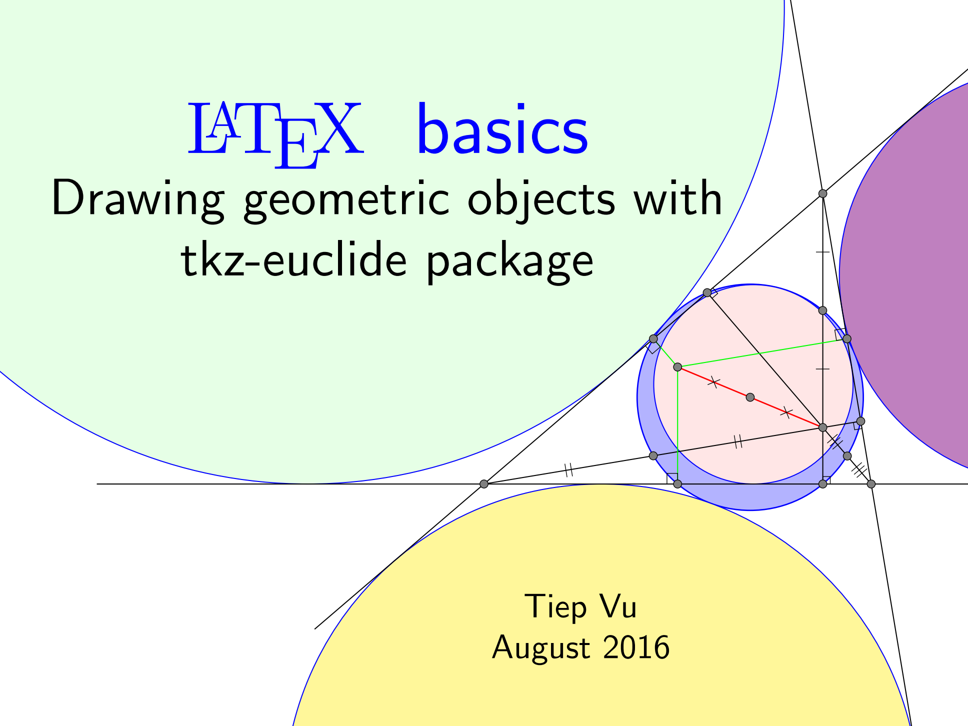
LaTeX basics

Drawing geometric objects with tkz-euclide package



Tiep Vu
August 2016

Outline

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   - Polar coordinate system
   - Relative coordinates
2. Lines, Segments, Rays
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   - Intersections
   - Orthogonal and Parallel
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4. Circles
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5. Triangles
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   - Centroid, Orthocenter, Circumcircle, Inscribed Circle

tkz-euclide

- documentclass

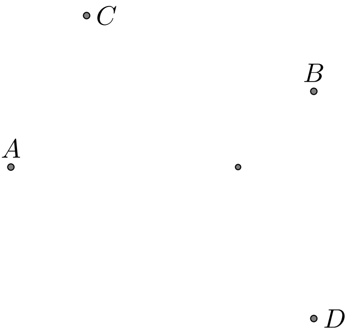
```
\documentclass{standalone}
%\documentclass{article}
```

- package

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

- main body

```
\begin{document}
% \begin{figure}
\begin{tikzpicture}
   ....
\end{tikzpicture}
% \end{figure}
\end{document}
```



See tkz-euclide examples here.

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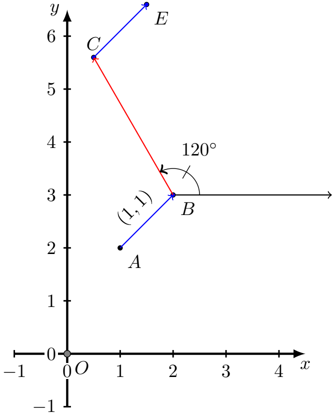
Points



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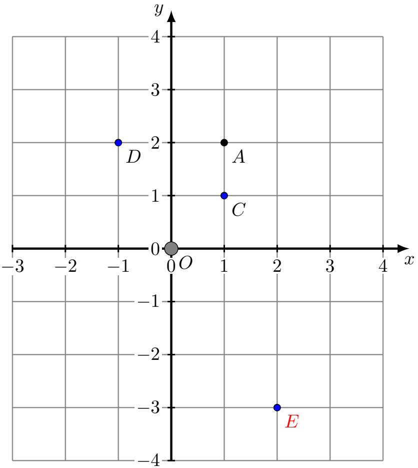
Points in Cartesian coordinate system

