

MATH 6: HANDOUT 23
RULER AND COMPASS CONSTRUCTIONS II

CONSTRUCTIONS WITH RULER AND COMPASS

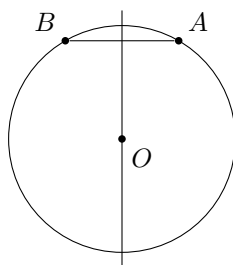
Here is a summary of operations we can do using a ruler and compass. You can freely use any of them in the problems below.

1. Construct the midpoint of a given segment AB
2. Construct the perpendicular bisector of segment AB , i.e. a line that goes through the midpoint of AB and is perpendicular to AB .
3. Given a line l and a point A on l , construct a perpendicular to l through A .
4. Given a line l and a point P outside of l , construct a perpendicular to l through P .
5. Given an angle AOB , construct the angle bisector (i.e., a ray OM such that $\angle AOM \cong \angle BOM$).

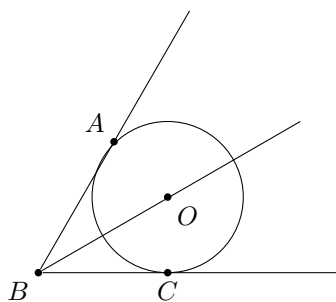
The following section explains the importance of these constructions.

PERPENDICULAR BISECTOR AND ANGLE BISECTOR

1. If two points A, B are on a circle, then the center of this circle lies on perpendicular bisector to AB (i.e., a line that goes through the midpoint of AB and is perpendicular to AB).



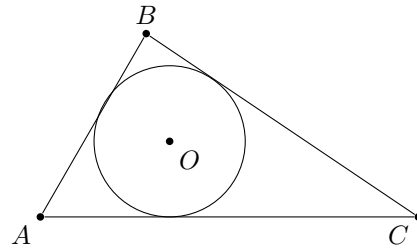
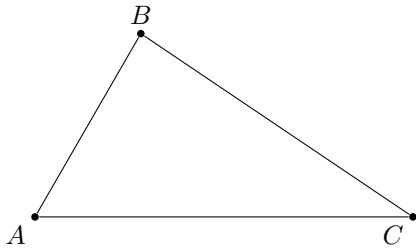
2. If a circle is inscribed in the angle ABC , then the center of this circle lies on the angle bisector.



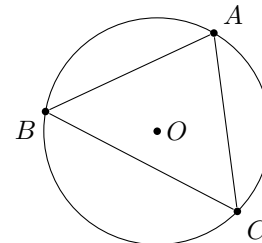
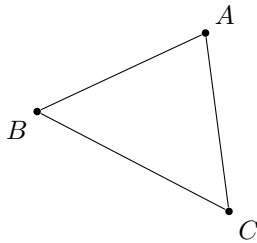
HOMEWORK

All constructions below are to be done using ruler and compass only!

1. Construct a rectangle with one side a and diagonal d .
2. Given length a , construct a square with side a .
3. Given a circle, construct an equilateral triangle inscribed in it. This means that all the vertices of the triangle are on the circumference.
4. Given a circle, construct a regular hexagon inscribed in the circle.
5. Given a circle, find its center.
6. Given a circle and a point P in its circumference, draw a line tangent to the circle that goes through P . *Hint:* A tangent line is perpendicular to the radius connecting the intersection of the line and the circle and the center of the circle.
7. Given a triangle $\triangle ABC$, construct a circle inscribed in the triangle (as shown on the right). *Hint:* The center of the circle will be at the intersection of the angle bisectors of the triangle.



8. Given a triangle $\triangle ABC$, construct a circle circumscribed around the triangle (as shown on the right). *Hint:* Draw the perpendicular bisectors of two sides of the triangles.



9. Six grasshoppers sit on a road. Every minute one grasshopper jumps 1 foot in one direction (along the road), and another grasshopper jumps 1 foot in the **opposite** direction. If initially the grasshoppers were at positions 1 ft, 2 ft, \dots , 6ft (measured from some point on the road), is it possible that after some time they all will all gather at the same place on the road?