MATH 6: HANDOUT XXIV
RULER AND COMPASS CONSTRUCTIONS 2

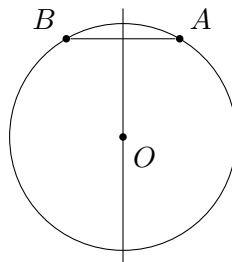### CONSTRUCTIONS WITH RULER AND COMPASS

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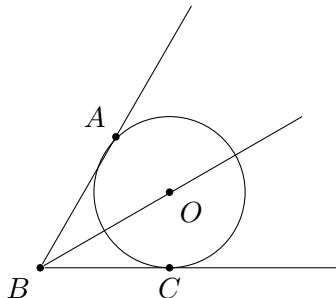
All constructions below are to be done using ruler and compass only!

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.
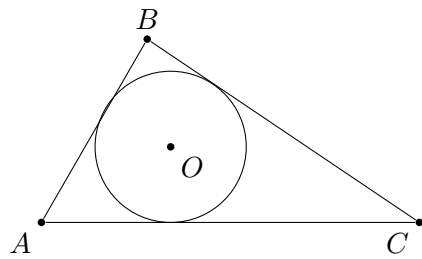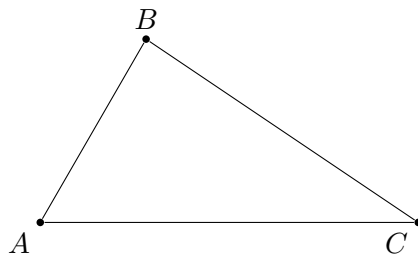
8. Given a triangle $\triangle ABC$, construct a circle circumscribed around the triangle (as shown on the right). *Hint:* Draw the perpendicular bisectors of two sides of the triangles.
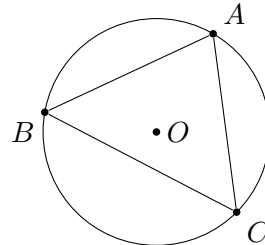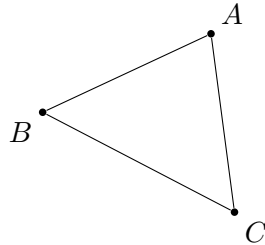
9. Six grasshoppers sit on a road. Every minute one grasshopper jumps 1 foot in one direction (along the road), and another grasshopper jumps 1 foot in the **opposite** direction. If initially the grasshoppers were at positions 1 ft, 2 ft, . . . , 6ft (measured from some point on the road), is it possible that after some time they all will all gather at the same place on the road?