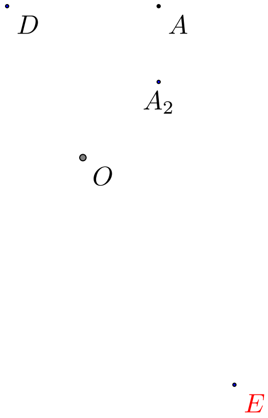
```
%% def_point_Cartesian.tex
...
\begin{document}
\begin{tikzpicture}
   ...
   % Cartesian coordinate (x,y)
   \coordinate (O) at (0, 0);
   \coordinate (A) at (1, 2);
   % using tkz—euclide
   \tkzDefPoint(1,1){C}
   \tkzDefPoints{—1/2/D, 2/—3/E}
   ...
\end{tikzpicture}
\end{document}
```

See more here.



Drawing and Labeling points

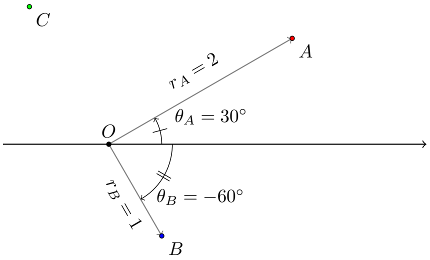
```
%% draw_label_points.tex
...
\begin{tikzpicture}
  ...
  % drawing points
  \tkzDrawPoints(O)
  \tkzDrawPoints[size=3, fill=black](A)
  \tkzDrawPoints[size=3, fill=blue](D,E)
  % labeling points
  \tkzLabelPoints(O,A,D)
  \tkzLabelPoints[red](E)
  % labeling in mathmode
  \tkzDefPoint[label = below:$A_2$](1,1){A2}
  \tkzDrawPoints[size=3, fill=blue](A2)
\end{tikzpicture}
```



Points in polar coordinate system

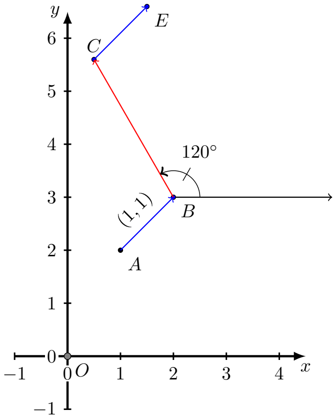
```
%% def_point_polar.tex
...
\begin{document}
\begin{tikzpicture}
   ...
   \coordinate (O) at (0, 0);
   % polar coordinate, (theta:r)
   \coordinate (A) at (30:2);
   \coordinate (B) at (-60:1);

   \tkzDefPoint(120:1.5){C}
   ...
\end{tikzpicture}
\end{document}
```



Relative coordinates

```
%% relative_coordinate.tex
% ...
\usepackage{calc}
\begin{document}
\begin{tikzpicture}
   % ...
   \coordinate (O) at (0, 0);
   \coordinate (A) at (1, 2);
   \coordinate (B) at ($(A) + (1, 1)$);
   \coordinate (C) at ($(B) + (120:3)$);
   \coordinate (E) at ($(C)+(B)-(A)$);
   % ...
\end{tikzpicture}
\end{document}
```



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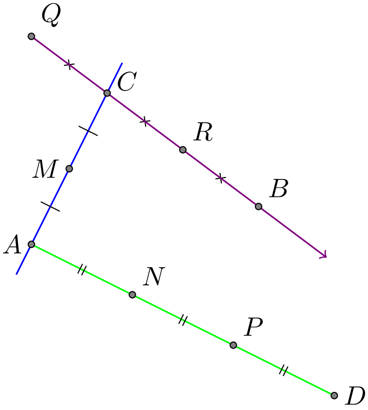
Lines, Segments, Rays



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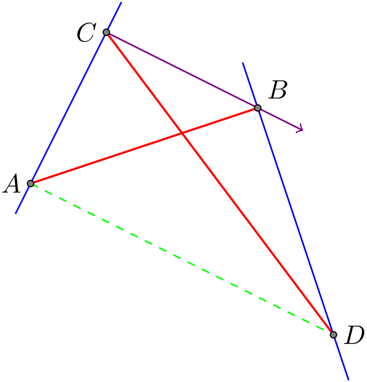
Line, Segment, Ray, connecting two points

