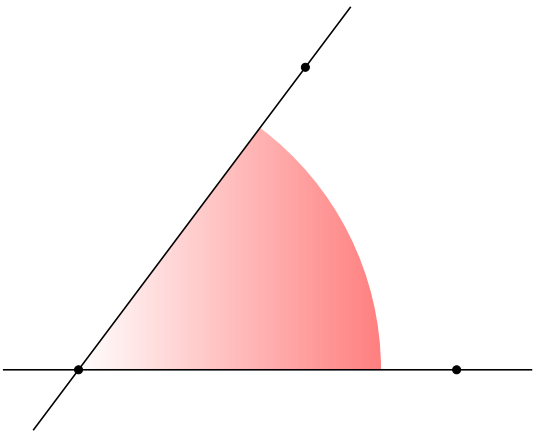


```
\begin{tikzpicture}
   \tkzInit
   \tkzDefPoints{0/0/O,2.5/0/A,1.5/2/B}
   \tkzFillAngle[size=2cm, fill=gray!10](A,O,B)
   \tkzDrawLines(O,A O,B)
   \tkzDrawPoints(O,A,B)
\end{tikzpicture}
```

22.1.2 Changement de l'ordre des points



```
\begin{tikzpicture}
   \tkzInit
   \tkzDefPoints{0/0/O,2.5/0/A,1.5/2/B}
   \tkzFillAngle[size=2cm,fill=gray!10](B,O,A)
   \tkzDrawLines(O,A O,B)
   \tkzDrawPoints(O,A,B)
\end{tikzpicture}
```

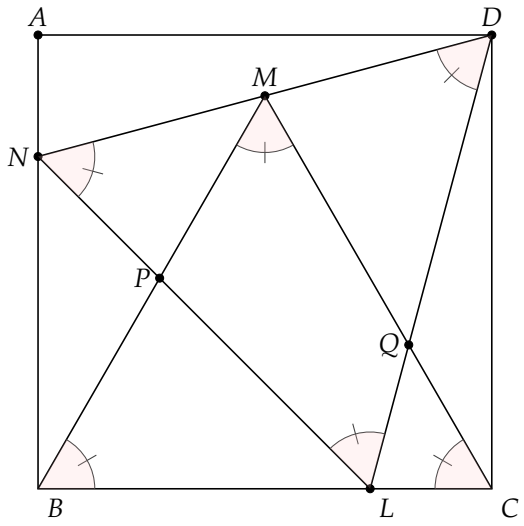


```
\begin{tikzpicture}
   \tkzInit
   \tkzDefPoints{0/0/O,5/0/A,3/4/B}
   % Don't forget {} to get, () to use
   \tkzFillAngle[size=4cm,left color=white,
                 right color=red!50](A,O,B)
   \tkzDrawLines(O,A O,B)
   \tkzDrawPoints(O,A,B)
\end{tikzpicture}
```

`\tkzFillAngles[⟨local options⟩](⟨A,O,B⟩)(⟨A',O',B'⟩)etc.`

Avec des options communes, il existe une macro pour de mutiples angles

22.1.3 Multiples angles




```
\begin{tikzpicture}[scale=0.75]
  \tkzDefPoint(0,0){B}
  \tkzDefPoint(8,0){C}
  \tkzDefPoint(0,8){A}
  \tkzDefPoint(8,8){D}
  \tkzDrawPolygon(B,C,D,A)
  \tkzDefTriangle[equilateral](B,C)
  \tkzGetPoint{M}
  \tkzInterLL(D,M)(A,B) \tkzGetPoint{N}
  \tkzDefPointBy[rotation=center N angle -60](D)
  \tkzGetPoint{L}
  \tkzInterLL(N,L)(M,B)      \tkzGetPoint{P}
  \tkzInterLL(M,C)(D,L)      \tkzGetPoint{Q}
  \tkzDrawSegments(D,N N,L L,D B,M M,C)
  \tkzDrawPoints(L,N,P,Q,M,A,D)
  \tkzLabelPoints[left](N,P,Q)
  \tkzLabelPoints[above](M,A,D)
  \tkzLabelPoints(L,B,C)
  \tkzMarkAngles(C,B,M B,M,C M,C,B%
                 D,L,N L,N,D N,D,L)
  \tkzFillAngles[fill=red!20,opacity=.2](C,B,M%
      B,M,C M,C,B D,L,N L,N,D N,D,L)
\end{tikzpicture}
```

22.2 Marquer un angle mark

Opération plus délicate car les options sont nombreuses. Les symboles utilisés pour le marquage outre ceux de TikZ sont définis dans le fichier `tkz-lib-marks.tex` et désignés par les caractères suivants:

`|, ||,|||, z, s, x, o, oo`

Leurs définitions est la suivante

```
\pgfdeclareplotmark{||}
  %double bar
{%
  \pgfpathmoveto{\pgfqpoint{2\pgflinewidth}{\pgfplotmarksize}}
  \pgfpathlineto{\pgfqpoint{2\pgflinewidth}{-\pgfplotmarksize}}
  \pgfpathmoveto{\pgfqpoint{-2\pgflinewidth}{\pgfplotmarksize}}
  \pgfpathlineto{\pgfqpoint{-2\pgflinewidth}{-\pgfplotmarksize}}
  \pgfusepathqstroke
}



  %triple bar
  \pgfdeclareplotmark{|||}
  {%
    \pgfpathmoveto{\pgfqpoint{0 pt}{\pgfplotmarksize}}
    \pgfpathlineto{\pgfqpoint{0 pt}{-\pgfplotmarksize}}
    \pgfpathmoveto{\pgfqpoint{-3\pgflinewidth}{\pgfplotmarksize}}
    \pgfpathlineto{\pgfqpoint{-3\pgflinewidth}{-\pgfplotmarksize}}
    \pgfpathmoveto{\pgfqpoint{3\pgflinewidth}{\pgfplotmarksize}}
    \pgfpathlineto{\pgfqpoint{3\pgflinewidth}{-\pgfplotmarksize}}
    \pgfusepathqstroke
  }



  % An bar slant
  \pgfdeclareplotmark{s|}
  {%
    \pgfpathmoveto{\pgfqpoint{-.70710678\pgfplotmarksize}%
                             {-.70710678\pgfplotmarksize}}
    \pgfpathlineto{\pgfqpoint{.70710678\pgfplotmarksize}%
                             {.70710678\pgfplotmarksize}}
    \pgfusepathqstroke
  }



  % An double bar slant
  \pgfdeclareplotmark{s||}
  {%
   \pgfpathmoveto{\pgfqpoint{-0.75\pgfplotmarksize}{-\pgfplotmarksize}}
   \pgfpathlineto{\pgfqpoint{0.25\pgfplotmarksize}{\pgfplotmarksize}}
   \pgfpathmoveto{\pgfqpoint{0\pgfplotmarksize}{-\pgfplotmarksize}}
   \pgfpathlineto{\pgfqpoint{1\pgfplotmarksize}{\pgfplotmarksize}}
   \pgfusepathqstroke
  }
```

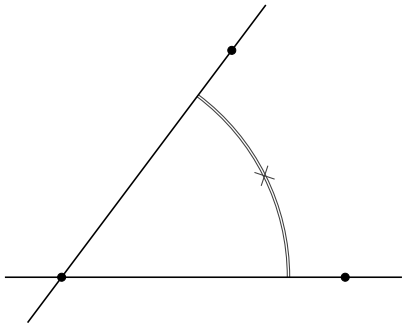
```
% z
\pgfdeclareplotmark{z}
{%
  \pgfpathmoveto{\pgfqpoint{0.75\pgfplotmarksize}{-\pgfplotmarksize}}
  \pgfpathlineto{\pgfqpoint{-0.75\pgfplotmarksize}{-\pgfplotmarksize}}
  \pgfpathlineto{\pgfqpoint{0.75\pgfplotmarksize}{\pgfplotmarksize}}
  \pgfpathlineto{\pgfqpoint{-0.75\pgfplotmarksize}{\pgfplotmarksize}}
  \pgfusepathqstroke
}



% s
\pgfdeclareplotmark{s}
{%
   \pgfpathmoveto{\pgfqpoint{0pt}{0pt}}
   \pgfpathcurveto
       {\pgfpoint{0pt}{0pt}}
       {\pgfpoint{-\pgfplotmarksize}{\pgfplotmarksize}}
       {\pgfpoint{\pgfplotmarksize}{\pgfplotmarksize}}
   \pgfpathmoveto{\pgfqpoint{0pt}{0pt}}
    \pgfpathcurveto
       {\pgfpoint{0pt}{0pt}}
       {\pgfpoint{\pgfplotmarksize}{-\pgfplotmarksize}}
       {\pgfpoint{-\pgfplotmarksize}{-\pgfplotmarksize}}
    \pgfusepathqstroke
}



% infinity
\pgfdeclareplotmark{oo}
{%
   \pgfpathmoveto{\pgfqpoint{0pt}{0pt}}
   \pgfpathcurveto
       {\pgfpoint{0pt}{0pt}}
       {\pgfpoint{.5\pgfplotmarksize}{1\pgfplotmarksize}}
       {\pgfpoint{\pgfplotmarksize}{0pt}}
   \pgfpathmoveto{\pgfqpoint{0pt}{0pt}}
    \pgfpathcurveto
       {\pgfpoint{0pt}{0pt}}
       {\pgfpoint{-.5\pgfplotmarksize}{1\pgfplotmarksize}}
       {\pgfpoint{-\pgfplotmarksize}{0pt}}
   \pgfpathmoveto{\pgfqpoint{0pt}{0pt}}
      \pgfpathcurveto
       {\pgfpoint{0pt}{0pt}}
       {\pgfpoint{.5\pgfplotmarksize}{-1\pgfplotmarksize}}
       {\pgfpoint{\pgfplotmarksize}{0pt}}
   \pgfpathmoveto{\pgfqpoint{0pt}{0pt}}
    \pgfpathcurveto
       {\pgfpoint{0pt}{0pt}}
       {\pgfpoint{-.5\pgfplotmarksize}{-1\pgfplotmarksize}}
       {\pgfpoint{-\pgfplotmarksize}{0pt}}
    \pgfusepathqstroke
}
```

`\tkzMarkAngle[⟨local options⟩](⟨A,O,B⟩)`

O est le sommet. Attention les arguments varient en fonction des options. Plusieurs marquages sont possibles. Vous pouvez simplement tracer un arc ou bian ajouter une marque sur cet arc. Le style de l'arc est choisi avec l'option **arc**, le rayon de l'arc est donné par **mksize**, l'arc peut bien sûr être colorié.

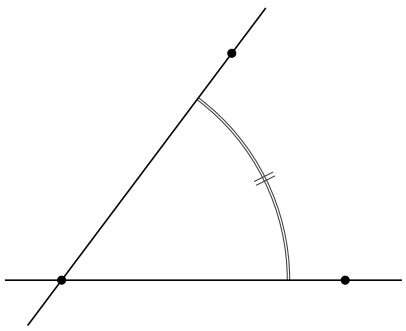
options	default	definition
arc	l	choix parmi l, ll et lll simple, double ou triple.
size	1 cm	rayon de l'arc.
mark	none	choix parmi s.
mksize	4pt	taille du symbol (mark).
mkcolor	black	couleur du symbole (mark).
mkpos	0.5	position du symbole sur l'arc.

22.2.1 Exemple avec mark = x



```
\begin{tikzpicture}[scale=.75]
    \tkzDefPoints{0/0/O,5/0/A,3/4/B}
    \tkzMarkAngle[size = 4cm,mark = x,
                  arc=ll,mkcolor = red](A,O,B)
    \tkzDrawLines(O,A O,B)
    \tkzDrawPoints(O,A,B)
\end{tikzpicture}
```

22.2.2 Exemple avec mark =||



```
\begin{tikzpicture}[scale=.75]
    \tkzDefPoints{0/0/O,5/0/A,3/4/B}
    \tkzMarkAngle[size = 4cm,mark = ||,
                  arc=ll,mkcolor = red](A,O,B)
    \tkzDrawLines(O,A O,B)
    \tkzDrawPoints(O,A,B)
\end{tikzpicture}
```

`\tkzMarkAngles[⟨local options⟩](⟨A,O,B⟩)(⟨A',O',B'⟩)etc.`

Avec des options communes, il existe une macro pour de mutiples angles

22.3 Label dans un angle

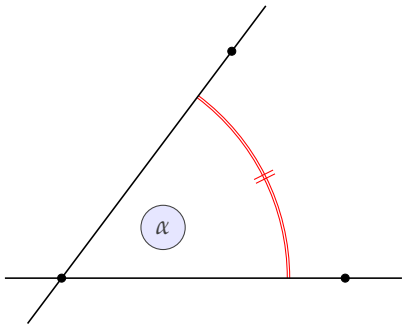
`\tkzLabelAngle[⟨local options⟩](⟨A,O,B⟩)`

Une seule option **dist** qui n'est pas indispensable car l'option **pos** de TikZ fonctionne très bien.

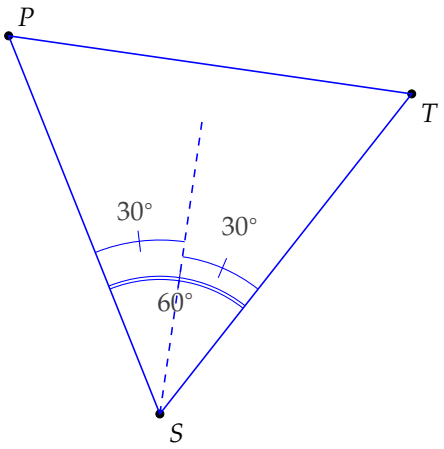
options	default	definition
pos	1	ou dist, permet de contrôler la distance du sommet au label.

Il est possible de déplacer le label avec toutes les options de TikZ : rotate, shift, below, etc.

22.3.1 Exemple avec pos




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoints{0/0/O,5/0/A,3/4/B}
  \tkzMarkAngle[size = 4cm,mark = ||,
      arc=ll,color = red](A,O,B)%
  \tkzDrawLines(O,A O,B)
  \tkzDrawPoints(O,A,B)
  \tkzLabelAngle[pos=2,draw,circle,
      fill=blue!10](A,O,B){$\alpha$}
\end{tikzpicture}
```




```
\begin{tikzpicture}[rotate=30]
  \tkzDefPoint(2,1){S}
  \tkzDefPoint(7,3){T}
  \tkzDefPointBy[rotation=center S angle 60](T)
  \tkzGetPoint{P}
  \tkzDefLine[bisector,normed](T,S,P)
  \tkzGetPoint{s}
  \tkzDrawPoints(S,T,P)
  \tkzDrawPolygon[color=blue](S,T,P)
  \tkzDrawLine[dashed,color=blue,add=0 and 3](S,s)
  \tkzLabelPoint[above right](P){$P$}
  \tkzLabelPoints(S,T)
  \tkzMarkAngle[size = 1.8cm,mark = |,arc=ll,
                color = blue](T,S,P)
  \tkzMarkAngle[size = 2.1cm,mark = |,arc=l,
                color = blue](T,S,s)
  \tkzMarkAngle[size = 2.3cm,mark = |,arc=l,
                color = blue](s,S,P)
 \tkzLabelAngle[pos = 1.5](T,S,P){$60^{\circ}$}%
 \tkzLabelAngles[pos = 2.7](T,S,s s,S,P){$30^{\circ}$}%
\end{tikzpicture}
```

`\tkzLabelAngles[⟨local options⟩](⟨A,O,B⟩)(⟨A',O',B'⟩)etc.`

Avec des options communes, il existe une macro pour de mutiples angles

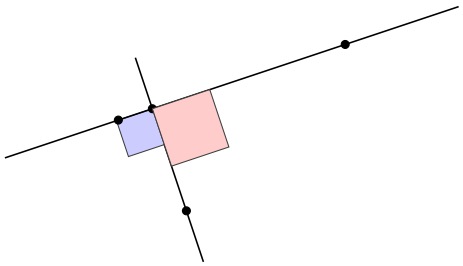
22.4 Marquer un angle droit

`\tkzMarkRightAngle[⟨local options⟩](⟨A,O,B⟩)`

L'option **german** permet de changer le style du dessin. L'option **size** permet de modifier la taille du dessin.

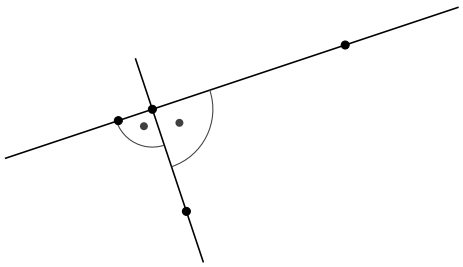
options	default	definition
german	normal	german arc avec point intérieur.
size	0.2	taille d'un coté.

22.4.1 Exemple de marquage d'un angle droit



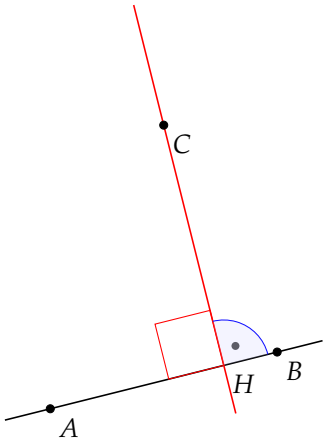
```
\begin{tikzpicture}
  \tkzDefPoints{0/0/A,3/1/B,0.9/-1.2/P}
  \tkzDefPointBy[projection = onto B--A](P)  \tkzGetPoint{H}
  \tkzDrawLines[add=.5 and .5](P,H)
  \tkzMarkRightAngle[fill=blue!20,size=.5,draw](A,H,P)
  \tkzDrawPoints[](A,B,P,H)
  \tkzDrawLines[add=.5 and .5](A,B)
  \tkzMarkRightAngle[fill=red!20,size=.8](B,H,P)
\end{tikzpicture}
```

22.4.2 Exemple de marquage d'un angle droit, german style



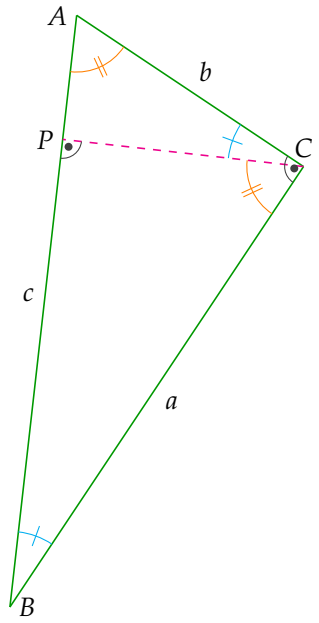
```
\begin{tikzpicture}
  \tkzDefPoints{0/0/A,3/1/B,0.9/-1.2/P}
  \tkzDefPointBy[projection = onto B--A](P)  \tkzGetPoint{H}
  \pgfresetboundingbox
  \tkzDrawLines[add=.5 and .5](P,H)
  \tkzMarkRightAngle[german,size=.5,draw](A,H,P)
  \tkzDrawPoints[](A,B,P,H)
  \tkzDrawLines[add=.5 and .5,fill=blue!20](A,B)
  \tkzMarkRightAngle[german,size=.8](P,H,B)
\end{tikzpicture}
```

22.4.3 Mélange de styles




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(4,1){B}
  \tkzDefPoint(2,5){C}
  \tkzDefPointBy[projection=onto B--A](C)
      \tkzGetPoint{H}
  \tkzDrawLine(A,B)
  \tkzDrawLine[add = .5 and .2,color=red](C,H)
  \tkzMarkRightAngle[,size=1,color=red](C,H,A)
  \tkzMarkRightAngle[german,size=.8,color=blue](B,H,C)
  \tkzFillAngle[opacity=.2,fill=blue!20,size=.8](B,H,C)
  \tkzLabelPoints(A,B,C,H)
  \tkzDrawPoints(A,B,C)
\end{tikzpicture}
```

22.4.4 Exemple complet




```
\begin{tikzpicture}[rotate=-90]
\tkzDefPoint(0,1){A}
\tkzDefPoint(2,4){C}
\tkzDefPointWith[orthogonal normed,K=7](C,A)
\tkzGetPoint{B}
\tkzDrawSegment[green!60!black](A,C)
\tkzDrawSegment[green!60!black](C,B)
\tkzDrawSegment[green!60!black](B,A)
\tkzDrawLine[altitude,dashed,color=magenta](B,C,A)
\tkzGetPoint{P}
\tkzLabelPoint[left](A){$A$}
\tkzLabelPoint[right](B){$B$}
\tkzLabelPoint[above](C){$C$}
\tkzLabelPoint[left](P){$P$}
\tkzLabelSegment[auto](B,A){$c$}
\tkzLabelSegment[auto,swap](B,C){$a$}
\tkzLabelSegment[auto,swap](C,A){$b$}
\tkzMarkAngle[size=1cm,color=cyan,mark=|](C,B,A)
\tkzMarkAngle[size=1cm,color=cyan,mark=|](A,C,P)
\tkzMarkAngle[size=0.75cm,color=orange,mark=||](P,C,B)
\tkzMarkAngle[size=0.75cm,color=orange,mark=||](B,A,C)
\tkzMarkRightAngle[german](A,C,B)
\tkzMarkRightAngle[german](B,P,C)
\end{tikzpicture}
```

22.5 \tkzMarkRightAngles

\tkzMarkRightAngles[⟨local options⟩](⟨A,O,B⟩)(⟨A',O',B'⟩)etc.

