

**MATH 6: ASSIGNMENT 17**  
**RULER AND COMPASS**

CONSTRUCTIONS WITH RULER AND COMPASS

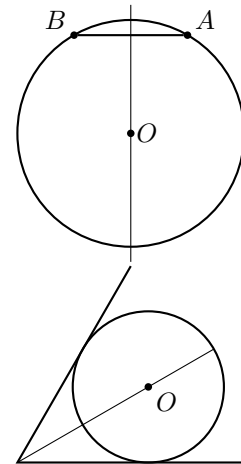
Here is a summary of operations we can do using a ruler and compass. You can freely use any of them in the problems below.

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

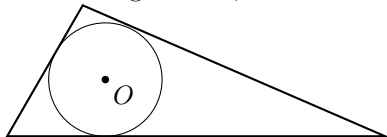
1. If two points  $A, B$  are on a circle, then the center of this circle lies on perpendicular bisector to  $AB$  (i.e., a line that goes through the midpoint of  $AB$  and is perpendicular to  $AB$ ).
2. If a circle is inscribed in the angle  $ABC$ , then the center of this circle lies on the angle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



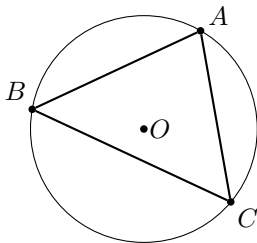
HOMEWORK

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

1. Construct a rectangle with one side  $a$  and diagonal  $d$ .
2. Construct a rhombus with one side  $a$  and diagonal  $d$ .
3. Given length  $a$ , construct a square with side  $a$
4. Construct a regular 12-gon.
5. Given a circle, find its center.
6. Given a triangle  $ABC$ , construct a circle inscribed in the triangle:



7. Given a triangle  $ABC$ , construct a circle circumscribed around the triangle:



8. 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?