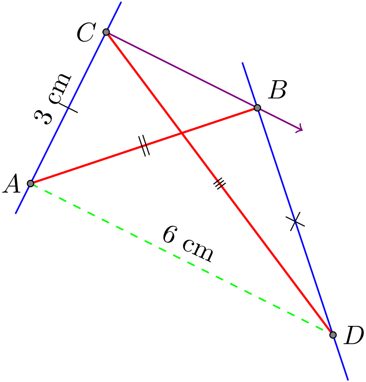
```
%% line_segment_ray.tex
\begin{tikzpicture}
   % ...
   % drawing red segments
   \tkzDrawSegments[red, thick](A,B C,D)
   % drawing dashed green segment
   \tkzDrawSegments[green,dashed](A,D)
   % drawing blue line
   \tkzDrawLines[draw=blue](A,C B,D)
   % array with arrow
   \tkzDrawLines[add = 0 and 0.3, ...
       draw=violet, arrows=->](C,B)
   % ...
\end{tikzpicture}
```



See more here.

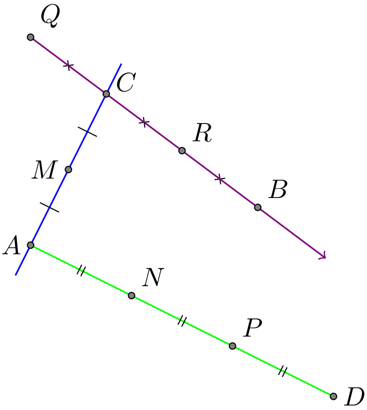
Labeling and Markers

```
%% lsr_label_marker.tex
\begin{tikzpicture}
   % ...
   % labeling
   \tkzLabelSegment[above=1pt, ...
       rotate=65](A,C){3 cm}
   \tkzLabelSegment[above=0pt, ...
       rotate=-25](A,D){6 cm}
   % markers
   \tkzMarkSegment[mark=|](A,C)
   \tkzMarkSegment[mark=||](A,B)
   \tkzMarkSegment[mark=|||, size = ...
       2](C,D)
   \tkzMarkSegment[mark=x](B,D)
   % ...
\end{tikzpicture}
```



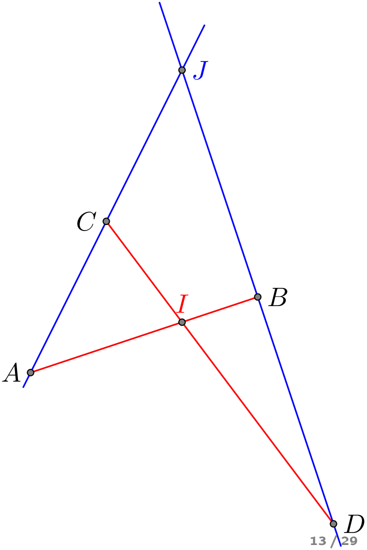
Define a point between two points for a given length ratio

```
%% ratio_point.tex
\begin{tikzpicture}
   % ...
   % middle points
   \tkzDefMidPoint(A,C)\tkzGetPoint{M}
   % others
   \coordinate (N) at ($(A)!1/3!(D)$);
   \coordinate (P) at ($(A)!2/3!(D)$);
   \coordinate (Q) at ($(C)!-1/2!(B)$);
   \coordinate (R) at ($(C)!1/2!(B)$);
   % ...
\end{tikzpicture}
```



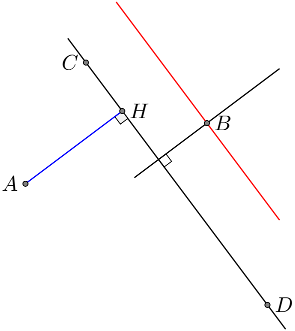
Intersection of two lines

```
%% intersection1.tex
...
\begin{tikzpicture}
   %% defining points
   % InterLL for intersection of ...
       `Line' and `Line'
   \tkzInterLL(A,B)(C,D) \tkzGetPoint{I}
   \tkzInterLL(A,C)(B,D) \tkzGetPoint{J}
   %% showing points
\end{tikzpicture}
```