Avec des options communes, il existe une macro pour de mutiples angles

22.6 \tkzGetAngle

\tkzGetAngle(⟨macro⟩)

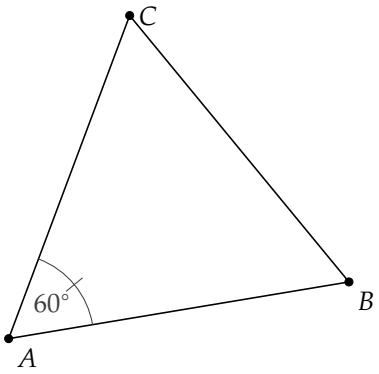
Attribue la valeur d'un angle à une macro.

22.7 \tkzFindAngle

\tkzFindAngle(⟨A,O,B⟩)

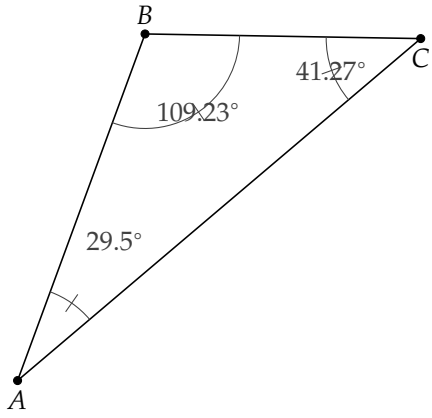
Détermine la valeur de l'angle en degrés.

22.7.1 Vérication de la mesure d'un angle




```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoint(-1,1){A}
  \tkzDefPoint(5,2){B}
  \tkzDefEquilateral(A,B)
  \tkzGetPoint{C}
  \tkzDrawPolygon(A,B,C)
  \tkzFindAngle(B,A,C)
  \tkzGetAngle{angleBAC}
  \edef\angleBAC{\fpeval{round(\angleBAC)}}
  \tkzDrawPoints(A,B,C)
  \tkzLabelPoints(A,B)
  \tkzLabelPoint[right](C){$C$}
  \tkzLabelAngle(B,A,C){\angleBAC$^\circ$}
  \tkzMarkAngle[size=1.5cm](B,A,C)
\end{tikzpicture}
```

22.7.2 Détermination des trois angles d'un triangle



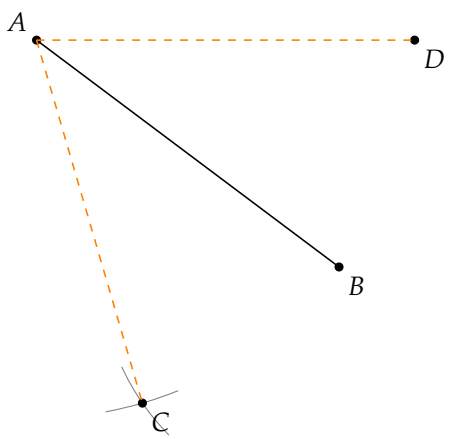

```
\begin{tikzpicture}[scale=1.25,rotate=30]
\tkzDefPoints{0.5/1.5/A, 3.5/4/B, 6/2.5/C}
\tkzDrawPolygon(A,B,C)
\tkzDrawPoints(A,B,C)
\tkzLabelPoints[below](A,C)
\tkzLabelPoints[above](B)
\tkzMarkAngle[size=1cm](B,C,A)
\tkzFindAngle(B,C,A)
\tkzGetAngle{angleBCA}
\edef\angleBCA{\fpeval{round(\angleBCA,2)}}
\tkzLabelAngle[pos = 1](B,C,A){$\angleBCA^{\circ}$}
\tkzMarkAngle[size=1cm](C,A,B)
\tkzFindAngle(C,A,B)
\tkzGetAngle{angleBAC}
\edef\angleBAC{\fpeval{round(\angleBAC,2)}}
\tkzLabelAngle[pos = 1.8](C,A,B){%
          $\angleBAC^{\circ}$}
\tkzMarkAngle[size=1cm](A,B,C)
\tkzFindAngle(A,B,C)
\tkzGetAngle{angleABC}
\edef\angleABC{\fpeval{round(\angleABC,2)}}
\tkzLabelAngle[pos = 1](A,B,C){$\angleABC^{\circ}$}
\end{tikzpicture}
```

22.8 \tkzFindSlopeAngle

\tkzFindSlopeAngle(⟨A,B⟩)

Détermine la pente de la droite (AB).

22.8.1 Pliage




```
\begin{tikzpicture}
  \tkzDefPoint(1,5){A}
  \tkzDefPoint(5,2){B}  \tkzDrawSegment(A,B)
  \tkzFindSlopeAngle(A,B)\tkzGetAngle{tkzang}
  \tkzDefPointBy[rotation= center A angle \tkzang ](B)
  \tkzGetPoint{C}
  \tkzDefPointBy[rotation= center A angle -\tkzang ](B)
  \tkzGetPoint{D}
  \tkzCompass[length=1](A,C)
  \tkzCompass[delta=10](B,C)   \tkzDrawPoints(A,B,C,D)
  \tkzLabelPoints(B,C,D)  \tkzLabelPoints[above left](A)
  \tkzDrawSegments[style=dashed,color=orange](A,C A,D)
\end{tikzpicture}
```

23 Les secteurs

23.1 \tkzDrawSector

\tkzDrawSector[⟨local options⟩](⟨O,…⟩)(⟨…⟩)

Attention les arguments varient en fonction des options.

options	default	definition
towards	towards	O est le centre et l'arc par de A vers (OB)
rotate	towards	l'arc part de A et l'angle détermine sa longueur
R	towards	On donne le rayon et deux angles
R with nodes	towards	On donne le rayon et deux points

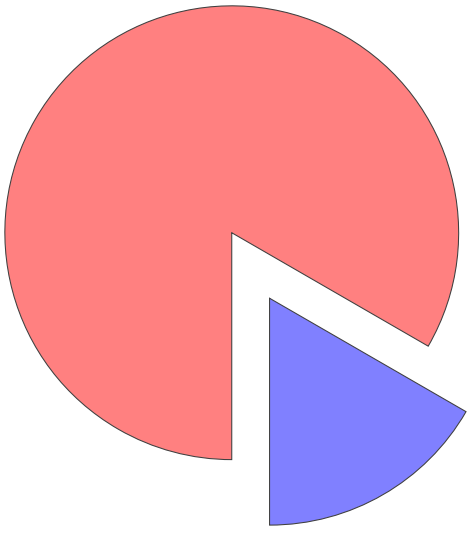
Il faut ajouter bien sûr tous les styles de TikZ pour les tracés

options	arguments	exemple
towards	(⟨pt,pt⟩)(⟨pt⟩)	\tkzDrawSector(O,A)(B)
rotate	(⟨pt,pt⟩)(⟨an⟩)	\tkzDrawSector[rotate,color=red](O,A)(90)
R	(⟨pt,r⟩)(⟨an,an⟩)	\tkzDrawSector[R,color=blue](O,2 cm)(30,90)
R with nodes	(⟨pt,r⟩)(⟨pt,pt⟩)	\tkzDrawSector[R with nodes](O,2 cm)(A,B)

Quelques exemples :

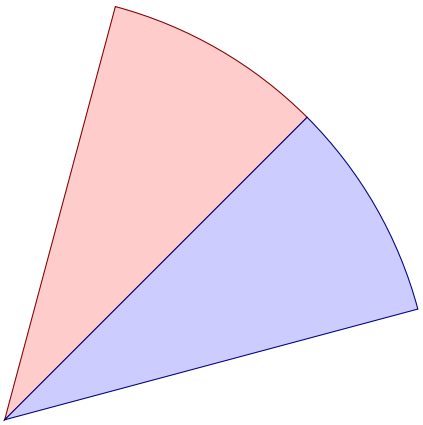
23.1.1 \tkzDrawSector et towards

Il est inutile de mettre **towards**. Il est possible d'utiliser **fill** en option.



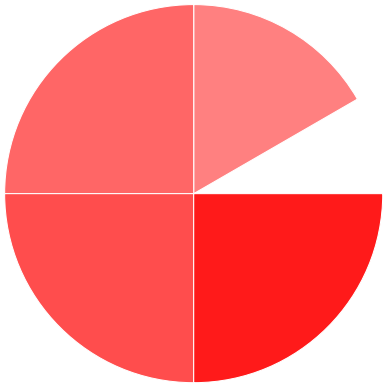
```
\begin{tikzpicture}[scale=1]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(-30:3){A}
  \tkzDefPointBy[rotation = center O angle -60](A)
  \tkzDrawSector[fill=red!50](O,A)(tkzPointResult)
 \begin{scope}[shift={(-60:1cm)}]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(-30:3){A}
  \tkzDefPointBy[rotation = center O angle -60](A)
  \tkzDrawSector[fill=blue!50](O,tkzPointResult)(A)
  \end{scope}
\end{tikzpicture}
```

23.1.2 \tkzDrawSector et rotate



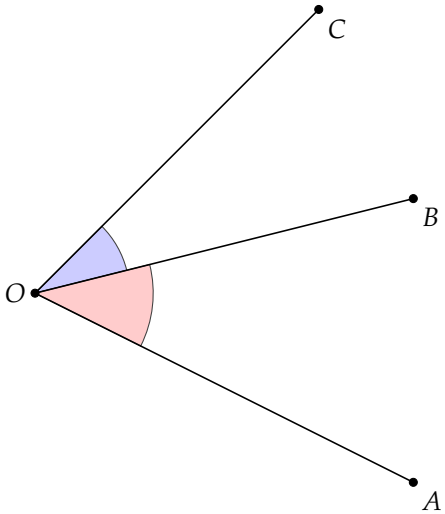
```
\begin{tikzpicture}[scale=2]
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(2,2){A}
 \tkzDrawSector[rotate,draw=red!50!black,%
 fill=red!20](O,A)(30)
 \tkzDrawSector[rotate,draw=blue!50!black,%
 fill=blue!20](O,A)(-30)
\end{tikzpicture}
```

23.1.3 \tkzDrawSector et R



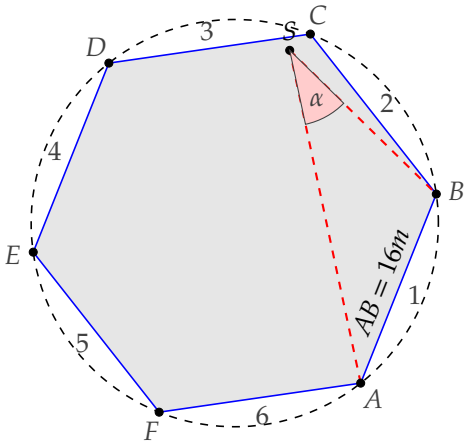
```
\begin{tikzpicture}[scale=1.25]
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(2,-1){A}
 \tkzDrawSector[R,draw=white,%
 fill=red!50](O,2cm)(30,90)
 \tkzDrawSector[R,draw=white,%
 fill=red!60](O,2cm)(90,180)
 \tkzDrawSector[R,draw=white,%
 fill=red!70](O,2cm)(180,270)
 \tkzDrawSector[R,draw=white,%
 fill=red!90](O,2cm)(270,360)
\end{tikzpicture}
```

23.1.4 \tkzDrawSector et R




```
\begin{tikzpicture}[scale=1.25]
 \tkzDefPoint(0,0){O}
 \tkzDefPoint(4,-2){A}
 \tkzDefPoint(4,1){B}
 \tkzDefPoint(3,3){C}
 \tkzDrawSector[R with nodes,%
                fill=blue!20](O,1 cm)(B,C)
 \tkzDrawSector[R with nodes,%
                fill=red!20](O,1.25 cm)(A,B)
\tkzDrawSegments(O,A O,B O,C)
\tkzDrawPoints(O,A,B,C)
\tkzLabelPoints(A,B,C)
\tkzLabelPoints[left](O)
\end{tikzpicture}
```

23.1.5 \tkzDrawSector et R with nodes




```
\begin{tikzpicture} [scale=.5]
 \tkzDefPoint(-1,-2){A}
 \tkzDefPoint(1,3){B}
 \tkzDefRegPolygon[side,sides=6](A,B)
 \tkzGetPoint{O}
 \tkzDrawPolygon[fill=black!10,
                 draw=blue](P1,P...,P6)
 \tkzLabelRegPolygon[sep=1.05](O){A,...,F}
 \tkzDrawCircle[dashed](O,A)
 \tkzLabelSegment[above,sloped,
                  midway](A,B){\(A B = 16m\)}
 \foreach \i  [count=\xi from 1]  in {2,...,6,1}
   {%
    \tkzDefMidPoint(P\xi,P\i)
    \path (O) to [pos=1.1] node {\xi} (tkzPointResult) ;
    }
  \tkzDefRandPointOn[segment = P3--P5]
  \tkzGetPoint{S}
  \tkzDrawSegments[thick,dashed,red](A,S S,B)
  \tkzDrawPoints(P1,P...,P6,S)
  \tkzLabelPoint[left,above](S){$S$}
  \tkzDrawSector[R with nodes,fill=red!20](S,2 cm)(A,B)
  \tkzLabelAngle[pos=1.5](A,S,B){$\alpha$}
\end{tikzpicture}
```

23.2 \tkzFillSector

\tkzFillSector[⟨local options⟩](⟨O,…⟩)(⟨…⟩)

Attention les arguments varient en fonction des options.

options	default	definition
towards	towards	O est le centre et l'arc par de A vers (OB)
rotate	towards	l'arc part de A et l'angle détermine sa longueur
R	towards	On donne le rayon et deux angles
R with nodes	towards	On donne le rayon et deux points

Il faut ajouter bien sûr tous les styles de TikZpour les tracés

options	arguments	exemple
towards	(⟨pt,pt⟩)(⟨pt⟩)	\tkzFillSector(O,A)(B)
rotate	(⟨pt,pt⟩)(⟨an⟩)	\tkzFillSector[rotate,color=red](O,A)(90)
R	(⟨pt,r⟩)(⟨an,an⟩)	\tkzFillSector[R,color=blue](O,2 cm)(30,90)
R with nodes	(⟨pt,r⟩)(⟨pt,pt⟩)	\tkzFillSector[R with nodes](O,2 cm)(A,B)

23.2.1 \tkzFillSector et towards

Il est inutile de mettre **towards** et vous remarquerez que les contours ne sont pas tracés,seule la surface est colorée.

```
\begin{tikzpicture}[scale=.6]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(-30:3){A}
  \tkzDefPointBy[rotation = center O angle -60](A)
  \tkzFillSector[fill=red!50](O,A)(tkzPointResult)
  \begin{scope}[shift={(-60:1cm)}]
   \tkzDefPoint(0,0){O}
   \tkzDefPoint(-30:3){A}
   \tkzDefPointBy[rotation = center O angle -60](A)
   \tkzFillSector[color=blue!50](O,tkzPointResult)(A)
  \end{scope}
\end{tikzpicture}
```

23.2.2 \tkzFillSector et rotate


```
\begin{tikzpicture}[scale=1.5]
 \tkzDefPoint(0,0){O} \tkzDefPoint(2,2){A}
 \tkzFillSector[rotate,color=red!20](O,A)(30)
 \tkzFillSector[rotate,color=blue!20](O,A)(-30)
\end{tikzpicture}
```

23.3 \tkzClipSector

\tkzClipSector[⟨local options⟩](⟨O,…⟩)(⟨…⟩)

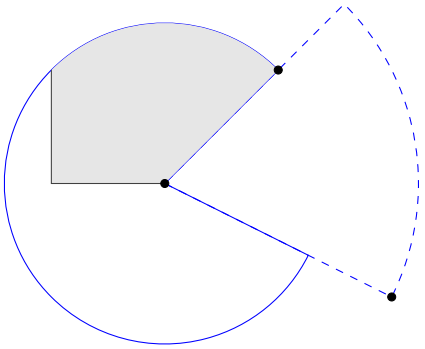
Attention les arguments varient en fonction des options.

options	default	definition
towards	towards	O est le centre et le secteur part de A vers (OB)
rotate	towards	le secteur part de A et l'angle détermine son amplitude
R	towards	On donne le rayon et deux angles

Il faut ajouter bien sûr tous les styles de TikZ pour les tracés

options	arguments	exemple
towards	(⟨pt,pt⟩)(⟨pt⟩)	\tkzClipSector(O,A)(B)
rotate	(⟨pt,pt⟩)(⟨angle⟩)	\tkzClipSector[rotate](O,A)(90)
R	(⟨pt,*r*⟩)(⟨angle 1,angle 2⟩)	\tkzClipSector[R](O,2 cm)(30,90)

23.3.1 \tkzClipSector



```
\begin{tikzpicture}[scale=1.5]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,-1){A}
  \tkzDefPoint(1,1){B}
  \tkzDrawSector[color=blue,dashed](O,A)(B)
  \tkzDrawSector[color=blue](O,B)(A)
  \tkzClipBB
  \begin{scope}
    \tkzClipSector(O,B)(A)
    \draw[fill=gray!20] (-1,0) rectangle (3,3);
  \end{scope}
  \tkzDrawPoints(A,B,O)
\end{tikzpicture}
```

24 Les arcs

`\tkzDrawArc[⟨local options⟩](⟨O,…⟩)(⟨…⟩)`

Cette macro trace un arc de centre O. Suivant les options, les arguments diffèrent. Il s'agit de déterminer un point de départ et un point d'arrivée. Soit le point de départ est donné, c'est ce qu'il y a de plus simple, soit on donne le rayon de l'arc. Dans ce dernier cas, il est nécessaire d'avoir deux angles. On peut soit donner directement les angles, soit donner des nodes qui associés au centre permettront de les déterminer.

options	default	definition
towards	towards	O est le centre et l'arc par de A vers (OB)
rotate	towards	l'arc part de A et l'angle détermine sa longueur
R	towards	On donne le rayon et deux angles
R with nodes	towards	On donne le rayon et deux points
delta	0	angle ajouté de chaque côté

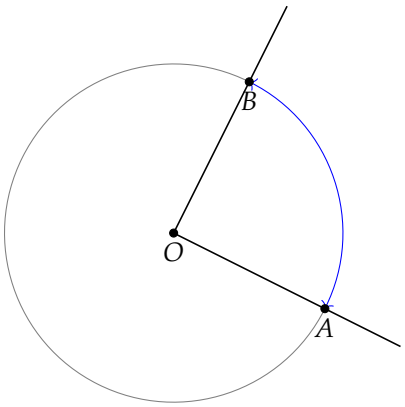
Il faut ajouter bien sûr tous les styles de TikZpour les tracés

options	arguments	exemple
towards	(⟨pt,pt⟩)(⟨pt⟩)	`\tkzDrawArc[delta=10](O,A)(B)`
rotate	(⟨pt,pt⟩)(⟨an⟩)	`\tkzDrawArc[rotate,color=red](O,A)(90)`
R	(⟨pt,*r*⟩)(⟨an,an⟩)	`\tkzDrawArc[R,color=blue](O,2 cm)(30,90)`
R with nodes	(⟨pt,*r*⟩)(⟨pt,pt⟩)	`\tkzDrawArc[R with nodes](O,2 cm)(A,B)`

Quelques exemples :

24.1 \tkzDrawArc et towards

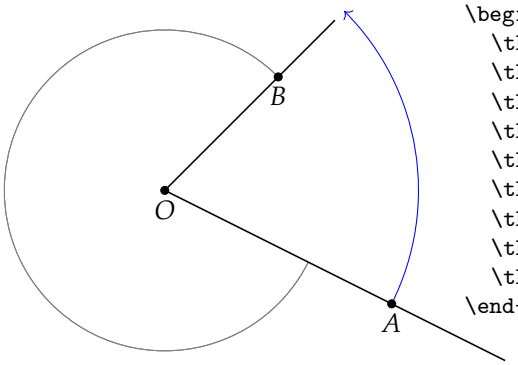
Il est inutile de mettre **towards**. Dans ce premier exemple l'arc part de A et va sur B. L'arc qui va de B vers A est différent. On obtient le saillant en allant dans le sens direct du cercle trigonométrique.




```
\begin{tikzpicture}
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,-1){A}
  \tkzDefPointBy[rotation= center O angle 90](A)
  \tkzGetPoint{B}
  \tkzDrawArc[color=blue,<->](O,A)(B)
  \tkzDrawArc(O,B)(A)
  \tkzDrawLines[add = 0 and .5](O,A O,B)
  \tkzDrawPoints(O,A,B)
  \tkzLabelPoints[below](O,A,B)
\end{tikzpicture}
```

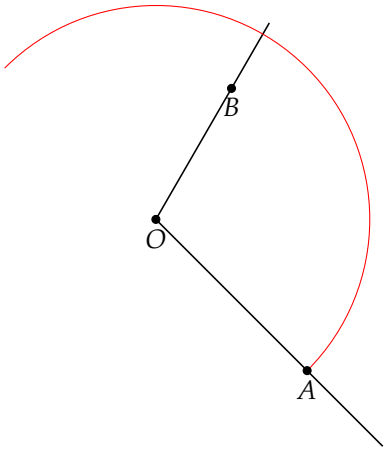
24.2 \tkzDrawArc et towards

Dans celui-ci, l'arc part de A mais s'arrête sur la droite (OB).



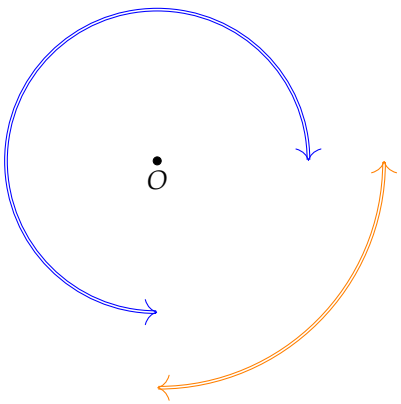

```
\begin{tikzpicture}[scale=1.5]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,-1){A}
  \tkzDefPoint(1,1){B}
  \tkzDrawArc[color=blue,->](O,A)(B)
  \tkzDrawArc[color=gray](O,B)(A)
  \tkzDrawArc(O,B)(A)
  \tkzDrawLines[add = 0 and .5](O,A O,B)
  \tkzDrawPoints(O,A,B)
  \tkzLabelPoints[below](O,A,B)
\end{tikzpicture}
```

24.3 \tkzDrawArc et rotate



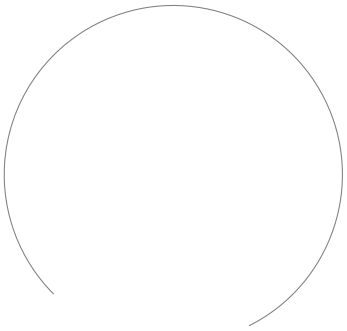

```
\begin{tikzpicture}
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,-2){A}
  \tkzDefPoint(60:2){B}
  \tkzDrawLines[add = 0 and .5](O,A O,B)
  \tkzDrawArc[rotate,color=red](O,A)(180)
  \tkzDrawPoints(O,A,B)
  \tkzLabelPoints[below](O,A,B)
\end{tikzpicture}
```

24.4 \tkzDrawArc et R




```
\begin{tikzpicture}
  \tkzDefPoints{0/0/O}
  \tikzset{compass style/.append style={<->}}
  \tkzDrawArc[R,color=orange,double](O,3cm)(270,360)
  \tkzDrawArc[R,color=blue,double](O,2cm)(0,270)
  \tkzDrawPoint(O)
  \tkzLabelPoint[below](O){$O$}
\end{tikzpicture}
```

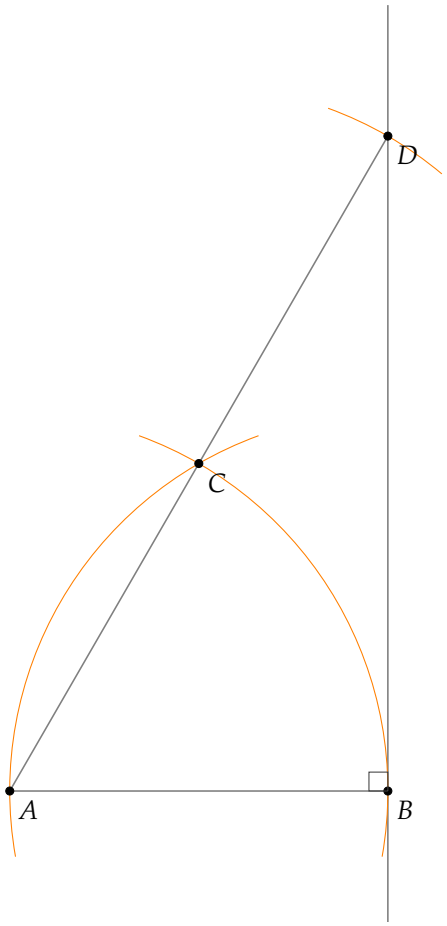
24.5 \tkzDrawArc et R with nodes



```
\begin{tikzpicture}
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2,-1){A}
  \tkzDefPoint(1,1){B}
  \tkzCalcLength(B,A)\tkzGetLength{radius}
  \tkzDrawArc[R with nodes](B,\radius pt)(A,O)
\end{tikzpicture}
```

24.6 \tkzDrawArc et delta

Cette option permet un peu comme **\tkzCompass** de placer un arc et de déborder de chaque côté. delta est une mesure en degré.




```
\begin{tikzpicture}
 \tkzInit
 \tkzDefPoint(0,0){A}
 \tkzDefPoint(5,0){B}
 \tkzDefPointBy[rotation= center A angle 60](B)
 \tkzGetPoint{C}
 \tkzSetUpLine[color=gray]
 \tkzDefPointBy[symmetry= center C](A)
 \tkzGetPoint{D}
 \tkzDrawSegments(A,B A,D)
 \tkzDrawLine(B,D)
 \tkzSetUpCompass[color=orange]
 \tkzDrawArc[delta=10](A,B)(C)
 \tkzDrawArc[delta=10](B,C)(A)
 \tkzDrawArc[delta=10](C,D)(D)
 \tkzDrawPoints(A,B,C,D)
 \tkzLabelPoints(A,B,C,D)
 \tkzMarkRightAngle(D,B,A)
\end{tikzpicture}
```

25 Utilisation du compas

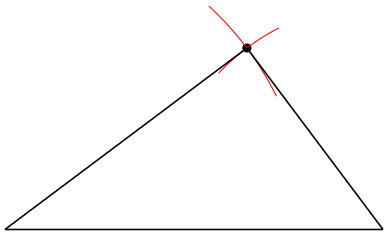
25.1 Macro principale \tkzCompass

\tkzCompass[⟨local options⟩](⟨A,B⟩)

Cette macro permet de laisser une trace de compas autrement dit un arc en un point désigné. Il faut indiquer le centre. Plusieurs options spécifiques vont modifier l'aspect de l'arc ainsi que les options de TikZ comme le style, la couleur, l'épaisseur du trait etc.

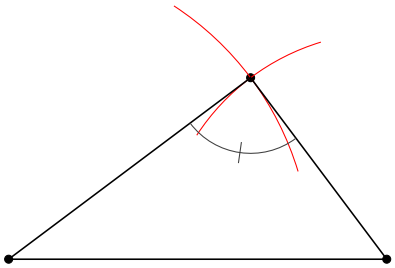
options	default	definition
delta	0	Modifie l'angle de l'arc en l'augmentant symétriquement
length	1	Modifie la longueur

25.1.1 Option length



```
\begin{tikzpicture}
  \tkzDefPoint(1,1){A}
  \tkzDefPoint(6,1){B}
  \tkzInterCC[R](A,4cm)(B,3cm)
  \tkzGetPoints{C}{D}
  \tkzDrawPoint(C)
  \tkzCompass[color=red,length=1.5](A,C)
  \tkzCompass[color=red](B,C)
  \tkzDrawSegments(A,B A,C B,C)
\end{tikzpicture}
```

25.1.2 Option delta



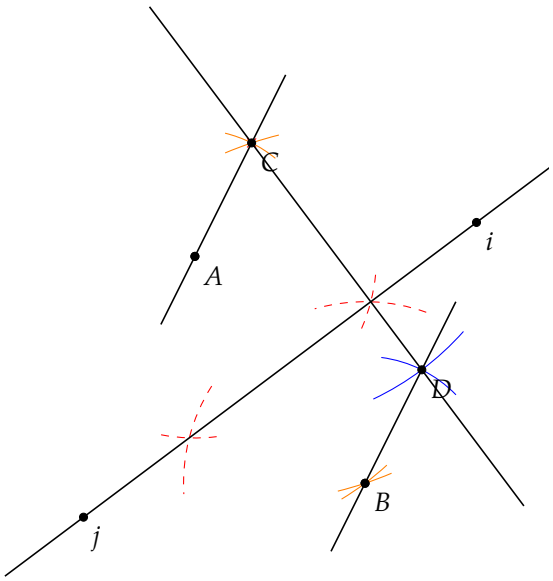
```
\begin{tikzpicture}
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(5,0){B}
  \tkzInterCC[R](A,4cm)(B,3cm)
  \tkzGetPoints{C}{D}
  \tkzDrawPoints(A,B,C)
  \tkzCompass[color=red,delta=20](A,C)
  \tkzCompass[color=red,delta=20](B,C)
  \tkzDrawPolygon(A,B,C)
  \tkzMarkAngle(A,C,B)
\end{tikzpicture}
```

25.2 Multiples constructions \tkzCompasss

\tkzCompasss[⟨local options⟩](⟨pt1,pt2 pt3,pt4,...⟩)

Attention les arguments sont des listes de deux points. Cela permet d'économiser quelques lignes de codes.

options	default	definition
delta	0	Modifie l'angle de l'arc en l'augmentant symétriquement
length	1	Modifie la longueur



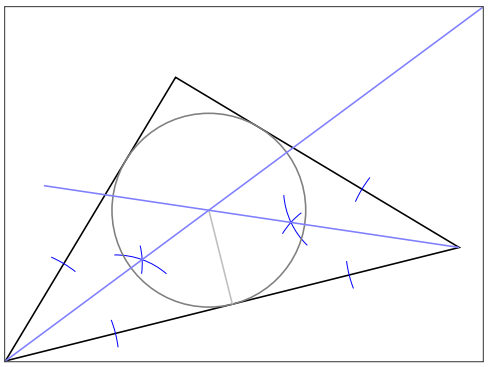

```
\begin{tikzpicture}[scale=.75]
 \tkzDefPoint(2,2){A}  \tkzDefPoint(5,-2){B}
 \tkzDefPoint(3,4){C}  \tkzDrawPoints(A,B)
 \tkzDrawPoint[color=red,shape=cross out](C)
 \tkzCompasss[color=orange](A,B A,C B,C C,B)
 \tkzShowLine[mediator,color=red,
                              dashed,length = 2](A,B)
 \tkzShowLine[parallel = through C,
                             color=blue,length=2](A,B)
 \tkzDefLine[mediator](A,B)  \tkzGetPoints{i}{j}
 \tkzDefLine[parallel=through C](A,B) \tkzGetPoint{D}
 \tkzDrawLines[add=.6 and .6](C,D A,C B,D)
 \tkzDrawLines(i,j) \tkzDrawPoints(A,B,C,i,j,D)
 \tkzLabelPoints(A,B,C,i,j,D)
\end{tikzpicture}
```

25.3 Macro de configuration \tkzSetUpCompass

\tkzSetUpCompass[⟨local options⟩]

options	default	definition
line width	0.4pt	épaisseur du trait
color	black!50	couleur du trait
style	solid	style du trait solid, dashed,dotted,...

```
\tkzSetUpCompass[color=blue,line width=.3 pt]
```



```
\begin{tikzpicture}[scale=.75,
      showbi/.style={bisector,size=2,gap=3}]
  \tkzSetUpCompass[color=blue,line width=.3 pt]
  \tkzDefPoints{0/1/A, 8/3/B, 3/6/C}
  \tkzDrawPolygon(A,B,C)
  \tkzDefLine[bisector](B,A,C)  \tkzGetPoint{a}
  \tkzDefLine[bisector](C,B,A)  \tkzGetPoint{b}
  \tkzShowLine[showbi](B,A,C)
  \tkzShowLine[showbi](C,B,A)
  \tkzInterLL(A,a)(B,b) \tkzGetPoint{I}
  \tkzDefPointBy[projection= onto A--B](I)
 \tkzGetPoint{H}
  \tkzDrawCircle[radius,color=gray](I,H)
  \tkzDrawSegments[color=gray!50](I,H)
  \tkzDrawLines[add=0 and -.2,color=blue!50 ](A,a B,b)
\tkzShowBB
\end{tikzpicture}
```

26 The Show

26.1 Montrer les constructions de certaines lignes \tkzShowLine

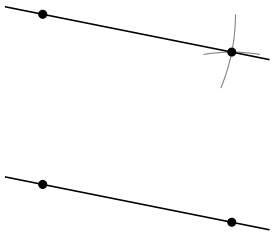
\tkzShowLine[⟨local options⟩](⟨pt1,pt2⟩) ou (⟨pt1,pt2,pt3⟩)

Ces constructions concernent les médiatrices, les droites perpendiculaires ou parallèles passant par un point donné et les bissectrices. Les arguments sont donc des listes de deux ou bien de trois points. Plusieurs options permettent l'ajustement des constructions. L'idée de cette macro revient à **Yves Combe**

options	default	definition
mediator	mediator	affiche les constructions d'une médiatrice
perpendicular	mediator	constructions pour une perpendiculaire
orthogonal	mediator	idem
bisector	mediator	constructions pour une bissectrice
K	1	cercle inscrit dans à un triangle
length	1	en cm, longueur d'un arc
ratio	.5	rapport entre les longueurs des arcs
gap	2	placement le point de construction
size	1	rayon d'un arc (voir bissectrice)

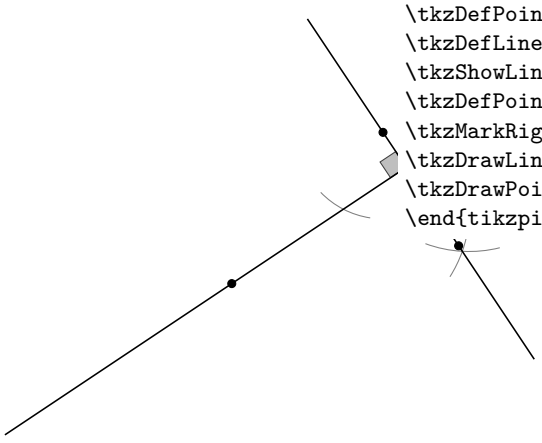
Il faut ajouter bien sûr tous les styles de TikZ pour les tracés

26.1.1 Exemple de \tkzShowLine et parallel



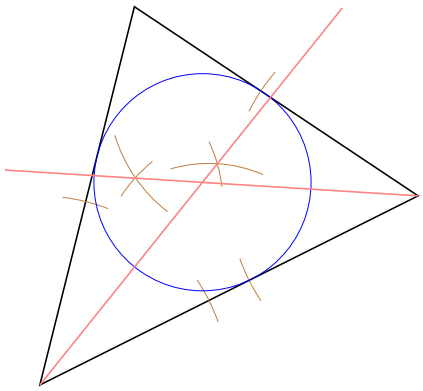
```
\begin{tikzpicture}
 \tkzDefPoints{-1.5/-0.25/A,1/-0.75/B,-1.5/2/C}
 \tkzDrawLine(A,B)
 \tkzDefLine[parallel=through C](A,B) \tkzGetPoint{c}
 \tkzShowLine[parallel=through C](A,B)
 \tkzDrawLine(C,c) \tkzDrawPoints(A,B,C,c)
\end{tikzpicture}
```