Orthogonal and Parallel lines

```
%% orthogonal_parallel.tex
...
\begin{tikzpicture}
   % ...
   %% orthogonal
   \tkzDefPointBy[projection=onto C—D](A)
   \tkzGetPoint{H}
   \tkzDefLine[orthogonal=through B](C,D)
   \tkzGetPoint{K}
   %% parallel
   \tkzDefLine[parallel=through B](C,D)
   \tkzDrawLine[draw = red, add = .5 and ...
       —.6](B,tkzPointResult)
   % ...
\end{tikzpicture}
```



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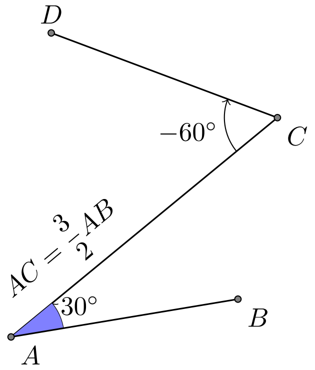
Angles



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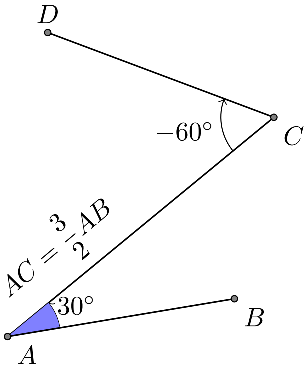
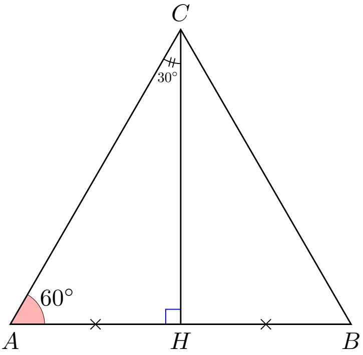
Angles

```
%% angle.tex
...
\begin{tikzpicture}
   % ...
  \coordinate (C) at ($(A)!1.5!30:(B)$);
  \coordinate (D) at ($(C)!.7!-60:(A)$);
   % ...
\end{tikzpicture}
```



Labeling and Markers

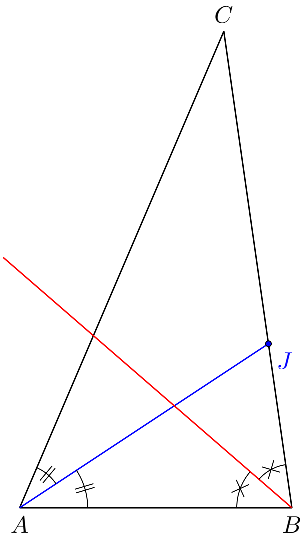
```
%% angle_label_marks.tex
...
\begin{tikzpicture}
   % ...
   % marker
   \tkzMarkAngle[size = .5, fill = ...
       red!30](B,A,C)
   \tkzMarkAngle[size = .5, mark = ...
       ||,mksize=2](A,C,H)
   % labeling
   \tkzLabelAngle[pos=.8](B,A,C){ ...
       $60^\circ$}
   \tkzLabelAngle[pos=1.2,scale = ...
       .6](A,C,H){$30^\circ$}
   % right angle marker
   \tkzMarkRightAngle[draw =blue](A,H,C)
   % ...
\end{tikzpicture}
```



Angle Bisector

```
%% angle_bisector.tex
...
\begin{tikzpicture}
   % ...
  \tkzDefLine[bisector](C,B,A)
  \tkzGetPoint{i}

  \tkzDrawBisector[draw=blue](C,A,B)
  \tkzGetPoint{J}
   % ...
\end{tikzpicture}
```



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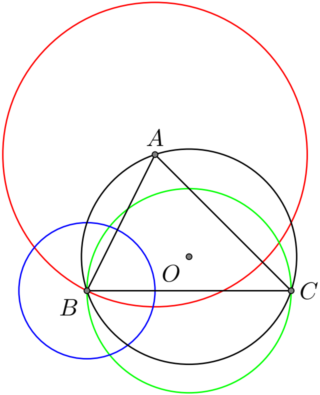
Circles



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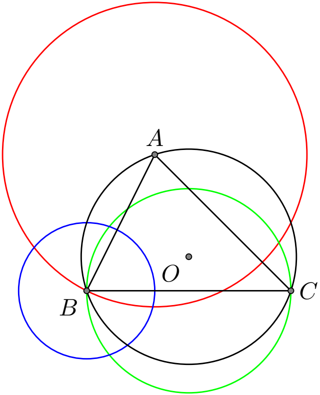
Drawing Circles