26.1.2 Exemple de \tkzShowLine et perpendicular



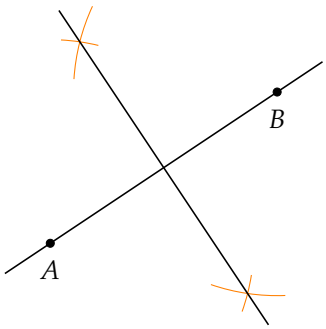
```
\begin{tikzpicture}
\tkzDefPoints{0/0/A, 3/2/B, 2/2/C}
\tkzDefLine[perpendicular=through C,K=-.5](A,B) \tkzGetPoint{c}
\tkzShowLine[perpendicular=through C,K=-.5,gap=3](A,B)
\tkzDefPointBy[projection=onto A--B](c)\tkzGetPoint{h}
\tkzMarkRightAngle[fill=lightgray](A,h,C)
\tkzDrawLines[add=1 and 1](A,B C,c)
\tkzDrawPoints(A,B,C,h,c)
\end{tikzpicture}
```

26.1.3 Exemple de \tkzShowLine et bisector



```
\begin{tikzpicture}[scale=1.25]
 \tkzDefPoints{0/0/A, 4/2/B, 1/4/C}
 \tkzDrawPolygon(A,B,C)
 \tkzSetUpCompass[color=brown,line width=.1 pt]
 \tkzDefLine[bisector](B,A,C)  \tkzGetPoint{a}
 \tkzDefLine[bisector](C,B,A)  \tkzGetPoint{b}
 \tkzInterLL(A,a)(B,b) \tkzGetPoint{I}
 \tkzDefPointBy[projection = onto A--B](I)
   \tkzGetPoint{H}
 \tkzShowLine[bisector,size=2,gap=3,blue](B,A,C)
 \tkzShowLine[bisector,size=2,gap=3,blue](C,B,A)
 \tkzDrawCircle[radius,color=blue,%
 line width=.2pt](I,H)
 \tkzDrawSegments[color=red!50](I,tkzPointResult)
 \tkzDrawLines[add=0 and -0.3,color=red!50](A,a B,b)
\end{tikzpicture}
```

26.1.4 Exemple de \tkzShowLine et mediator




```
\begin{tikzpicture}
\tkzDefPoint(2,2){A}
\tkzDefPoint(5,4){B}
\tkzDrawPoints(A,B)
\tkzShowLine[mediator,color=orange,length=1](A,B)
\tkzGetPoints{i}{j}
\tkzDrawLines[add=-0.1 and -0.1](i,j)
\tkzDrawLines(A,B)
\tkzLabelPoints[below =3pt](A,B)
\end{tikzpicture}
```

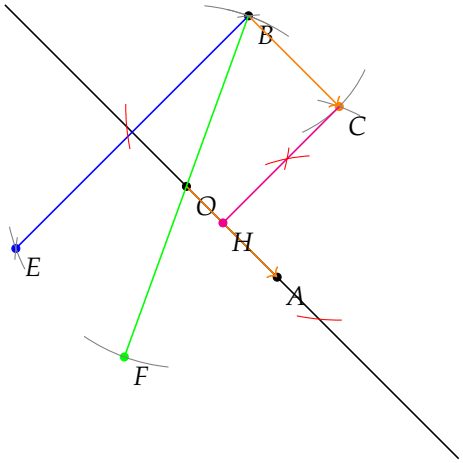
26.2 Constructions de certaines transformations \tkzShowTransformation

\tkzShowTransformation[⟨local options⟩](⟨pt1,pt2⟩) ou (⟨pt1,pt2,pt3⟩)

Ces constructions concernent les symétries orthogonales, les symétries centrales, les projections orthogonales et les translations. Plusieurs options permettent l'ajustement des constructions. L'idée de cette macro revient à **Yves Combe**

options	default	definition
reflection= over pt1--pt2	reflection	constructions d'une symétrie orthogonale
symmetry=center pt	reflection	constructions d'une symétrie centrale
projection=onto pt1--pt2	reflection	constructions d'une projection
translation=from pt1 to pt2	reflection	constructions d'une translation
K	1	cercle inscrit dans à un triangle
length	1	longueur d'un arc
ratio	.5	rapport entre les longueurs des arcs
gap	2	placement le point de construction
size	1	rayon d'un arc (voir bissectrice)

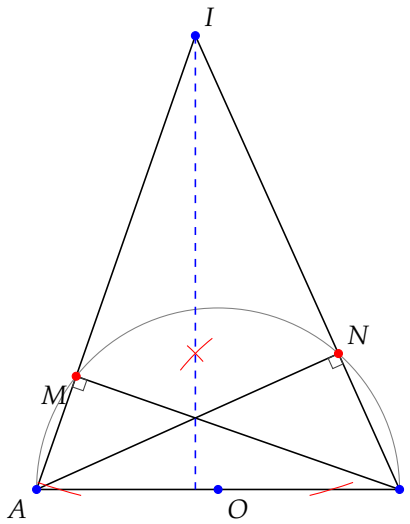
26.2.1 Exemple d'utilisation de \tkzShowTransformation




```
\begin{tikzpicture}[scale=.6]
  \tkzDefPoint(0,0){O} \tkzDefPoint(2,-2){A}
  \tkzDefPoint(70:4){B} \tkzDrawPoints(A,O,B)
  \tkzLabelPoints(A,O,B)
  \tkzDrawLine[add= 2 and 2](O,A)
  \tkzDefPointBy[translation=from O to A](B)
  \tkzGetPoint{C}
  \tkzDrawPoint[color=orange](C)  \tkzLabelPoints(C)
  \tkzShowTransformation[translation=from O to A,%
            length=2](B)
  \tkzDrawSegments[->,color=orange](O,A B,C)
  \tkzDefPointBy[reflection=over O--A](B) \tkzGetPoint{E}
  \tkzDrawSegment[blue](B,E)
  \tkzDrawPoint[color=blue](E)\tkzLabelPoints(E)
  \tkzShowTransformation[reflection=over O--A,size=2](B)
  \tkzDefPointBy[symmetry=center O](B) \tkzGetPoint{F}
  \tkzDrawSegment[color=green](B,F)
  \tkzDrawPoint[color=green](F)\tkzLabelPoints(F)
  \tkzShowTransformation[symmetry=center O,%
                      length=2](B)
  \tkzDefPointBy[projection=onto O--A](C)
  \tkzGetPoint{H}
  \tkzDrawSegments[color=magenta](C,H)
  \tkzDrawPoint[color=magenta](H)\tkzLabelPoints(H)
  \tkzShowTransformation[projection=onto O--A,%
                         color=red,size=3,gap=-2](C)
\end{tikzpicture}
```

26.2.2 Autre exemple d'utilisation de \tkzShowTransformation

Vous retouverez cette figure, mais sans les traits de construction




```
\begin{tikzpicture}[scale=.6]
  \tkzDefPoints{0/0/A,8/0/B,3.5/10/I}
  \tkzDefMidPoint(A,B) \tkzGetPoint{O}
  \tkzDefPointBy[projection=onto A--B](I)
     \tkzGetPoint{J}
  \tkzInterLC(I,A)(O,A)  \tkzGetPoints{M'}{M}
  \tkzInterLC(I,B)(O,A)  \tkzGetPoints{N}{N'}
  \tkzDrawSemiCircle[diameter](A,B)
  \tkzDrawSegments(I,A I,B A,B B,M A,N)
  \tkzMarkRightAngles(A,M,B A,N,B)
  \tkzDrawSegment[style=dashed,color=blue](I,J)
  \tkzShowTransformation[projection=onto A--B,
                  color=red,size=3,gap=-3](I)
  \tkzDrawPoints[color=red](M,N)
  \tkzDrawPoints[color=blue](O,A,B,I)
  \tkzLabelPoints(O)
  \tkzLabelPoints[above right](N,I)
  \tkzLabelPoints[below left](M,A)
\end{tikzpicture}
```

27 Différents points

27.1 \tkzDefEquiPoints

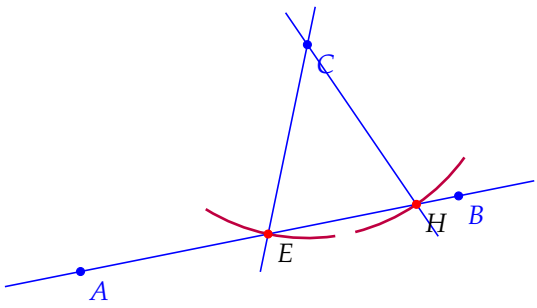
Cette macro permet d'obtenir deux points d'une droite équidistants d'un point donné.

\tkzDefEquiPoints[⟨local options⟩](⟨pt1,pt2⟩)

arguments	défaut	définition
(pt1,pt2)	no default	liste non ordonnée de deux points

options	default	definition
dist	2 cm	moitié de la distance entre les deux points
from=pt	no default	point de référence
show	false	si true affiche les traces de compas
/compass/delta	0	taille des traces de compas

27.1.1 Utilisation de \tkzDefEquiPoints avec des options




```
\begin{tikzpicture}
  \tkzSetUpCompass[color=purple,line width=1pt]
  \tkzDefPoint(0,1){A}
  \tkzDefPoint(5,2){B}
  \tkzDefPoint(3,4){C}
  \tkzDefEquiPoints[from=C,dist=1,show,
      /tkzcompass/delta=20](A,B)
   \tkzGetPoints{E}{H}
   \tkzDrawLines[color=blue](C,E C,H A,B)
   \tkzDrawPoints[color=blue](A,B,C)
   \tkzDrawPoints[color=red](E,H)
   \tkzLabelPoints(E,H)
   \tkzLabelPoints[color=blue](A,B,C)
\end{tikzpicture}
```

28 Rapporteurs

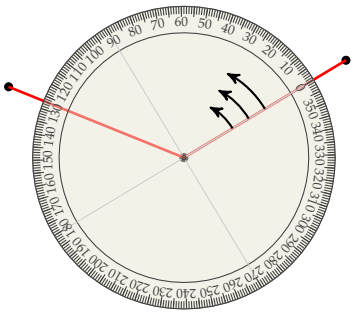
D'après une idée de Yves Combe., la macro suivante permet de dessiner un rapporteur.

`\tkzProtractor[⟨local options⟩](⟨O,A⟩)`

options	défaut	définition
lw	0.4 pt	épaisseur des lignes
scale	1	ratio : permet d'ajuster la taille du rapporteur
return	false	sens indirect du cercle trigonométrique

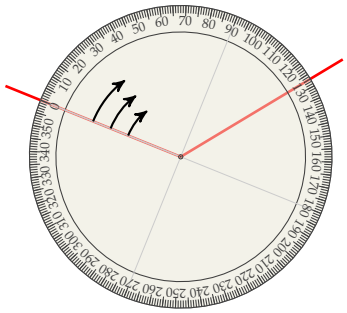
28.1 Le rapporteur circulaire

Mesure dans le sens direct



```
\begin{tikzpicture}[scale=.5]
\tkzDefPoint(2,0){A}\tkzDefPoint(0,0){O}
\tkzDefShiftPoint[A](31:5){B}
\tkzDefShiftPoint[A](158:5){C}
\tkzDrawPoints(A,B,C)
\tkzDrawSegments[color = red,
    line width = 1pt](A,B A,C)
  \tkzProtractor[scale = 1](A,B)
\end{tikzpicture}
```

28.2 Le rapporteur circulaire, transparent et retourné



```
\begin{tikzpicture}[scale=.5]
  \tkzDefPoint(2,3){A}
  \tkzDefShiftPoint[A](31:5){B}
   \tkzDefShiftPoint[A](158:5){C}
  \tkzDrawSegments[color=red,line width=1pt](A,B A,C)
  \tkzProtractor[return](A,C)
\end{tikzpicture}
```

29 Des exemples

29.1 Quelques exemples intéressants

29.1.1 Triangles isocèles semblables

Ce qui suit provient de l'excellent site **Descartes et les Mathématiques**. Je n'ai pas modifié le texte et je ne suis l'auteur que de la programmation des figures.

http://debart.pagesperso-orange.fr/seconde/triangle.html

Bibliographie : Géométrie au Bac - Tangente, hors série no 8 - Exercice 11, page 11

Élisabeth Busser et Gilles Cohen : 200 nouveaux problèmes du Monde - POLE 2007

Affaire de logique n° 364 - Le Monde 17 février 2004

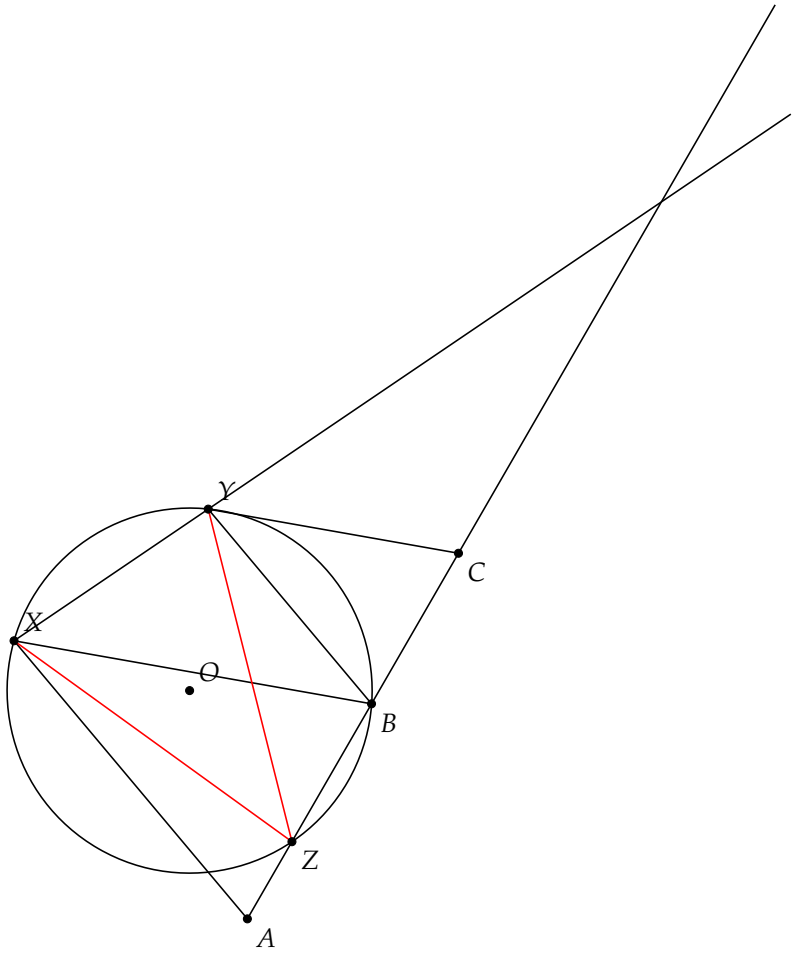
Deux énoncés ont été proposés, l'un par la revue Tangente, et l'autre par le journal Le Monde.

Rédaction de la revue Tangente : On construit deux triangles isocèles semblables AXB et BYC de sommets principaux X et Y, tels que A, B et C soient alignés et que ces triangles soient « indirect ». Soit α l'angle au sommet $\widehat{AXB} = \widehat{BYC}$. On construit ensuite un troisième triangle isocèle XZY semblable aux deux premiers, de sommet principal Z et « indirect ».
On demande de démontrer que le point Z appartient à la droite (AC).

Rédaction du Monde : On construit deux triangles isocèles semblables AXB et BYC de sommets principaux X et Y, tels que A, B et C soient alignés et que ces triangles soient « indirect ». Soit α l'angle au sommet $\widehat{AXB} = \widehat{BYC}$. Le point Z du segment [AC] est équidistant des deux sommets X et Y.
Sous quel angle voit-il ces deux sommets ?

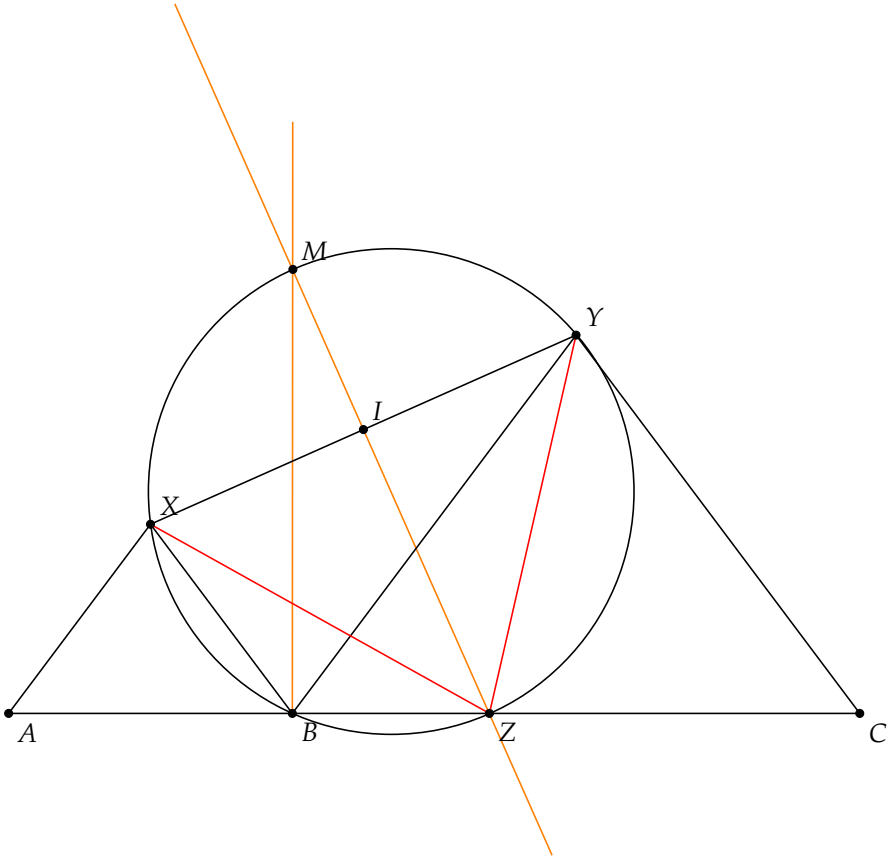
Les constructions et leurs codes associés sont sur les deux pages suivantes, mais vous pouvez chercher avant de regarder. La programmation respecte (il me semble ...), mon raisonnement dans les deux cas.