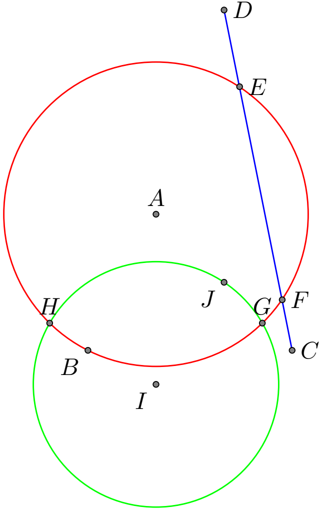
```
%% circle_1.tex
...
\begin{tikzpicture}
   % ...
   % center A, passing B
   \tkzDrawCircle[draw = red](A,B)
   % diameter BC
   \tkzDrawCircle[diameter, draw = ...
       green](B,C)
   % center B, radius 1 cm
   \tkzDrawCircle[R, draw = blue](B, ...
       1 cm)
   % passing A, B, C
   \tkzDrawCircle[circum](A,B,C)
   % get its center
   \tkzCircumCenter(A,B,C)\tkzGetPoint{O}
   % ...
\end{tikzpicture}
```



See More Examples here.

Circle Intersection

```
%% circle_intersection.tex
...
\begin{tikzpicture}
   % ...
   % Line—Circle intersection
   \tkzInterLC(C,D)(A,B)
   \tkzGetPoints{E}{F}
   % Circle—Circle intersection
   \tkzInterCC(A,B)(I,J)
   \tkzGetPoints{G}{H}
   % ...
\end{tikzpicture}
```

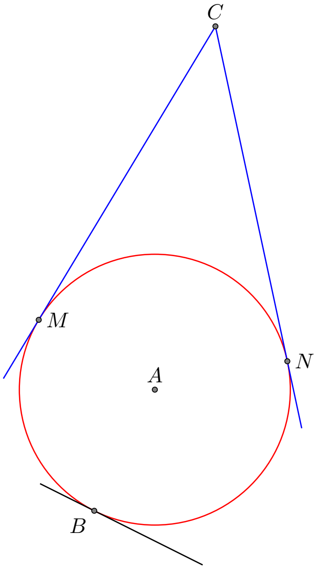


See More Examples here.

Circle and Tangents

```
%% circle_tangent.tex
...
\begin{tikzpicture}
   % ...
   \tkzDrawCircle[draw = red](A,B)
   % from a point on the circle
   \tkzTangent[at=B](A) \tkzGetPoint{h}
   % from a point outside the circle
   \tkzTangent[from=C](A,B)
   \tkzGetPoints{M}{N}
   % ...
\end{tikzpicture}
```

See More Examples here.



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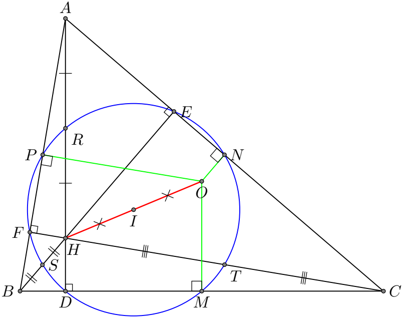
Triangles



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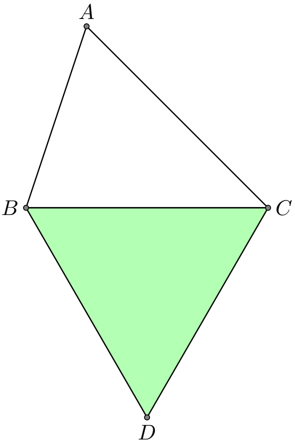
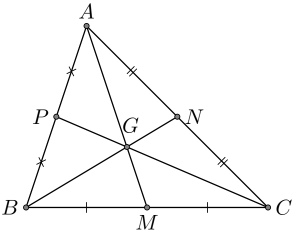
Drawing triangles

```
%% triangle_1.tex
...
\begin{tikzpicture}
   % ...
   % connecting 3 points
   \tkzDrawPolygon(A,B,C)
   % equilateral triangles
   \tkzDefTriangle[equilateral](C,B)
   \tkzGetPoint{D}
   \tkzDrawPolygon[fill=green!30](B,C,D)
   % ...
\end{tikzpicture}
```