29.1.2 version revue "Tangente"




```
\begin{tikzpicture}[scale=.8,rotate=60]
  \tkzDefPoint(6,0){X}   \tkzDefPoint(3,3){Y}
  \tkzDefShiftPoint[X](-110:6){A}    \tkzDefShiftPoint[X](-70:6){B}
  \tkzDefShiftPoint[Y](-110:4.2){A'} \tkzDefShiftPoint[Y](-70:4.2){B'}
  \tkzDefPointBy[translation= from A' to B ](Y) \tkzGetPoint{Y}
  \tkzDefPointBy[translation= from A' to B ](B') \tkzGetPoint{C}
  \tkzInterLL(A,B)(X,Y) \tkzGetPoint{O}
  \tkzDefMidPoint(X,Y) \tkzGetPoint{I}
  \tkzDefPointWith[orthogonal](I,Y)
  \tkzInterLL(I,tkzPointResult)(A,B) \tkzGetPoint{Z}
  \tkzDefCircle[circum](X,Y,B) \tkzGetPoint{O}
  \tkzDrawCircle(O,X)
  \tkzDrawLines[add = 0 and 1.5](A,C) \tkzDrawLines[add = 0 and 3](X,Y)
  \tkzDrawSegments(A,X B,X B,Y C,Y)   \tkzDrawSegments[color=red](X,Z Y,Z)
  \tkzDrawPoints(A,B,C,X,Y,O,Z)
  \tkzLabelPoints(A,B,C,Z)   \tkzLabelPoints[above right](X,Y,O)
\end{tikzpicture}
```

29.1.3 version "Le Monde"



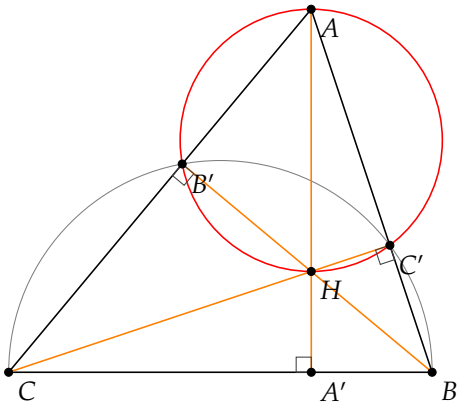

```
\begin{tikzpicture}[scale=1.25]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(3,0){B}
  \tkzDefPoint(9,0){C}
  \tkzDefPoint(1.5,2){X}
  \tkzDefPoint(6,4){Y}
  \tkzDefCircle[circum](X,Y,B) \tkzGetPoint{O}
  \tkzDefMidPoint(X,Y)                \tkzGetPoint{I}
  \tkzDefPointWith[orthogonal](I,Y)   \tkzGetPoint{i}
  \tkzDrawLines[add = 2 and 1,color=orange](I,i)
  \tkzInterLL(I,i)(A,B)               \tkzGetPoint{Z}
  \tkzInterLC(I,i)(O,B)               \tkzGetSecondPoint{M}
  \tkzDefPointWith[orthogonal](B,Z)   \tkzGetPoint{b}
  \tkzDrawCircle(O,B)
  \tkzDrawLines[add = 0 and 2,color=orange](B,b)
  \tkzDrawSegments(A,X B,X B,Y C,Y A,C X,Y)
  \tkzDrawSegments[color=red](X,Z Y,Z)
  \tkzDrawPoints(A,B,C,X,Y,Z,M,I)
  \tkzLabelPoints(A,B,C,Z)
  \tkzLabelPoints[above right](X,Y,M,I)
\end{tikzpicture}
```

29.1.4 Hauteurs d'un triangle

Ce qui suit provient encore de l'excellent site **Descartes et les Mathématiques**.

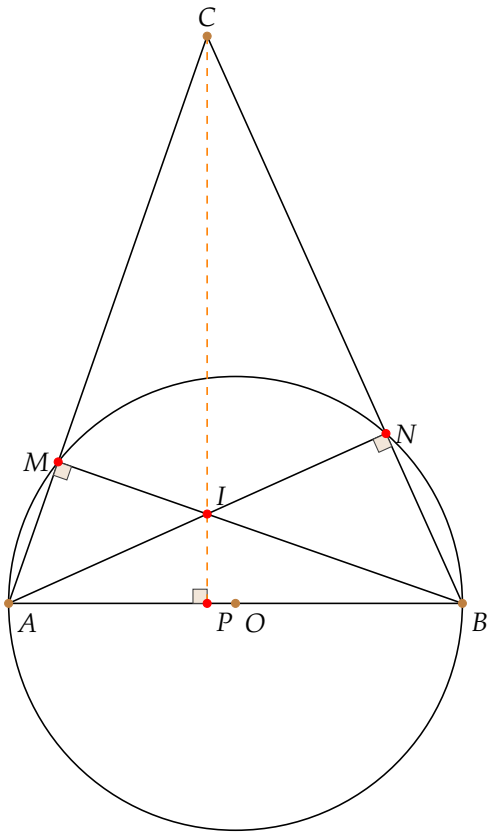
http://debart.pagesperso-orange.fr/geoplan/geometrie_triangle.html

Les trois hauteurs d'un triangle sont concourantes au même point H.




```
\begin{tikzpicture}[scale=.8]
   \tkzDefPoint(0,0){C}
   \tkzDefPoint(7,0){B}
   \tkzDefPoint(5,6){A}
   \tkzDrawPolygon(A,B,C)
   \tkzDefMidPoint(C,B)
   \tkzGetPoint{I}
   \tkzDrawArc(I,B)(C)
   \tkzInterLC(A,C)(I,B)
   \tkzGetSecondPoint{B'}
   \tkzInterLC(A,B)(I,B)
   \tkzGetFirstPoint{C'}
   \tkzInterLL(B,B')(C,C')
   \tkzGetPoint{H}
   \tkzInterLL(A,H)(C,B)
   \tkzGetPoint{A'}
     \tkzDefCircle[circum](A,B',C')
    \tkzGetPoint{O}
   \tkzDrawCircle[color=red](O,A)
   \tkzDrawSegments[color=orange](B,B' C,C' A,A')
   \tkzMarkRightAngles(C,B',B B,C',C C,A',A)
   \tkzDrawPoints(A,B,C,A',B',C',H)
   \tkzLabelPoints(A,B,C,A',B',C',H)
\end{tikzpicture}
```

29.1.5 Hauteurs - autre construction

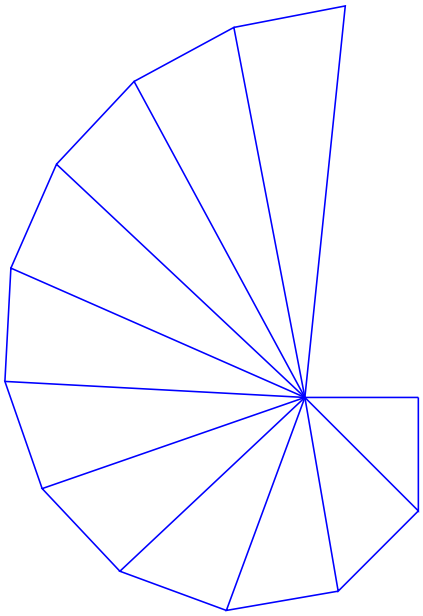



```
\begin{tikzpicture}[scale=.75]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(8,0){B}
  \tkzDefPoint(3.5,10){C}
  \tkzDefMidPoint(A,B)
  \tkzGetPoint{O}
  \tkzDefPointBy[projection=onto A--B](C)
  \tkzGetPoint{P}
  \tkzInterLC(C,A)(O,A)
  \tkzGetSecondPoint{M}
  \tkzInterLC(C,B)(O,A)
  \tkzGetFirstPoint{N}
  \tkzInterLL(B,M)(A,N)
  \tkzGetPoint{I}
  \tkzDrawCircle[diameter](A,B)
  \tkzDrawSegments(C,A C,B A,B B,M A,N)
  \tkzMarkRightAngles[fill=brown!20](A,M,B A,N,B A,P,C)
  \tkzDrawSegment[style=dashed,color=orange](C,P)
  \tkzLabelPoints(O,A,B,P)
  \tkzLabelPoint[left](M){$M$}
  \tkzLabelPoint[right](N){$N$}
  \tkzLabelPoint[above](C){$C$}
  \tkzLabelPoint[above right](I){$I$}
  \tkzDrawPoints[color=red](M,N,P,I)
  \tkzDrawPoints[color=brown](O,A,B,C)
\end{tikzpicture}
```

29.2 Different authors

29.2.1 Square root of the integers

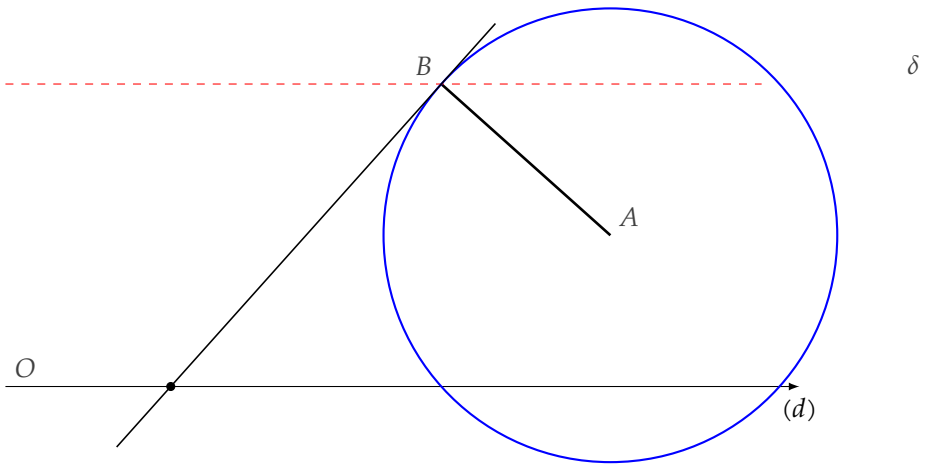
How to get 1, $\sqrt{2}$, $\sqrt{3}$ with a rule and a compass.



```
\begin{tikzpicture}[scale=1.5]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(1,0){a0}
   \tkzDrawSegment[blue](O,a0)
  \foreach \i [count=\j] in {0,...,10}{%
    \tkzDefPointWith[orthogonal normed](a\i,O)
    \tkzGetPoint{a\j}
    \tkzDrawPolySeg[color=blue](a\i,a\j,O)}
 \end{tikzpicture}
```

29.2.2 Circle and tangent

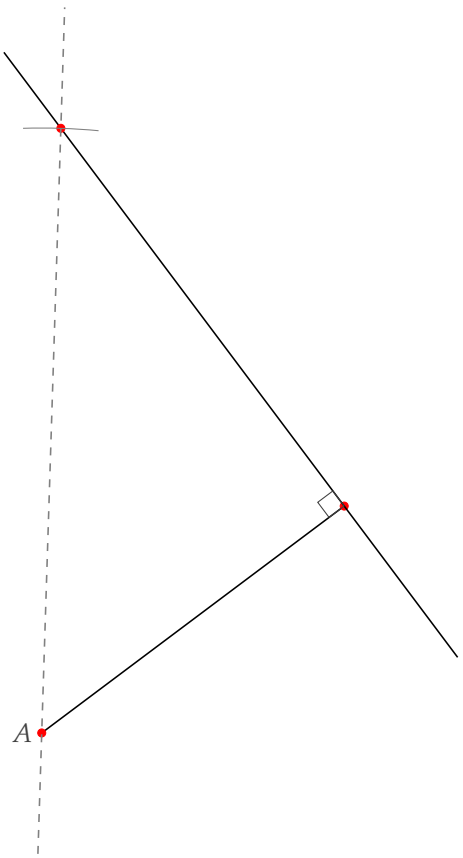
We have a point A (8,2), a circle with center A and radius=3cm and a line δ $y = 4$. The line intercepts the circle at B. We want to draw the tangent at the circle in B.



```
\begin{tikzpicture}
  \edef\alphaR{\fpeval{asin(2/3)}}
  \edef\xB{8-3*cos(\alphaR)}
  \tkzDrawX[noticks,label=$(d)$]
  \tkzDefPoint["$A$" above right](8,2){A}
  \tkzDefPoint[color=red,"$O$" above right](0,0){O}
  \tkzDefPoint["$B$" above left](\xB,4){B}
  \tkzDefLine[orthogonal=through B](A,B) \tkzGetPoint{b}
  \tkzDefPoint(1,0){i}
  \tkzInterLL(B,b)(O,i) \tkzGetPoint{B'}
  \tkzDrawSegment[line width=1pt](A,B)
  \tkzHLine[color=red,style=dashed]{4}
  \tkzText[above](12,4){$\delta$}
  \tkzDrawCircle[R,color=blue,line width=.8pt](A,3 cm)
  \tkzDrawPoint(B')
  \tkzDrawLine(B,B')
 \end{tikzpicture}
```

29.2.3 About right triangle

We have a segment $[AB]$ and we want to determine a point C such as $AC = 8cm$ and ABC is a right triangle in B.



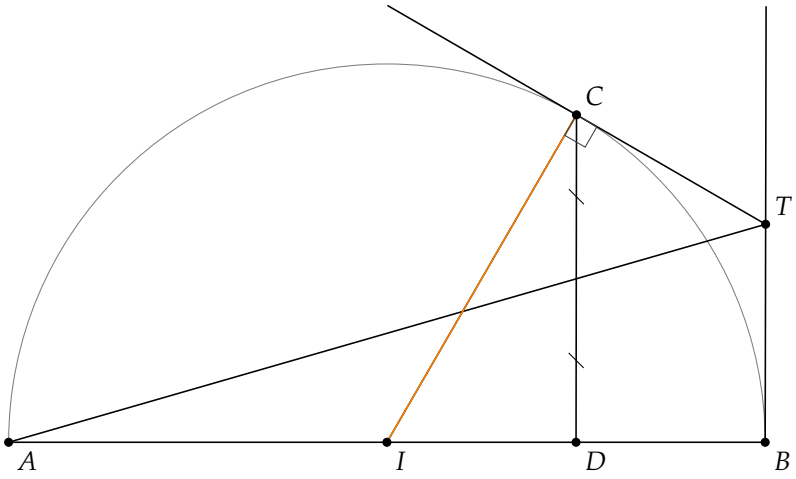

```
\begin{tikzpicture}
  \tkzDefPoint["$A$" left](2,1){A}
  \tkzDefPoint(6,4){B}
  \tkzDrawSegment(A,B)
  \tkzDrawPoint[color=red](A)
  \tkzDrawPoint[color=red](B)
  \tkzDefPointWith[orthogonal,K=-1](B,A)
  \tkzDrawLine[add = .5 and .5](B,tkzPointResult)
  \tkzInterLC[R](B,tkzPointResult)(A,8 cm)
  \tkzGetPoints{C}{J}
  \tkzDrawPoint[color=red](C)
  \tkzCompass(A,C)
  \tkzMarkRightAngle(A,B,C)
  \tkzDrawLine[color=gray,style=dashed](A,C)
\end{tikzpicture}
```

29.2.4 Archimedes

This is an ancient problem proved by the great Greek mathematician Archimedes . The figure below shows a semicircle, with diameter AB. A tangent line is drawn and touches the semicircle at B. An other tangent line

at a point, C, on the semicircle is drawn. We project the point C on the segment$[AB]$ on a point D . The two tangent lines intersect at the point T.

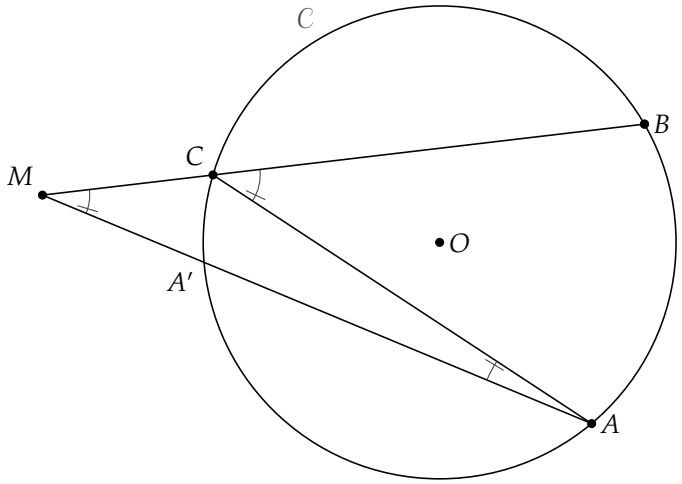
Prove that the line (AT) bisects (CD)




```
\begin{tikzpicture}[scale=1.25]
  \tkzDefPoint(0,0){A}\tkzDefPoint(6,0){D}
  \tkzDefPoint(8,0){B}\tkzDefPoint(4,0){I}
  \tkzDefLine[orthogonal=through D](A,D)
  \tkzInterLC[R](D,tkzPointResult)(I,4 cm) \tkzGetFirstPoint{C}
  \tkzDefLine[orthogonal=through C](I,C)    \tkzGetPoint{c}
  \tkzDefLine[orthogonal=through B](A,B)    \tkzGetPoint{b}
  \tkzInterLL(C,c)(B,b) \tkzGetPoint{T}
  \tkzInterLL(A,T)(C,D) \tkzGetPoint{P}
  \tkzDrawArc(I,B)(A)
  \tkzDrawSegments(A,B A,T C,D I,C) \tkzDrawSegment[color=orange](I,C)
  \tkzDrawLine[add = 1 and 0](C,T)   \tkzDrawLine[add = 0 and 1](B,T)
  \tkzMarkRightAngle(I,C,T)
  \tkzDrawPoints(A,B,I,D,C,T)
  \tkzLabelPoints(A,B,I,D)  \tkzLabelPoints[above right](C,T)
  \tkzMarkSegment[pos=.25,mark=s|](C,D) \tkzMarkSegment[pos=.75,mark=s|](C,D)
\end{tikzpicture}
```

29.2.5 Exemple : Dimitris Kapeta

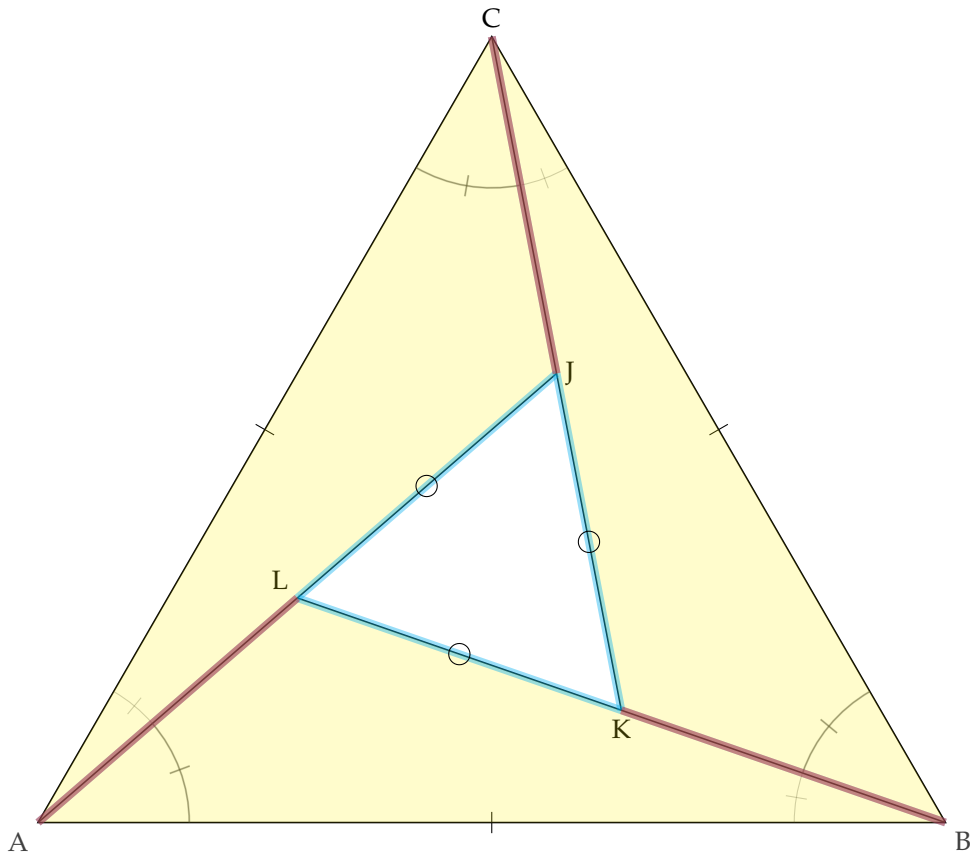
You need in this example to use **mkpos=.2** with **\tkzMarkAngle** because the measure of $\widehat{CAM}$ is too small. Another possiblity is to use **\tkzFillAngle**.




```
\begin{tikzpicture}[scale=1.25]
  \tkzDefPoint(0,0){O}
  \tkzDefPoint(2.5,0){N}
  \tkzDefPoint(-4.2,0.5){M}
  \tkzDefPointBy[rotation=center O angle 30](N)
  \tkzGetPoint{B}
  \tkzDefPointBy[rotation=center O angle -50](N)
  \tkzGetPoint{A}
  \tkzInterLC(M,B)(O,N) \tkzGetFirstPoint{C}
  \tkzInterLC(M,A)(O,N) \tkzGetSecondPoint{A'}
  \tkzMarkAngle[mkpos=.2, size=0.5](A,C,B)
  \tkzMarkAngle[mkpos=.2, size=0.5](A,M,C)
  \tkzDrawSegments(A,C M,A M,B)
  \tkzDrawCircle(O,N)
  \tkzLabelCircle[above left](O,N)(120){$\mathcal{C}$}
  \tkzMarkAngle[mkpos=.2, size=1.2](C,A,M)
  \tkzDrawPoints(O, A, B, M, B, C)
  \tkzLabelPoints[right](O,A,B)
  \tkzLabelPoints[above left](M,C)
  \tkzLabelPoint[below left](A'){$A'$}
\end{tikzpicture}
```

29.2.6 Example : John Kitzmiller

Prove $\triangle LKJ$ is equilateral

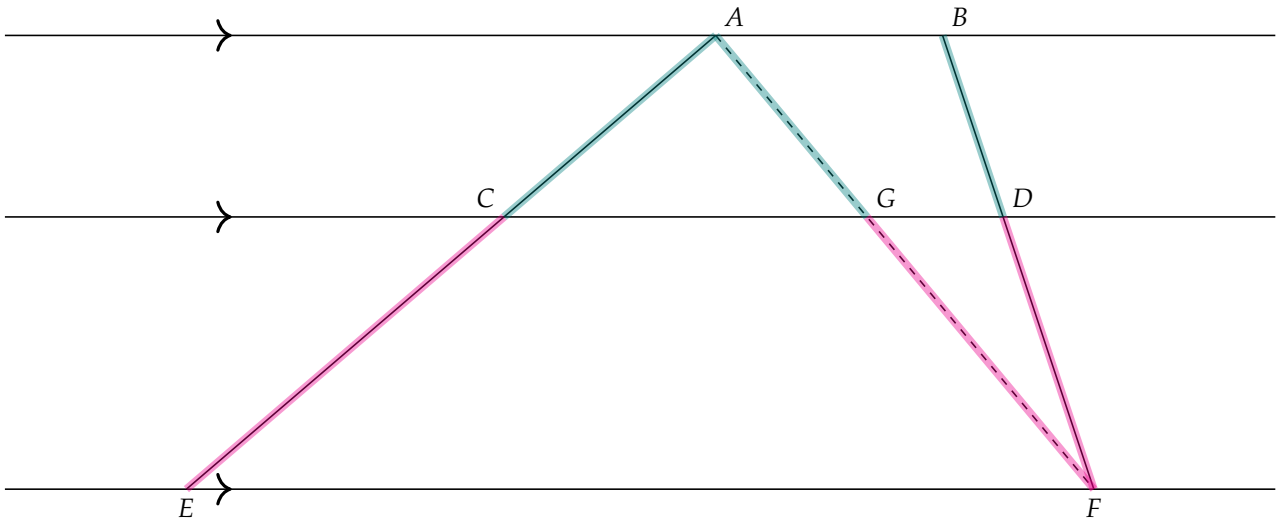



```
\begin{tikzpicture}[scale=2]
  \tkzDefPoint[label=below left:A](0,0){A}
  \tkzDefPoint[label=below right:B](6,0){B}
  \tkzDefTriangle[equilateral](A,B) \tkzGetPoint{C}
  \tkzMarkSegments[mark=|](A,B A,C B,C)
  \tkzDefBarycentricPoint(A=1,B=2) \tkzGetPoint{C'}
  \tkzDefBarycentricPoint(A=2,C=1) \tkzGetPoint{B'}
  \tkzDefBarycentricPoint(C=2,B=1) \tkzGetPoint{A'}
  \tkzInterLL(A,A')(C,C') \tkzGetPoint{J}
  \tkzInterLL(C,C')(B,B') \tkzGetPoint{K}
  \tkzInterLL(B,B')(A,A') \tkzGetPoint{L}
  \tkzLabelPoint[above](C){C}
  \tkzDrawPolygon(A,B,C) \tkzDrawSegments(A,J B,L C,K)
  \tkzMarkAngles[fill= orange,size=1cm,opacity=.3](J,A,C K,C,B L,B,A)
  \tkzLabelPoint[right](J){J}
  \tkzLabelPoint[below](K){K}
  \tkzLabelPoint[above left](L){L}
  \tkzMarkAngles[fill=orange, opacity=.3,thick,size=1,](A,C,J C,B,K B,A,L)
  \tkzMarkAngles[fill=green, size=1, opacity=.5](A,C,J C,B,K B,A,L)
  \tkzFillPolygon[color=yellow, opacity=.2](J,A,C)
  \tkzFillPolygon[color=yellow, opacity=.2](K,B,C)
  \tkzFillPolygon[color=yellow, opacity=.2](L,A,B)
  \tkzDrawSegments[line width=3pt,color=cyan,opacity=0.4](A,J C,K B,L)
  \tkzDrawSegments[line width=3pt,color=red,opacity=0.4](A,L B,K C,J)
  \tkzMarkSegments[mark=o](J,K K,L L,J)
\end{tikzpicture}
```

29.2.7 Exemple : John Kitzmiller

Prove $\dfrac{AC}{CE} = \dfrac{BD}{DF}$

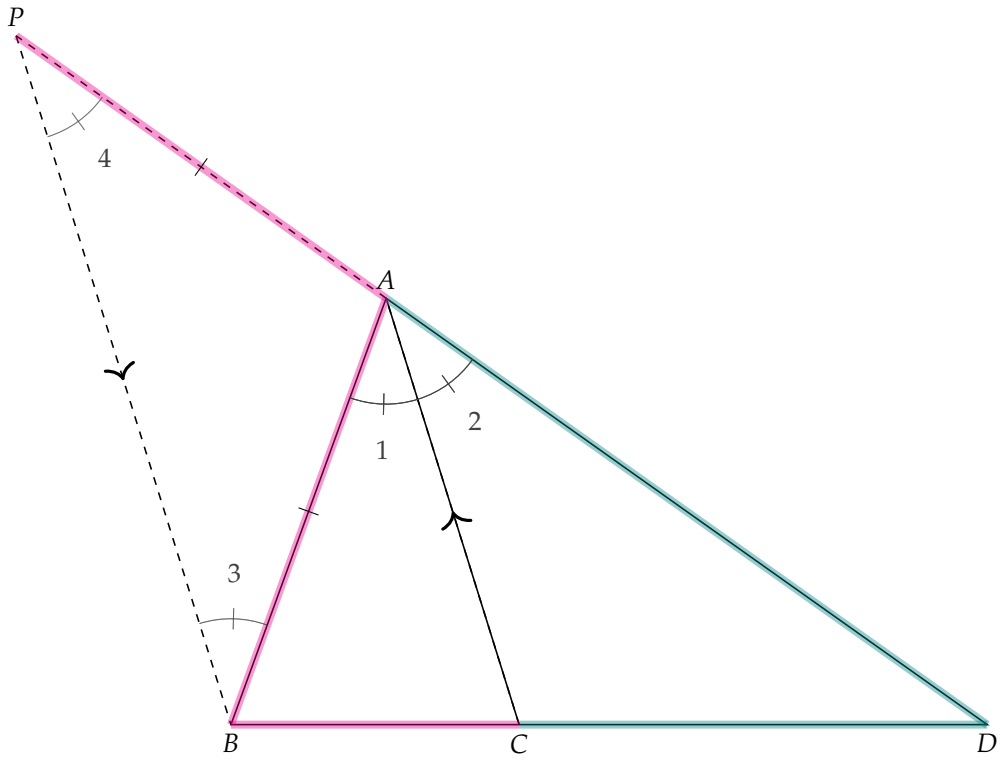
Another interesting example from John, you can see how to use some extra options like **decoration** and **postaction** from TikZ with **tkz-euclide**.




```
\begin{tikzpicture}[scale=2,decoration={markings,
  mark=at position 3cm with {\arrow[scale=2]{>}}}]
  \tkzDefPoints{0/0/E, 6/0/F, 0/1.8/P, 6/1.8/Q, 0/3/R, 6/3/S}
  \tkzDrawLines[postaction={decorate}](E,F P,Q R,S)
  \tkzDefPoints{3.5/3/A, 5/3/B}
  \tkzDrawSegments(E,A F,B)
  \tkzInterLL(E,A)(P,Q) \tkzGetPoint{C}
  \tkzInterLL(B,F)(P,Q) \tkzGetPoint{D}
  \tkzLabelPoints[above right](A,B)
  \tkzLabelPoints[below](E,F)
  \tkzLabelPoints[above left](C)
  \tkzDrawSegments[style=dashed](A,F)
  \tkzInterLL(A,F)(P,Q) \tkzGetPoint{G}
  \tkzLabelPoints[above right](D,G)
  \tkzDrawSegments[color=teal, line width=3pt, opacity=0.4](A,C A,G)
  \tkzDrawSegments[color=magenta, line width=3pt, opacity=0.4](C,E G,F)
  \tkzDrawSegments[color=teal, line width=3pt, opacity=0.4](B,D)
  \tkzDrawSegments[color=magenta, line width=3pt, opacity=0.4](D,F)
\end{tikzpicture}
```

29.2.8 Exemple : John Kitzmiller

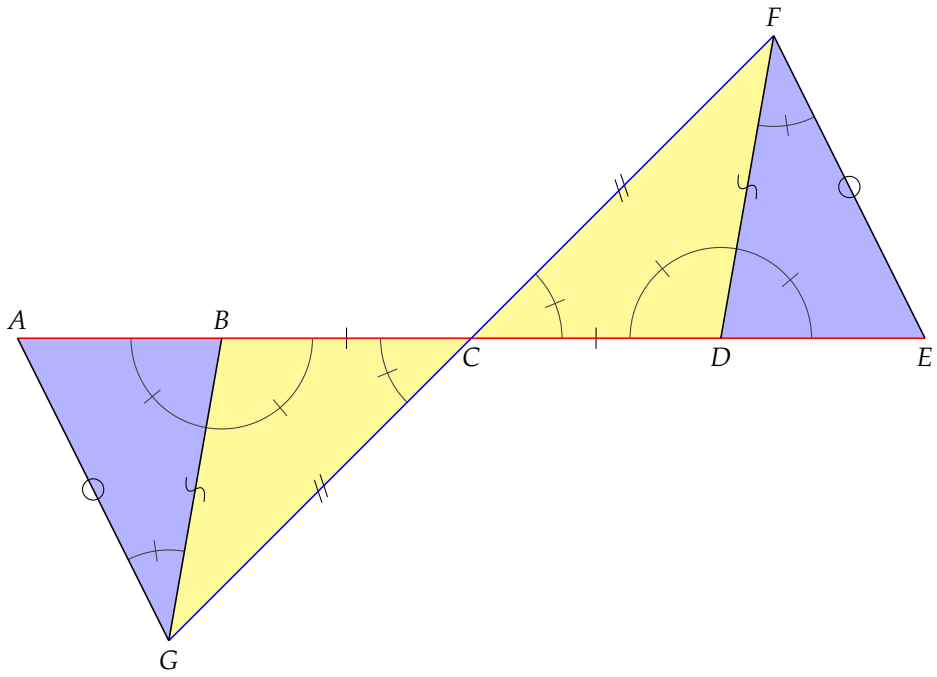
Prove $\dfrac{BC}{CD} = \dfrac{AB}{AD}$ (Angle Bisector)




```
\begin{tikzpicture}[scale=2]
  \tkzDefPoints{0/0/B, 5/0/D}       \tkzDefPoint(70:3){A}
  \tkzDrawPolygon(B,D,A)
  \tkzDefLine[bisector](B,A,D)      \tkzGetPoint{a}
  \tkzInterLL(A,a)(B,D)             \tkzGetPoint{C}
  \tkzDefLine[parallel=through B](A,C) \tkzGetPoint{b}
  \tkzInterLL(A,D)(B,b)             \tkzGetPoint{P}
  \begin{scope}[decoration={markings,
   mark=at position .5 with {\arrow[scale=2]{>}}}]
   \tkzDrawSegments[postaction={decorate},dashed](C,A P,B)
  \end{scope}
  \tkzDrawSegment(A,C) \tkzDrawSegment[style=dashed](A,P)
  \tkzLabelPoints[below](B,C,D) \tkzLabelPoints[above](A,P)
  \tkzDrawSegments[color=magenta, line width=3pt, opacity=0.4](B,C P,A)
  \tkzDrawSegments[color=teal,    line width=3pt, opacity=0.4](C,D A,D)
  \tkzDrawSegments[color=magenta, line width=3pt, opacity=0.4](A,B)
  \tkzMarkAngles[size=0.7](B,A,C C,A,D)
  \tkzMarkAngles[size=0.7, fill=green,   opacity=0.5](B,A,C A,B,P)
  \tkzMarkAngles[size=0.7, fill=yellow, opacity=0.3](B,P,A C,A,D)
  \tkzMarkAngles[size=0.7, fill=green,   opacity=0.6](B,A,C A,B,P B,P,A C,A,D)
  \tkzLabelAngle[pos=1](B,A,C){1}   \tkzLabelAngle[pos=1](C,A,D){2}
  \tkzLabelAngle[pos=1](A,B,P){3}    \tkzLabelAngle[pos=1](B,P,A){4}
  \tkzMarkSegments[mark=|](A,B A,P)
\end{tikzpicture}
```

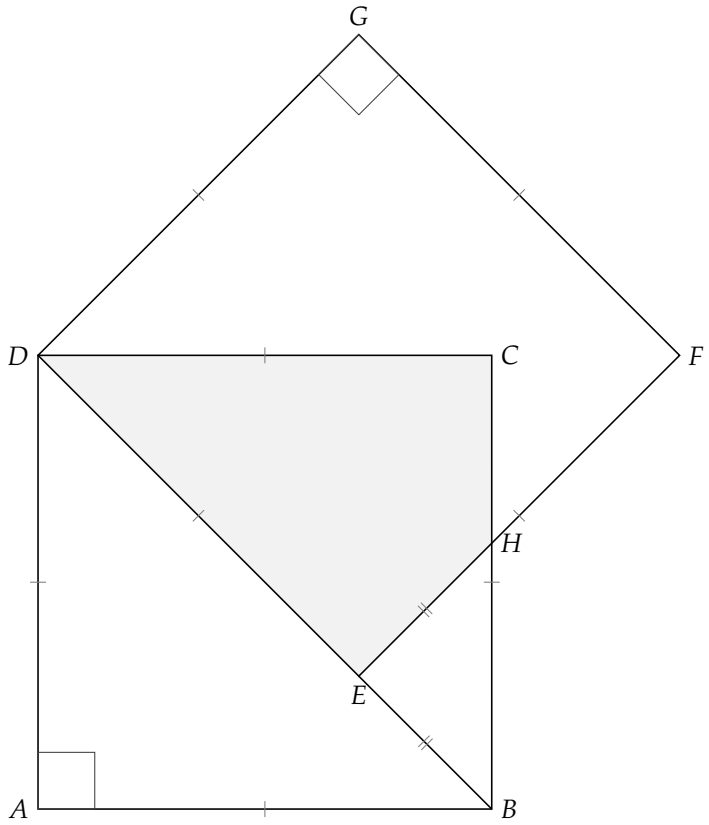
29.2.9 Exemple : author John Kitzmiller

Prove $\overline{AG} \cong \overline{EF}$ (Detour)