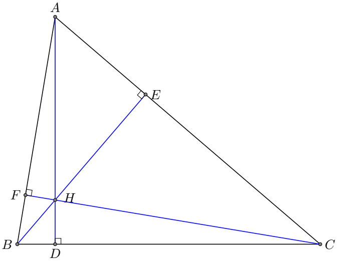
Centroid

```
%% triangle_centroid.tex
...
\begin{tikzpicture}
   % ...
   % get centroid
   \tkzCentroid(A,B,C)\tkzGetPoint{G}
   % drawing median lines
   \tkzDrawLines[add = 0 and 1/2](A,G ...
       B,G C,G)
   % ...
\end{tikzpicture}
```



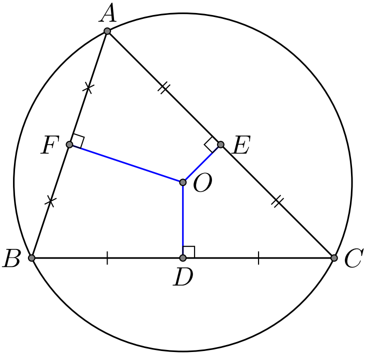
Orthocenter

```
%% triangle_orthocenter.tex
...
\begin{tikzpicture}
   % ...
   % drawing altitudes
  \tkzDrawAltitude[draw ...
      =blue](B,C)(A) \tkzGetPoint{D}
  \tkzDrawAltitude[draw ...
      =blue](A,C)(B) \tkzGetPoint{E}
  \tkzDrawAltitude[draw ...
      =blue](B,A)(C) \tkzGetPoint{F}
  % get the orthocenter
  \tkzInterLL(A,D)(B,E) \tkzGetPoint{H}
   % ...
\end{tikzpicture}
```



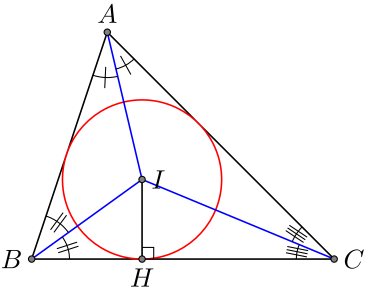
Circumcircle

```
%% triangle_circumcircle.tex
...
\begin{tikzpicture}
   % ...
  % draw the circumcircle
  \tkzDrawCircle[circum](A,B,C)
  % get its center
  \tkzCircumCenter(A,B,C)\tkzGetPoint{O}
  % draw perpendicular bisector lines
  \tkzDrawAltitude[draw ...
      =blue](B,C)(O) \tkzGetPoint{D}
  \tkzDrawAltitude[draw ...
      =blue](A,C)(O) \tkzGetPoint{E}
  \tkzDrawAltitude[draw ...
      =blue](B,A)(O) \tkzGetPoint{F}
   % ...
\end{tikzpicture}
```

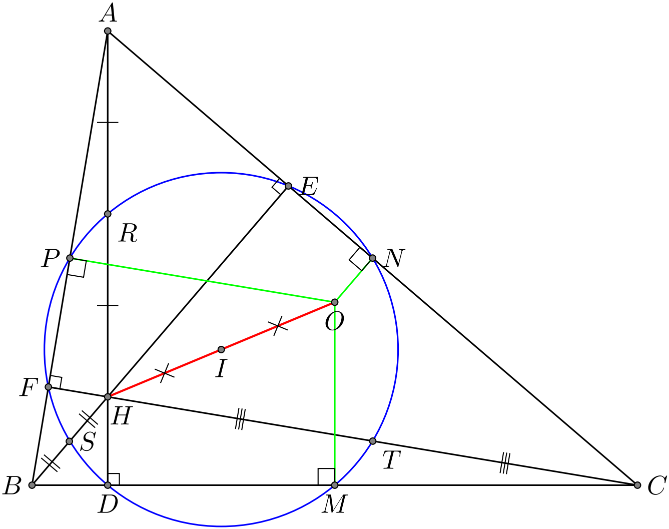


Inscribed circle

```
%% triangle_inscribedcircle.tex
...
\begin{tikzpicture}
   % ...
  % get the inscbided center
  \tkzInCenter(A,B,C) \tkzGetPoint{I}
  % project it into one edge
  \tkzDrawAltitude(B,C)(I) ...
      \tkzGetPoint{H}
  % draw the circle
  \tkzDrawCircle[draw = red](I,H)
   % ...
\end{tikzpicture}
```



Euler circle


A
E
R
P
N
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I
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H
S
T
B
D
M
C