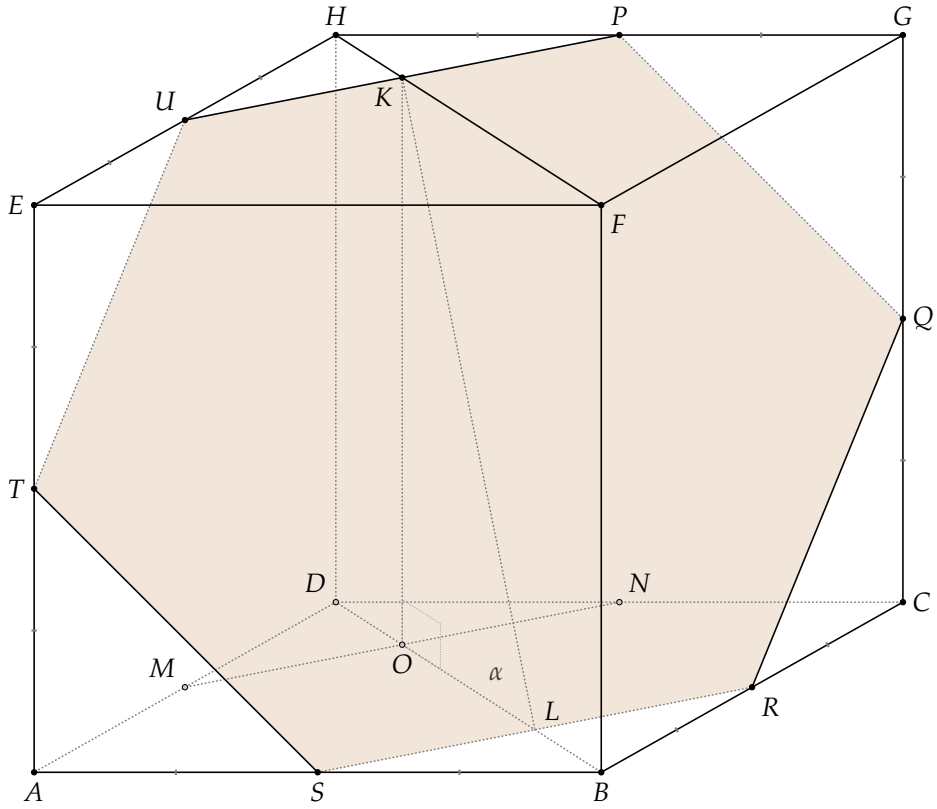

```
\begin{tikzpicture}[scale=2]
  \tkzDefPoint(0,3){A}    \tkzDefPoint(6,3){E}  \tkzDefPoint(1.35,3){B}
  \tkzDefPoint(4.65,3){D} \tkzDefPoint(1,1){G}  \tkzDefPoint(5,5){F}
  \tkzDefMidPoint(A,E)    \tkzGetPoint{C}
  \tkzFillPolygon[yellow, opacity=0.4](B,G,C)
  \tkzFillPolygon[yellow, opacity=0.4](D,F,C)
  \tkzFillPolygon[blue, opacity=0.3](A,B,G)
  \tkzFillPolygon[blue, opacity=0.3](E,D,F)
  \tkzMarkAngles[size=0.6,fill=green](B,G,A D,F,E)
  \tkzMarkAngles[size=0.6,fill=orange](B,C,G D,C,F)
  \tkzMarkAngles[size=0.6,fill=yellow](G,B,C F,D,C)
  \tkzMarkAngles[size=0.6,fill=red](A,B,G E,D,F)
  \tkzMarkSegments[mark=|](B,C D,C)  \tkzMarkSegments[mark=s||](G,C F,C)
  \tkzMarkSegments[mark=o](A,G E,F)  \tkzMarkSegments[mark=s](B,G D,F)
  \tkzDrawSegment[color=red](A,E)
  \tkzDrawSegment[color=blue](F,G)
  \tkzDrawSegments(A,G G,B E,F F,D)
  \tkzLabelPoints[below](C,D,E,G)  \tkzLabelPoints[above](A,B,F)
\end{tikzpicture}
```

29.2.10 Example from Indonesia



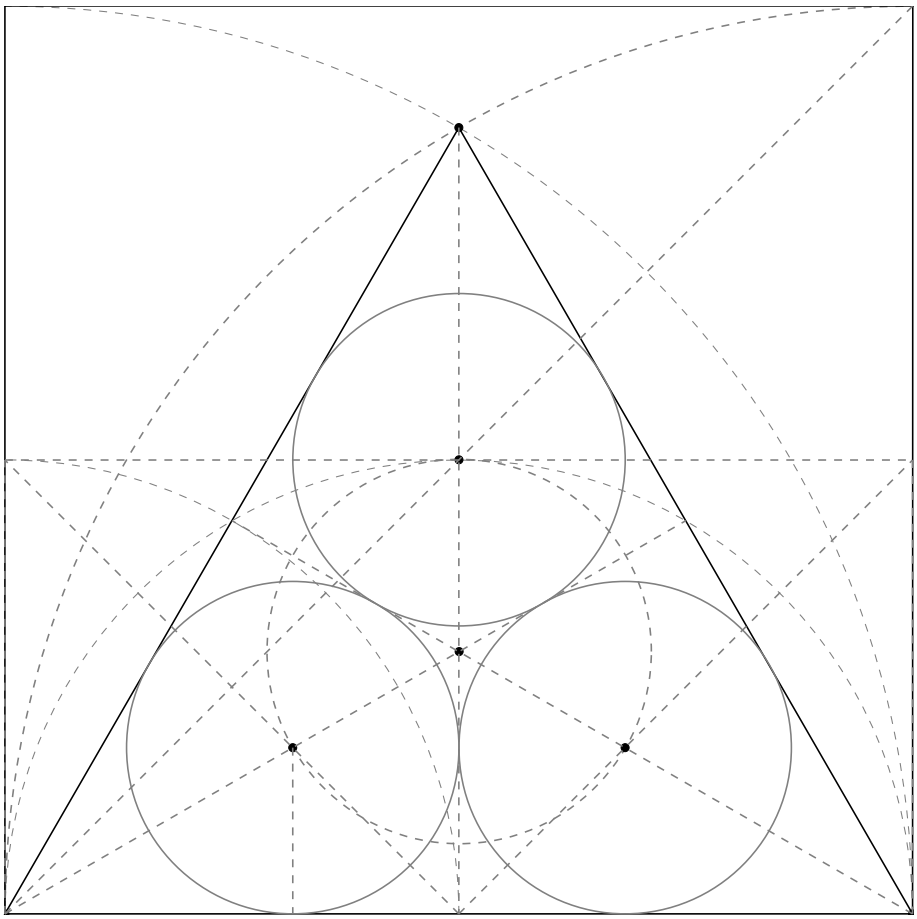

```
\begin{tikzpicture}[scale=3]
   \tkzDefPoints{0/0/A,2/0/B}
   \tkzDefSquare(A,B) \tkzGetPoints{C}{D}
   \tkzDefPointBy[rotation=center D angle 45](C)\tkzGetPoint{G}
   \tkzDefSquare(G,D)\tkzGetPoints{E}{F}
   \tkzInterLL(B,C)(E,F)\tkzGetPoint{H}
   \tkzFillPolygon[gray!10](D,E,H,C,D)
   \tkzDrawPolygon(A,...,D)\tkzDrawPolygon(D,...,G)
   \tkzDrawSegment(B,E)
   \tkzMarkSegments[mark=|,size=3pt,color=gray](A,B B,C C,D D,A E,F F,G G,D D,E)
   \tkzMarkSegments[mark=||,size=3pt,color=gray](B,E E,H)
   \tkzLabelPoints[left](A,D)
   \tkzLabelPoints[right](B,C,F,H)
   \tkzLabelPoints[above](G)\tkzLabelPoints[below](E)
   \tkzMarkRightAngles(D,A,B D,G,F)
\end{tikzpicture}
```

29.2.11 Another example from Indonesia



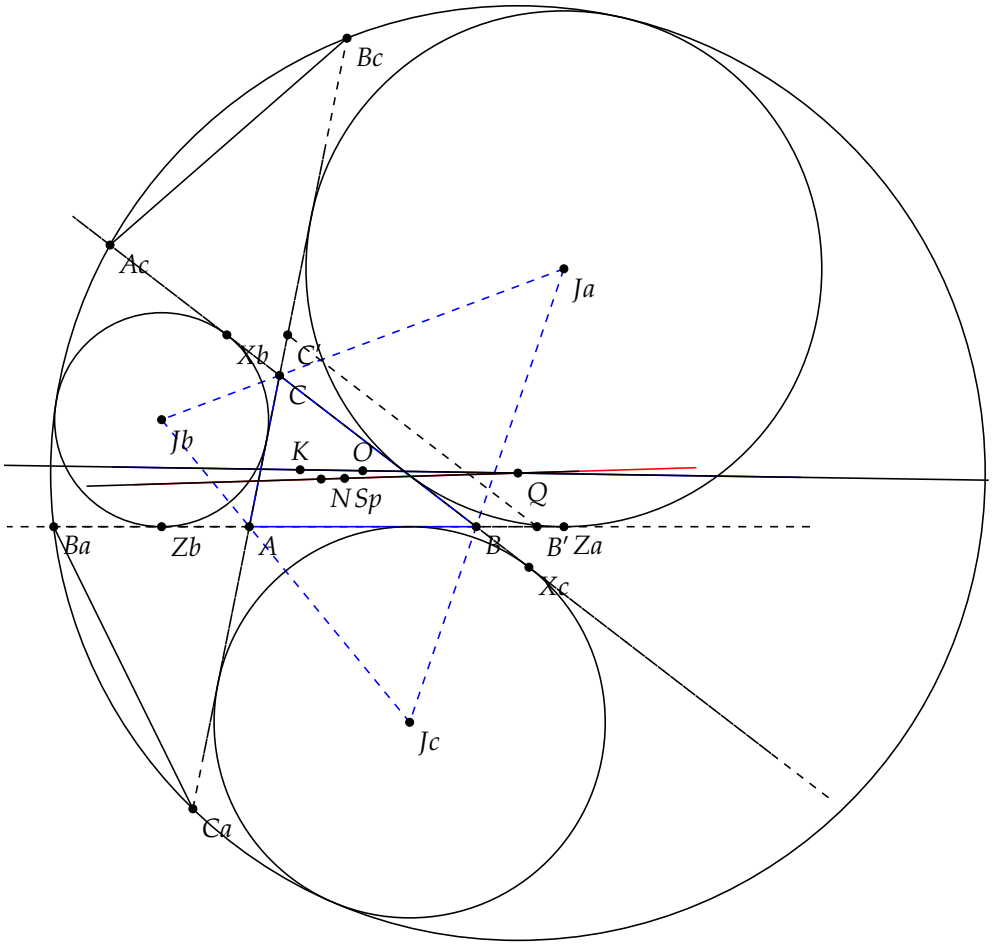
```
\begin{tikzpicture}[pol/.style={fill=brown!40,opacity=.5},
                    seg/.style={tkzdotted,color=gray},
                    hidden pt/.style={fill=gray!40},
                    mra/.style={color=gray!70,tkzdotted,/tkzrightangle/size=.2},
                    scale=3]
\tkzSetUpPoint[size=2]
\tkzDefPoints{0/0/A,2.5/0/B,1.33/0.75/D,0/2.5/E,2.5/2.5/F}
\tkzDefLine[parallel=through D](A,B) \tkzGetPoint{I1}
\tkzDefLine[parallel=through B](A,D) \tkzGetPoint{I2}
\tkzInterLL(D,I1)(B,I2) \tkzGetPoint{C}
\tkzDefLine[parallel=through E](A,D) \tkzGetPoint{I3}
\tkzDefLine[parallel=through D](A,E) \tkzGetPoint{I4}
\tkzInterLL(E,I3)(D,I4) \tkzGetPoint{H}
\tkzDefLine[parallel=through F](E,H) \tkzGetPoint{I5}
\tkzDefLine[parallel=through H](E,F) \tkzGetPoint{I6}
\tkzInterLL(F,I5)(H,I6) \tkzGetPoint{G}
\tkzDefMidPoint(G,H) \tkzGetPoint{P}
\tkzDefMidPoint(G,C) \tkzGetPoint{Q}
\tkzDefMidPoint(B,C) \tkzGetPoint{R}
\tkzDefMidPoint(A,B) \tkzGetPoint{S}
\tkzDefMidPoint(A,E) \tkzGetPoint{T}
\tkzDefMidPoint(E,H) \tkzGetPoint{U}
\tkzDefMidPoint(A,D) \tkzGetPoint{M}
\tkzDefMidPoint(D,C) \tkzGetPoint{N}
\tkzInterLL(B,D)(S,R) \tkzGetPoint{L}
\tkzInterLL(H,F)(U,P) \tkzGetPoint{K}
\tkzDefLine[parallel=through K](D,H) \tkzGetPoint{I7}
\tkzInterLL(K,I7)(B,D) \tkzGetPoint{O}

\tkzFillPolygon[pol](P,Q,R,S,T,U)
\tkzDrawSegments[seg](K,O K,L P,Q R,S T,U
                      C,D H,D A,D M,N B,D)
\tkzDrawSegments(E,H B,C G,F G,H G,C Q,R S,T U,P H,F)
\tkzDrawPolygon(A,B,F,E)
\tkzDrawPoints(A,B,C,E,F,G,H,P,Q,R,S,T,U,K)
\tkzDrawPoints[hidden pt](M,N,O,D)
\tkzMarkRightAngle[mra](L,O,K)
\tkzMarkSegments[mark=|,size=1pt,thick,color=gray](A,S B,S B,R C,R
                      Q,C Q,G G,P H,P
                      E,U H,U E,T A,T)

\tkzLabelAngle[pos=.3](K,L,O){$\alpha$}
\tkzLabelPoints[below](O,A,S,B)
\tkzLabelPoints[above](H,P,G)
\tkzLabelPoints[left](T,E)
\tkzLabelPoints[right](C,Q)
\tkzLabelPoints[above left](U,D,M)
\tkzLabelPoints[above right](L,N)
\tkzLabelPoints[below right](F,R)
\tkzLabelPoints[below left](K)
\end{tikzpicture}
```

29.2.12 Three circles



```
\begin{tikzpicture}[scale=1.5]
  \tkzDefPoints{0/0/A,8/0/B,0/4/a,8/4/b,8/8/c}
  \tkzDefTriangle[equilateral](A,B) \tkzGetPoint{C}
  \tkzDrawPolygon(A,B,C)
  \tkzDefSquare(A,B) \tkzGetPoints{D}{E}
  \tkzClipBB
  \tkzDefMidPoint(A,B) \tkzGetPoint{M}
  \tkzDefMidPoint(B,C) \tkzGetPoint{N}
  \tkzDefMidPoint(A,C) \tkzGetPoint{P}
  \tkzDrawSemiCircle[gray,dashed](M,B)
  \tkzDrawSemiCircle[gray,dashed](A,M)
  \tkzDrawSemiCircle[gray,dashed](A,B)
  \tkzDrawCircle[gray,dashed](B,A)
  \tkzInterLL(A,N)(M,a) \tkzGetPoint{Ia}
  \tkzDefPointBy[projection = onto A--B](Ia)
  \tkzGetPoint{ha}
  \tkzDrawCircle[gray](Ia,ha)
  \tkzInterLL(B,P)(M,b) \tkzGetPoint{Ib}
  \tkzDefPointBy[projection = onto A--B](Ib)
  \tkzGetPoint{hb}
  \tkzDrawCircle[gray](Ib,hb)
  \tkzInterLL(A,c)(M,C) \tkzGetPoint{Ic}
  \tkzDefPointBy[projection = onto A--C](Ic)
  \tkzGetPoint{hc}
  \tkzDrawCircle[gray](Ic,hc)
  \tkzInterLL(A,Ia)(B,Ib) \tkzGetPoint{G}
  \tkzDrawCircle[gray,dashed](G,Ia)
  \tkzDrawPolySeg(A,E,D,B)
  \tkzDrawPoints(A,B,C)
  \tkzDrawPoints(G,Ia,Ib,Ic)
  \tkzDrawSegments[gray,dashed](C,M A,N B,P M,a M,b A,a a,b b,B A,D Ia,ha)
\end{tikzpicture}
```

29.2.13 "The" Circle of APOLLONIUS



```
\begin{tikzpicture}[scale=.5]
\tkzDefPoints{0/0/A,6/0/B,0.8/4/C}
\tkzDefTriangleCenter[euler](A,B,C)        \tkzGetPoint{N}
\tkzDefTriangleCenter[circum](A,B,C)       \tkzGetPoint{O}
\tkzDefTriangleCenter[lemoine](A,B,C)      \tkzGetPoint{K}
\tkzDefTriangleCenter[spieker](A,B,C)      \tkzGetPoint{Sp}
\tkzDefExCircle(A,B,C)     \tkzGetPoint{Jb}
\tkzDefExCircle(C,A,B)     \tkzGetPoint{Ja}
\tkzDefExCircle(B,C,A)     \tkzGetPoint{Jc}
\tkzDefPointBy[projection=onto B--C ](Jc)   \tkzGetPoint{Xc}
\tkzDefPointBy[projection=onto B--C ](Jb)   \tkzGetPoint{Xb}
\tkzDefPointBy[projection=onto A--B ](Ja)   \tkzGetPoint{Za}
\tkzDefPointBy[projection=onto A--B ](Jb)   \tkzGetPoint{Zb}
\tkzDefLine[parallel=through Xc](A,C)       \tkzGetPoint{X'c}
\tkzDefLine[parallel=through Xb](A,B)       \tkzGetPoint{X'b}
\tkzDefLine[parallel=through Za](C,A)       \tkzGetPoint{Z'a}
\tkzDefLine[parallel=through Zb](C,B)       \tkzGetPoint{Z'b}
\tkzInterLL(Xc,X'c)(A,B)                    \tkzGetPoint{B'}
\tkzInterLL(Xb,X'b)(A,C)                    \tkzGetPoint{C'}
\tkzInterLL(Za,Z'a)(C,B)                    \tkzGetPoint{A''}
\tkzInterLL(Zb,Z'b)(C,A)                    \tkzGetPoint{B''}
\tkzDefPointBy[reflection= over Jc--Jb](B') \tkzGetPoint{Ca}
\tkzDefPointBy[reflection= over Jc--Jb](C') \tkzGetPoint{Ba}
\tkzDefPointBy[reflection= over Ja--Jb](A')\tkzGetPoint{Bc}
\tkzDefPointBy[reflection= over Ja--Jb](B')\tkzGetPoint{Ac}
\tkzDefCircle[circum](Ac,Ca,Ba)             \tkzGetPoint{Q}
\tkzDrawCircle[circum](Ac,Ca,Ba)
\tkzDefPointWith[linear,K=1.1](Q,Ac)        \tkzGetPoint{nAc}
\tkzClipCircle[through](Q,nAc)
\tkzDrawLines[add=1.5 and 1.5,dashed](A,B B,C A,C)
\tkzDrawPolygon[color=blue](A,B,C)
\tkzDrawPolygon[dashed,color=blue](Ja,Jb,Jc)
\tkzDrawCircles[ex](A,B,C B,C,A C,A,B)
\tkzDrawLines[add=0 and 0,dashed](Ca,Bc B,Za A,Ba B',C')
\tkzDrawLine[add=1 and 1,dashed](Xb,Xc)
\tkzDrawLine[add=7 and 3,blue](O,K)
\tkzDrawLine[add=8 and 15,red](N,Sp)
\tkzDrawLines[add=10 and 10](K,O N,Sp)
\tkzDrawSegments(Ba,Ca Bc,Ac)
\tkzDrawPoints(A,B,C,N,Ja,Jb,Jc,Xb,Xc,B',C',Za,Zb,Ba,Ca,Bc,Ac,Q,Sp,K,O)
\tkzLabelPoints(A,B,C,N,Ja,Jb,Jc,Xb,Xc,B',C',Za,Zb,Ba,Ca,Bc,Ac,Q,Sp)
\tkzLabelPoints[above](K,O)
\end{tikzpicture}
```

30 Customization

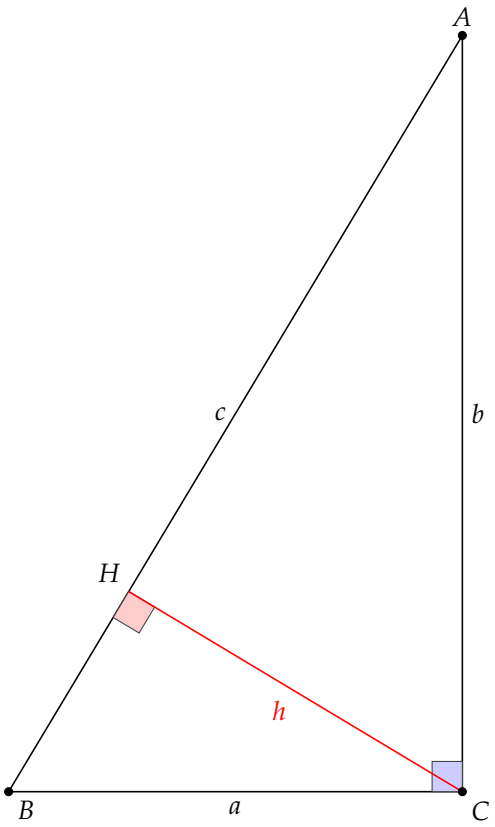
30.1 \tkzSetUpLine

It is a macro that allows you to define the style of all the lines. It is a macro that allows you to define the style of all the lines.

\tkzSetUpLine[⟨local options⟩]

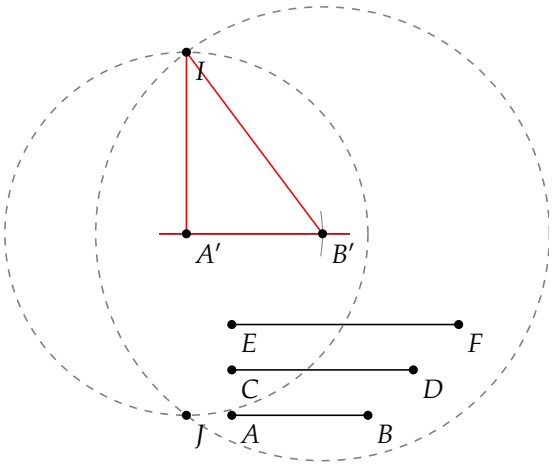
options	default	definition
color	black	colour of the construction arcs
line width	0.4pt	thickness of the construction arcs
style	solid	style des arcs de cercle de construction
add	.2 and .2	changing the length of a segment

30.1.1 Example 1 change line width



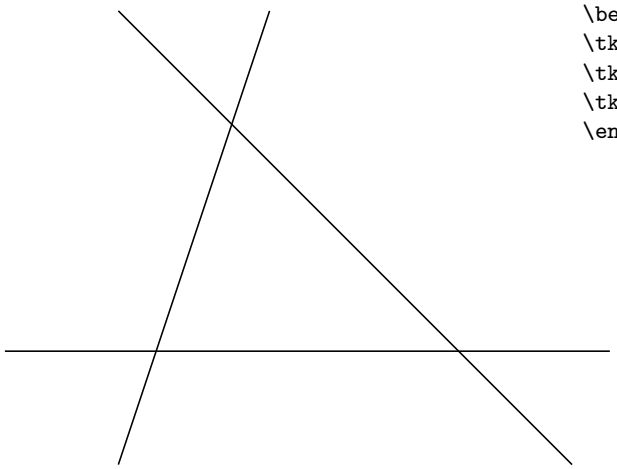

```
\begin{tikzpicture}
\begin{scope}[rotate=-90]
    \tkzDefPoint(10,6){C}
    \tkzDefPoint( 0,6){A}
    \tkzDefPoint(10,0){B}
    \tkzDefPointBy[projection = onto B--A](C)
    \tkzGetPoint{H}
    \tkzDrawPolygon(A,B,C)
    \tkzMarkRightAngle[size=.4,fill=blue!20](B,C,A)
    \tkzMarkRightAngle[size=.4,fill=red!20](B,H,C)
    \tkzDrawSegment[color=red](C,H)
\end{scope}
 \tkzSetUpLine[color=blue,line width=1pt]
 \tkzLabelSegment[below](C,B){$a$}
 \tkzLabelSegment[right](A,C){$b$}
 \tkzLabelSegment[left](A,B){$c$}
 \tkzLabelSegment[color=red](C,H){$h$}
 \tkzDrawPoints(A,B,C)
 \tkzLabelPoints[above left](H)
 \tkzLabelPoints(B,C)
 \tkzLabelPoints[above](A)
\end{tikzpicture}
```

30.1.2 Example 2 change style of line




```
\begin{tikzpicture}[scale=.6]
 \tkzDefPoint(1,0){A} \tkzDefPoint(4,0){B}
 \tkzDefPoint(1,1){C} \tkzDefPoint(5,1){D}
 \tkzDefPoint(1,2){E} \tkzDefPoint(6,2){F}
 \tkzDefPoint(0,4){A'}\tkzDefPoint(3,4){B'}
 \tkzDrawSegments(A,B C,D E,F)
 \tkzDrawLine(A',B')
 \tkzSetUpLine[style=dashed,color=gray]
 \tkzCompass(A',B')
 \tkzCalcLength[cm](C,D)  \tkzGetLength{rCD}
 \tkzDrawCircle[R](A',\rCD cm)
 \tkzCalcLength[cm](E,F)  \tkzGetLength{rEF}
 \tkzDrawCircle[R](B',\rEF cm)
 \tkzInterCC[R](A',\rCD cm)(B',\rEF cm)
 \tkzGetPoints{I}{J}
 \tkzSetUpLine[color=red] \tkzDrawLine(A',B')
 \tkzDrawSegments(A',I B',I)
 \tkzDrawPoints(A,B,C,D,E,F,A',B',I,J)
 \tkzLabelPoints(A,B,C,D,E,F,A',B',I,J)
\end{tikzpicture}
```

30.1.3 Example 3 extend lines



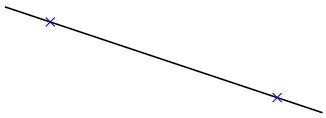
```
\begin{tikzpicture}
\tkzSetUpLine[add=.5 and .5]
\tkzDefPoints{0/0/A,4/0/B,1/3/C}
\tkzDrawLines(A,B B,C A,C)
\end{tikzpicture}
```

30.2 \tkzSetUpPoint

\tkzSetUpCompass[⟨local options⟩]

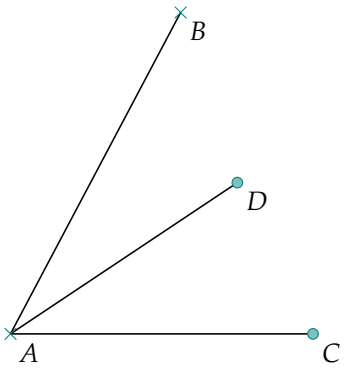
options	default	definition
color	black	point color
size	3pt	point size
fill	black!50	Inside point color
shape	circle	point shape circle or cross

30.2.1 use of\tkzSetUpPoint



```
\begin{tikzpicture}
  \tkzSetUpPoint[shape = cross out,color=blue]
  \tkzInit[xmax=100,xstep=20,ymax=.5]
  \tkzDefPoint(20,1){A}
  \tkzDefPoint(80,0){B}
  \tkzDrawLine(A,B)
  \tkzDrawPoints(A,B)
\end{tikzpicture}
```

30.2.2 use of\tkzSetUpPoint inside a group



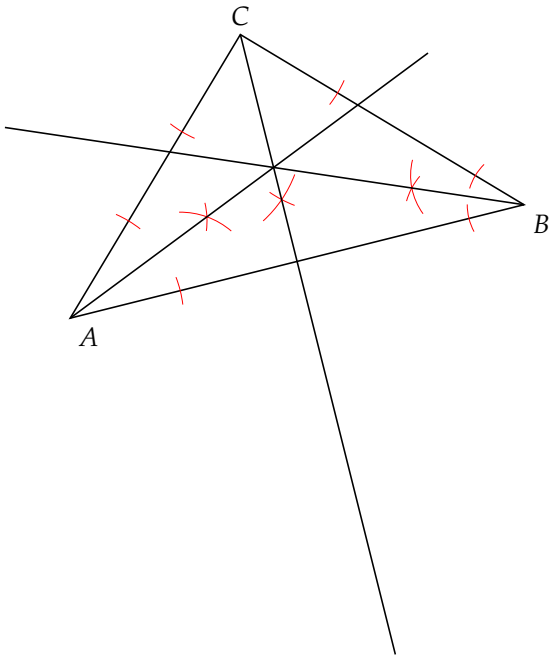

```
\begin{tikzpicture}
  \tkzInit[ymin=-0.5,ymax=3,xmin=-0.5,xmax=7]
  \tkzDefPoint(0,0){A}
  \tkzDefPoint(02.25,04.25){B}
  \tkzDefPoint(4,0){C}
  \tkzDefPoint(3,2){D}
  \tkzDrawSegments(A,B A,C A,D)
 {\tkzSetUpPoint[shape=cross out,
             fill= teal!50,
             size=4,color=teal]
  \tkzDrawPoints(A,B)}
  \tkzSetUpPoint[fill= teal!50,size=4,
                color=teal]
   \tkzDrawPoints(C,D)
  \tkzLabelPoints(A,B,C,D)
\end{tikzpicture}
```

30.3 \tkzSetUpCompass

\tkzSetUpCompass[⟨local options⟩]

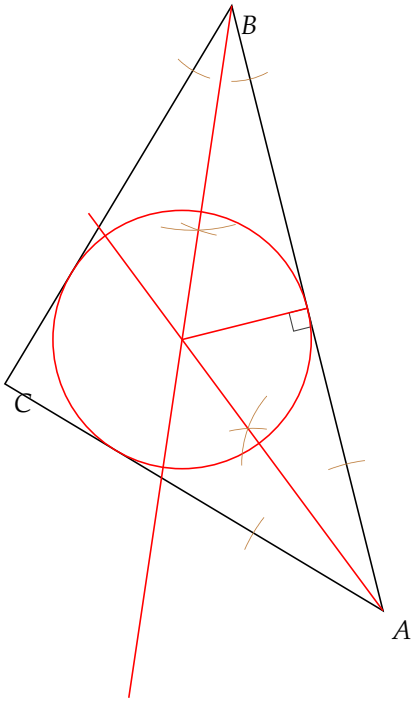
options	default	definition
color	black	color of construction arcs
line width	0.4pt	thickness of construction arcs
style	solid	style of the building arcs

30.3.1 use of\tkzSetUpCompass with bisector




```
\begin{tikzpicture}[scale=0.75]
  \tkzDefPoints{0/1/A, 8/3/B, 3/6/C}
  \tkzDrawPolygon(A,B,C)
  \tkzSetUpCompass[color=red,line width=.2 pt]
  \tkzDefLine[bisector](A,C,B) \tkzGetPoint{c}
  \tkzDefLine[bisector](B,A,C) \tkzGetPoint{a}
  \tkzDefLine[bisector](C,B,A) \tkzGetPoint{b}
  \tkzShowLine[bisector,size=2,gap=3](A,C,B)
  \tkzShowLine[bisector,size=2,gap=3](B,A,C)
  \tkzShowLine[bisector,size=1,gap=2](C,B,A)
  \tkzDrawLines[add=0 and 0 ](B,b C,c)
  \tkzDrawLine[add=0 and -.4 ](A,a)
  \tkzLabelPoints(A,B) \tkzLabelPoints[above](C)
\end{tikzpicture}
```

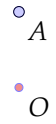
30.3.2 Another example of of\tkzSetUpCompass




```
\begin{tikzpicture}[scale=1,rotate=90]
  \tkzDefPoints{0/1/A, 8/3/B, 3/6/C}
  \tkzDrawPolygon(A,B,C)
  \tkzSetUpCompass[color=brown,
          line width=.3 pt,style=tkzdotted]
  \tkzDefLine[bisector](B,A,C)  \tkzGetPoint{a}
  \tkzDefLine[bisector](C,B,A)  \tkzGetPoint{b}
  \tkzInterLL(A,a)(B,b) \tkzGetPoint{I}
  \tkzDefPointBy[projection= onto A--B](I)
  \tkzGetPoint{H}
  \tkzMarkRightAngle(I,H,A)
  \tkzDrawCircle[radius,color=red](I,H)
  \tkzDrawSegments[color=red](I,H)
  \tkzDrawLines[add=0 and -.5,,color=red](A,a)
  \tkzDrawLines[add=0 and 0,color=red](B,b)
  \tkzShowLine[bisector,size=2,gap=3](B,A,C)
  \tkzShowLine[bisector,size=1,gap=3](C,B,A)
  \tkzLabelPoints(A,B,C)
\end{tikzpicture}
```

30.4 Own style

You can set the normal style with `tkzSetUpPoint` and your own style




```
\tkzSetUpPoint[color=blue!50!white, fill=gray!20!red!50!white]
\tikzset{/tikz/mystyle/.style={
         color=blue!20!black,
         fill=blue!20}}
  \begin{tikzpicture}
    \tkzDefPoint(0,0){O}
    \tkzDefPoint(0,1){A}
    \tkzDrawPoints(O) % general style
    \tkzDrawPoints[mystyle,size=4](A) % my style
    \tkzLabelPoints(O,A)
  \end{tikzpicture}
```

31 Summary of tkz-base

31.1 Utility of tkz-base

First of all, you don't have to deal with TikZ the size of the bounding box. Early versions of **tkz-euclide** did not control the size of the bounding box, now the size of the bounding box is limited.

However, it is sometimes necessary to control the size of what will be displayed. To do this, you need to have prepared the bounding box you are going to work in, this is the role of **tkz-base** and its main macro **\tkzInit**. It is recommended to leave the graphic unit equal to 1 cm. For some drawings, it is interesting to fix the extreme values (xmin,xmax,ymin and ymax) and to "clip" the definition rectangle in order to control the size of the figure as well as possible.

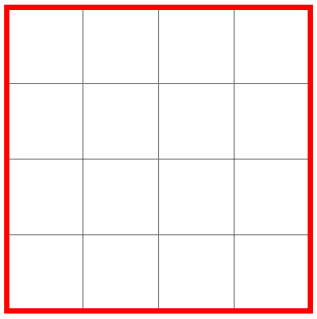
The two macros in **tkz-base** that are useful for **tkz-euclide** are:

- **\tkzInit**
- **\tkzClip**

To this, I added macros directly linked to the bounding box. You can now view it, backup it, restore it (see the documentation of **tkz-base** section BB)

31.2 \tkzInit et \tkzShowBB

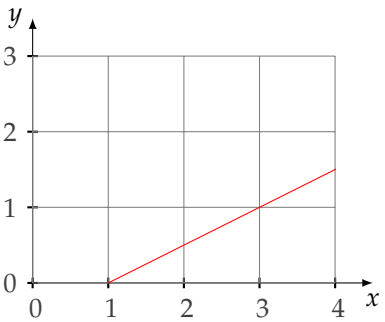
The rectangle around the figure shows you the bounding box.



```
\begin{tikzpicture}
 \tkzInit[xmin=-1,xmax=3,ymin=-1, ymax=3]
 \tkzGrid
 \tkzShowBB[red,line width=2pt]
\end{tikzpicture}
```

31.3 \tkzClip

The role of this macro is to "clip" the initial rectangle so that only the paths contained in this rectangle are drawn.



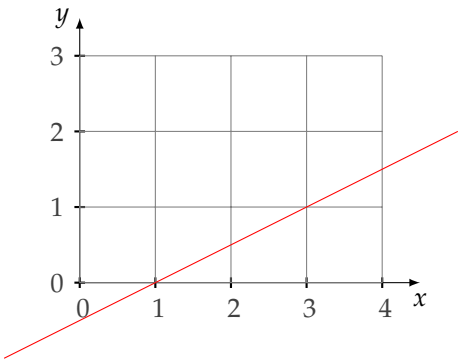

```
\begin{tikzpicture}
 \tkzInit[xmax=4, ymax=3]
 \tkzAxeXY
 \tkzGrid
 \tkzClip
 \draw[red] (-1,-1)--(5,2);
\end{tikzpicture}
```

It is possible to add a bit of space

```
\tkzClip[space=1]
```

31.4 \tkzClip et l'option space

This option allows you to add some space around the "clipped" rectangle.




```
\begin{tikzpicture}
 \tkzInit[xmax=4, ymax=3]
 \tkzAxeXY
 \tkzGrid
 \tkzClip[space=1]
 \draw[red] (-1,-1)--(5,2);
\end{tikzpicture}
```

the dimensions of the "clipped" rectangle are **xmin-1**, **ymin-1**, **xmax+1** et **ymax+1**.

32 FAQ

32.1 Most common errors

For the moment, I'm basing myself on my own, because having changed syntax several times, I've made a number of mistakes. This section is going to be expanded.

- ☞ `\tkzDrawPoint(A,B)` when it is necessary `\tkzDrawPoints`
- ☞ `\tkzGetPoint(A)` When defining an object, use braces and not brackets, so write : `\tkzGetPoint{A}`
- ☞ `\tkzGetPoint{A}` in place of `\tkzGetFirstPoint{A}`. When a macro gives two points as results, either we retrieve these points using `\tkzGetPoints{A}{B}`, or we retrieve only one of the two points, using `\tkzGetFirstPoint{A}` or `\tkzGetSecondPoint{A}`. These two points can be used with the reference `tkzFirstPointResult` or `tkzSecondPointResult`. It is possible that a third point is given as `tkzPointResult`.
- ☞ `\tkzDrawSegment(A,B A,C)` when you need `\tkzDrawSegments`. It is possible to use only the versions with an "s" but it is less efficient!
- ☞ Mixing options and arguments; all macros that use a circle need to know the radius of the circle. If the radius is given by a measure then the option includes a `R`.
- ☞ `\tkzDrawSegments[color = gray,style=dashed]{B,B' C,C'}` is a mistake. Only macros that define an object use braces.
- ☞ The angles are given in degrees, more rarely in radians.
- ☞ If an error occurs in a calculation when passing parameters, then it is better to make these calculations before calling the macro.
- ☞ Do not mix the syntax of `pgfmath` and `xfp`. I've often chosen `xfp` but if you prefer pgfmath then do your calculations before passing parameters.
- ☞ Use of `\tkzClip` : In order to get accurate results, I avoided using normalized vectors. The advantage of normalization is to control the dimension of the manipulated objects, the disadvantage is that with TeX, this implies inaccuracies. These inaccuracies are often small, in the order of a thousandth, but they lead to disasters if the drawing is enlarged. Not normalizing implies that some points are far away from the working area and `\tkzClip` allows you to reduce the size of the drawing.
- ☞ An error occurs if you use the macro `\tkzDrawAngle` with too small an angle. The error is produced by the `decoration` library when you want to place a mark on an arc. Even if the mark is absent, the error is still present. It is possible to get around this difficulty with the option `mkpos=.2` for example, which will place the mark before the arc. Another possibility is to use the macro `\tkzFillAngle`.

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